

8th Asian Wetland Symposium (AWS2017)
— Wetlands for Sustainable Life —
7–11 November 2017, Saga, Japan

ABSTRACTS



Ministry of the Environment



Wetlands
INTERNATIONAL



RCJ

JAWS

Asian Wetland Symposium 2017 Executive Committee

Contents

Organization of AWS2017	6
Plenary Keynote Presentations	
Martha Rojas-Urrego: Wetland and Sustainable Development.....	8
Naohisa Okuda: Conservation Strategy on Wetlands and Biodiversity of Japan.....	8
Hiroji Isozaki: 25th Anniversary of AWS and the Prospects for the Next 25 Years.....	9
Ajit K. Pattnaik: Restoration of Chilika Lake: A journey from Montreux Record to Ramsar Wetland Conservation Award, and the way forward	9
Ariake Sea Session	
Yuichi Hayami: Characteristics of the marine environment in Ariake Sea	10
Yasuhisa Henmi: Animals and Plants in Tidal Flat of Ariake Sea	10
Atsushi Ishimatsu: Reproduction of mudskippers: Aerial embryos developing in a mudflat burrow.....	11
Akiyuki Miyahara: Wild birds in Ariake sea (past, present, and future).....	11
Masaru Tanaka: Toward Restoration of Ariake Sea by Means of an Integrated Studies "CoHHO" Collaborated with Its Relevant Social Movement "The Sea is Longing for the Forest"	12
Yoshiyuki Kawakami: Efforts toward Revitalization and Creation of Ariake Sea	12
Kango Nakao: Traditional Fisheries of Ariake Sea	13
Gunji Aramaki: Festival and culture in Ariake Sea coastal area.....	13
Fumihiko Koyama: The history of Nori farming in Tokyo Bay and trial to pass down it to later generation.....	14
Session 1 Wetlands and Disaster Risk Reduction / Climate Change	
Keynote: Naoya Furuta: The Role of Wetlands for Disaster Risk Reduction	15
Chotiwiut Techakijvej: Carbon Retention in Sediment by Check Dams in Phayao Province, Thailand.....	15
Chandrashekhar Deshmukh: Evaluating the impacts of hydrological variations on carbon fluxes in tropical peatlands.....	16
Saswata Kumar Mohapatra: Lessons learned in building community resilience: 100 villages on the bank of 3rd largest river system of Peninsula of India in 5 years	16
Sanowar Hossain: Impact of climate change on the wetlands of Bangladesh	17
Yuki Arai: Reducing Fire on Peatlands in Indonesia – Experiences and Lessons Learnt from an International Cooperation Project in West Kalimantan, Indonesia	17
Minerva J Martinez: Interventions for wetland conservation in the Pampanga River Basin and Candaba wetlands, Philippines	18
Kiyofumi Kobayashi: Huge Water Channel Construction Project with Nature and Human Friendly Approach in the Sendai River....	18
Amado Jr. Samala Tolentino: Wetlands for a Disaster Resilient Asia: Legal Agenda.....	19
Session 2 Wetlands and Policy / Changes / International Cooperation	
Keynote: Yan Fang: China's New National Policy on the System of Wetland Conservation and Restoration.....	20
Yoshikatsu Kikuchi: Ramsar COP as a turning point of awareness and the present activities: Some cases to promote local awareness through international collaboration and understanding impressing with the concept of Wise Use	20
Pyae Phyo Aung: Spoon-billed Sandpiper conservation in the internationally importance wetland Gulf of Mottama	21
Tess Elizabeth Van Geelen: The Montreux Record under the Ramsar Convention: An effective mechanism for promoting State Party compliance?.....	21
Mashhor Mansor: The Establishment of Southeast Asian Limnological Society Network (SEAL-Net).....	22
Akane Tokorodani: Team SPOON: Creating connection of people and nature for sustainable society and East Asia peace.....	22
Kelin Chen: Yellow Sea Region Coordinated Waterbird Survey	23
Solongo Khurelbaatar: Opportunities to promote cooperation on the conservation and wise use of wetlands between Asia and the Pacific.....	23
Session 3 Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security	
Keynote: Muneharu Nakagai: Living in Harmony with Nature	24
Neda Asad Falsafi Zadeh: Lake Urmia Restoration via Local Community Participation in Sustainable Agriculture	24
Suvaluck Satumanatpan: Response of freshwater farmers to the environmental changes: a case study of Thailand	25
Tamotsu Sugunami: National Reclamation Project and "Ariake Sea Disaster": "Open-gate survey" for the harmony of healthy fishery and agriculture	25
Alifereti Tawake: Locally Managed Marine Areas (LMMAs) - a pathway to holistic and integrated island management and sustainable development: A Fiji case example.....	26
Shimpei Iwasaki: New forest commons towards solving the underuse of Satoyama from fishers' initiatives in Japan.....	26

Session 4 Urban Wetlands / Wetland City / Natural Infrastructure

Keynote: Sandhya Chandrasekharan: Urban wetlands and Governance challenges in the two Indian mega cities of Chennai and Bengaluru	27
Akihiko Higuchi: Making a wooden footbridge connecting nature and people in an artificial wetland	27
Sonal Gupta: Sustainable Management of Urban Lakes Environment and Ecosystem: A study on Lakes of Udaipur	28
Martinus Nanang: Conservation of Karang Mumus River and Swamps di North Samarinda: Efforts by Clean Karang Mumus River Movement and Stakeholders' Responses	28
Satoquo Seino: Horseshoe Crab Habitat Conservation and Coastal Zone Management in Japan	29
Panida Rahong: Urban Wetlands and Mosquito Born Disease Problem in Chiang Mai, Thailand	29
Abu Jubayer: Wetland Services for Elementary Urban Planning: Perspective from Bangladesh.....	30

Session 5 Wetlands and Youth

Keynote: Takuma Satoh: The environmental activities of Youth Ramsar Japan (YRJ), NGO organized by students ranging from junior high school students to graduate students.....	31
Atsushi Tanabe: Fundamental study on conservation and restoration of river estuaries habitat - Classification of estuary and their transitions since 1900s.....	31
Yiqing Hu: The value of wetlands and what we students should do for it--take Hengshuihu wetlands for example	32
Wenling Kou: My observation of status of Wetland	32
Ruichen Zhang: Obligation to the Wetland Conservation of the Youth	33
Sreeya Patnaik: The Youth Frontier Transforming Waste to Wealth – A case of novel efforts by young entrepreneurs towards the struggle for depolluting the holy River Ganges	33
Fumi Kasahara: Can youth help wetlands?.....	34
Takahiro Fukushima: CEPA activitise of Taishi high school science club	34
Hiromi Hayashi: Activities of Yonago Waterbird Sanctuary Jr.Ranger Club to foster mind for protecting wonderful our local nature to the next generation.....	35
Min Thiha Zaw: An Assessment of Species Diversity and Abundance of Waterbirds in Gulf of Mottama Wetland, Myanmar	35
Darry Shel Malla Estorba: Youth-in-Action for Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Ecosystem-based Adaptation (EbA)	36
Nichakant Kerdnamchai: The Study of Grey Water Footprint of Inorganic-Rice Cultivation for The Lower Central Plain Management in Thailand: Case Study in Nakhonchaisi District, Nakhon pathom Province	36
Thanayaporn Katesuja: River Continuum Concept and Ecological Health Monitoring of Loei River, North-Eastern Thailand	37

Session 6 Wetlands and Sustainable Tourism

Keynote: Maheshwar Dhakal: Entry Fees for Environmental Services in Community Based Ecotourism: An Experience from Bishazaari Wetland of Nepal.....	38
Kasimiro Talemaivatuwiri Taukeinikoro: To bring awareness of appreciation for the culture & environment by providing low impact activities that promote conservation & preservation through socially responsible and environmentally sensitive interaction with people, landscape and ecosystems.....	38
Shiina Suzuki: Promoting the Implementation of Environmental Treaties for Sustainable Tourism: In the Light of the Ramsar Convention	39
Zau Lunn: Biodiversity value of Meinmahla Kyun Wildlife Sanctuary Ramsar Site and development of ecotourism for the communities	39
Ajit Kumar Pattnaik: Initiative by the reformed bird hunters of Mangalajodi Marsh, Chilika Lake, India for successful conservation of biodiversity and sustainable tourism	40
Romell A. Seronay: Pagatpatan Mangrove Wetland Learning Center: Towards Wetland Conservation, Climate Change Adaptation and Education for Sustainable Developmen.....	40
Sansanee Choowaew: Integration of Visits to Crab Banks in Sustainable Tourism.....	41

Session 7 Wetlands and Culture

Keynote: Bishnu B. Bhandari: Wetland Culture in Conservation: Meaning, Concept & Application	42
Katsue Fukamachi: Bio-cultural diversity and flood control in the Kameoka Basin floodplain.....	42
Mohammad Shafi Sharifi: Wetland and Culture in Afghanistan	43
Puspa Lal Pokhrel: People's Perception towards Wetland Culture	43
Tapas Ranjan Chakraborty: Influence of Wetland in the Culture of Bangladesh.....	44
Tidimane Ntsabane: Traditional Conservation Strategies in Botsuwana's Wetlands.....	44

Session 8 Wetlands and CEPA (Communication, Capacity building, Education, Participation and Awareness) / ESD (Education for Sustainable Development)

Keynote: Lydia Lee Yan Pang: Localizing ESD Best Practice for Wetland Conservation- From Mai Po Nature Reserve to South China Region	45
---	----

Durga Prasad Dash: Building capacity of the local communities towards conservation and wise use of wetlands through CEPA approach in Eastern part of India	45
Hong Jing Ng: Penang Seagrass Project – An Environmental Education Project to Encourage Volunteerism & Field Education	46
Tomoko Ichikawa: How to promote Flyway-wide activities and involve key national stakeholders	46
Szu Ting Hsu: AdventureTime in Shezi Island, Tamsui River: Explore Our Hometown	47
Hideki Sato: Efforts and Challenges for Coastal Stability and Conservation with Proper Natural Resources Management in Sundarbans Region, Bangladesh	47
Jenna Ho Marris: BioBlitz in Hong Kong: Best practice sharing in wetlands CEPA	48
Xiuzhi Yang: Development of Wetland School in China	48

Session 9 Wetlands and Biodiversity / Restoration / Reintroduction

Keynote: Hidenobu Kunii: Present status and future prospects of the nature restoration in coastal lagoon Lake Nakaumi, Japan	49
Md Golam Rabbi: Haor of Bangladesh and Present Scenario.....	49
Mariko Abe: Threats to the biodiversity rich Henoko/Oura bay – Ramsar candidate site	50
Li Yan Qi: Introduction to configuration concept of aquatic acrophytes in lake ecological restoration - An example of ecological restoration in Gonghu Bay	50
Masanori Sato: Anthropogenic decline of the mudflat-specific fauna and flora in Japan: significance of the restoration of the estuary in Isahaya Bay in the Ariake Sea.....	51
Sungwon Hong: Re-establishment of the Eurasian otter in South Korea	51
Satoshi Kobayashi: Securing management measures of wild deer in Kushiro Marsh, the first Ramsar Site in Japan.....	52
Shivona Suneel Bhojwani: Linking wetland bird ecology with human activities in multiple-use wetlands in India	52

Poster Session I..... 53

[Wetlands and Disaster Risk Reduction / Climate Change] Adaptive Actions by the community to resolve various issues of Climate Change in the Wetlands along the coast of Bay of Bengal, Odisha, India / Numerical Simulation on Algae Bloom in Chaohu Lake, China / Impact of Changes in Environment and Climate on the Ecology of a Tropical Coastal Wetland of India [Wetlands and Policy / Changes / International Cooperation] Effect of policy change and human activity on vegetation pattern and biodiversity conservation in coastal wetlands: A case study in Yancheng, China / The Seabirds of Tubbataha Amidst Change / JICA Technical Cooperation Project for Biodiversity Conservation through Implementation of the Papua New Guinea Policy on Protected Area / Recent environmental changes and benthic community response in Lake Nakaumi and the Honjo area, Japan / Our approaches on the monitoring of wetlands' biodiversity for environmental conservation [Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security] Envisaging the Wetlands Degradation due to poor management practices in Bentota Area Sri Lanka / Wetland Conservation Action by Government and NGOs in Bangladesh and Future Course of Action [Urban Wetlands / Wetland City / Natural Infrastructure] Sungei Buloh Wetland Reserve / Codes for urban wetland management in a developing country: the case of Cameroon / Study on flood control effect of rainwater tank with small hole and creation of wetland habitat in urban area / A Case Study of Rainwater Society Initiative Projects that Promotes De-Centralized Water Management Systems [Wetlands and Sustainable Tourism] Preparation of Lake Conservation Management Plan for Sustainable Tourism in Gaidahawa Lake, Lowland Nepal / Lake Danao of San Francisco, Cebu, Philippines as Titlist of Clean and Green Lake: Its Development, Problems And Prospects / The Impact of Wetland Conservation Around Tourism Protected Areas. A Case of Kashaasha Wetland Around Bwindi Impenetrable National Park in South Western Uganda [Wetlands and Culture] Registration of Higashiyoka Higata as a Ramsar Site and Change in Regional Culture / Study of evaluation of traditional dry-stone revetment [Wetlands and CEPA (Communication, Capacity building, Education, Participation and Awareness) / ESD] Always on the Way to Wetland and Environmental Protection Education / Management Effectiveness Assessment of Jagadishpur Reservoir Ramsar Site, Nepal / Wetlands in Central Asia: raising awareness about their values in local communities in Kazakhstan, Kyrgyzstan and Turkmenistan / Roles of Resident Researchers to Promote Adaptive Fisheries: Lessons Learned from Lake Saroma, Japan / KODOMO Ramsar in Tsurui Villege / Science communication about the Hizen-Kashima Coast / Development of an environmental education program on tidal flat / The Progress of Environmental Education in Kashima city [Wetlands and Biodiversity / Restoration / Reintroduction] Physico-chemical Parameters of Water and Its Impact on Biodiversity of Hakaluki Haor at Sylhet, Bangladesh / Where is the future of our wetland? It lies in the hand of our youth / Status and Habitat Preference of Three Threatened Waders with Regeneration and Floristic Composition of Inter-tidal Mudflat Vegetation in Sonadia Island, Bangladesh / Community based Management of Marine Biodiversity in Bay of Bengal / Community led bio diversity conservation in Rushikulya estuary, India / Species and functional diversities of zooplankton in shallow water bodies and its application as ecological indicator / Large-scale private-public peat swamp forest restoration in Riau, Sumatra, Indonesia / Reasonability of cyclic floodplain rejuvenation for biodiversity and flood management in Japanese lowland rivers / Comparison of the photosynthetic responses to temperature and irradiance of two edible brown algae, <i>Cladosiphon okamuranus</i> from Amami Islands and <i>Cladosiphon umezakii</i> from Takeno, Honshu Island, Japan / The effect of irradiance and temperature on the photosynthesis of a temperate seagrass, <i>Zostera marina</i> (Zosteraceae) from Kagoshima, Japan, as the southern end of its distribution in the western Pacific / Field Observation Study on the effect of Fe-Fulvic acid silica complex material aiming at the NAGASU Tidal Flat restoration / Protection and utilization of great salamander in Toyosaka district, Higashi-Hiroshima city / Analysing social perceptions on the risks and benefits of tidal flat restorations: Cases from Japan and Malaysia / Red-crowned Cranes in Japan ; Is it Possible for Them to be Independent? / Integrated evaluation of biodiversity in tidal flat in Tokyo Bay	
---	--

Poster Session II 75

[Wetlands and Disaster Risk Reduction / Climate Change] Sago Eco-Techno Village: Towards Alleviating Disaster and Vulnerability of Agriculture and Communities through Nature Conservation and Enhancement in the Agusan River Basin in Mindanao, Philippines / Practice of rebirth of the Tora area in a special emergency project to cope with severe disasters / Study on river improvement technology in high gradient river using masonry groin for environmental conservation **[Wetlands and Policy / Changes / International Cooperation]** Establishment of Monitoring Program in Iranian Wetland Ecosystems / Should we go alone, if we want to go fast? Should we go together, if we want to go far? A discussion of sustainable cooperative efforts among registered and non-registered wetlands / Develop and startup ESD activities for rehabilitation of mangrove forests in Malaysia / Continuable hydrological monitoring with high data availability **[Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security]** Water Quality of Malaysian Tropical Reservoir Associated with Aquaculture Activities / Sustainable use of natural resources for community livelihoods in the Setiu Wetlands, Terengganu, Malaysia **[Urban Wetlands / Wetland City / Natural Infrastructure]** The roles and actions of the wetland centre of Yatsu-higata Tidal Flat, a wetland in the city that experienced massive urban development in the inner area of Tokyo / Evaluation of infiltration characteristic of amended soil by long term observation under natural rainfall for establishing runoff reduction technology **[Wetlands and Youth]** The Study of Grey Water Footprint of Organic-Rice Cultivation for The Lower Central Plain Management in Thailand: Case Study in Nakhonchaisi District, Nakhon pathom Province / Diversity and distribution of Macroalgae in Chiang Mai, Thailand / Diversity of Macroalgae and Benthic Diatom in Upstream of Mae Chaem River, Kalayaniwathana District, Chiang Mai, Thailand / Project of the visit center on peatlands – young view from Siberia / Comparison of CEPA activities and base facilities in Peru and Japan / Growth and burrows of the Japanese mud shrimp (Upogebia major) in the Arao tidal flat / Benthos of the Arao tidal flat, its list and specimen / The tideland which was left in the city “HIRAKATA-Bay” / The activities of Shisei junior high school biology club—Our hometown builds on the beautiful tidal lands, levees and canals— **[Wetlands and Culture]** Thangmi Folk Cultural Values of Forest for Wetland Conservation in Himalayas, Nepal / Valuation of village ponds as cultural landscape component in India **[Wetlands and CEPA (Communication, Capacity building, Education, Participation and Awareness) / ESD]** Building Capacities for Wetland Ecosystem-based Disaster Risk Reduction and Climate Change Adaptation in the Philippines / Using Art in Engaging and Enabling the Public to Act to Conserve Wetlands / Increasing capacity of local communities to implement wetland conservation and Eco- DRR and EbA activities in the Laguna de Bay Region and Marikina-Pasig River Watershed / Distribution and growth of Pectinatella magnifica (Leidy, 1851) in four large rivers, South Korea / Ramsar Biwa-Kids Ambassador Project / About the effectiveness of simple questions during nature observation for promoting development of self-expression / The Role and Process of Wetlands Education through Environmental Education and ESD in Japan / How can a senior high school biology teacher contribute to CEPA activities at the Arao Tideland / Collaborative activities around the Hizen- Kashima Area: MAE-UMI Citizens’ Association Activities **[Wetlands and Biodiversity / Restoration / Reintroduction]** From a bird to a policy: a brief history of wetland conservation in southern Taiwan / The Massive Noxious Golden Apple Snail Pomacea canaliculata Populations were Wiped During Rainy Season; A Case Study on Chenderoh Reservoir, Perak, Malaysia / Habitat use of Siberian warbler species at a stopover site in Far East Russia / Faunal Inventory in The Mangrove Areas of The Three Islands of Camotes, Central Philippines / Conservation and Management of Himalayan High Altitude Wetlands in India / Post-Project Appraisal of Urban Wetland Restoration: A Case of Mangrove Restoration Project in Jhongdou Wetlands Park, Kaohsiung City / Landscape design and the evaluation of the artificial wetland at the Nishinotani dry dam reservoir in Kagoshima, Japan / Practice of nature restoration in Sarobetsu Mire / Aster tripolium(sea aster) and greening of the sea wall in Tokyo Bay / Temporal and spatial variability of macrobenthic fauna in the high intertidal mud flat of the Ariake Bay / Evaluation of burrowing pattern and burrow structures of crabs in the muddy tidal flat of the Ariake Bay / The transition of river morphology and minor restoration in Kamisaiyo river

Poster Session III 97

[Wetlands and Disaster Risk Reduction / Climate Change] Prediction of Drought Using Coupled Ocean-Atmospheric Phenomena in the Watershed of Maharlu and Bakhtegan Lakes, Iran / Estimation of Environmental Risk of Pollution Water in The Rivers / Possibility as ECO-DRR of The Japanese Traditional Water Management System **[Wetlands and Policy / Changes / International Cooperation]** Response of biotic components after hydrological intervention in the tropical lagoon / Setiu Wetlands, Malaysia: Assessing changes in landscape condition and building a case for improved management / Shorebirds and Threatened Spoon-billed Sandpiper in Ariake Tidal Flats - Trends and Importance of Conservation **[Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security]** Handicraft And Souvenir Making Using Water Hyacinth (Eichhornia crassipes) And Tikog (Cyperus malaccensis) / Social Innovation for Biodiversity Preservation in Wetlands Kahokugata; Vegetable Cultivation for Establishing a Sound Material-Cycle Society “Suzume-Yasai”, and Rice Cultivation by Cooperation in Farmers and NPO “Ikimono-Genki-Mai” / RiceBEDProject, for Mainstreaming Biodiversityin Rice Paddiesby Networking People of Various Sectors in Japan and Overseas / What is the rainwater underground harvesting tank “Tametotto”? **[Urban Wetlands / Wetland City / Natural Infrastructure]** The “Wise Use” of Green Infrastructure: Community-Based Revitalization of Urban Wetland in Gowanus Canal, New York City / Onga River Reconstruction Project: East Side High-Water Channel Design to Balance the Flood Control and People-Friendly Open Space **[Wetlands and Sustainable Tourism]** Potential of Nature Tourism in Rural Environs Around Keoladeo National Park, Bharatpur (Rajasthan, India) / Cultural ecosystem services of temperate coastal area of Japan:from the visitors of tidal flat, sandy beach, and rocky/coral area / Wetland and Sustainable Tourism Higashimatsushima version **[Wetlands and Culture]** The Seletar Kids Art Education Project – A project to document the Wetland Jewels of Malaysia / Valuation of village ponds as cultural landscape component in India: preliminary study **[Wetlands and CEPA (Communication, Capacity building, Education, Participation and Awareness) / ESD]** “Citizen Social Responsibility” in conserving water resources / Cultural

Dimensions of Local Social Movements at Kuala Gula, Taiping, Perak, Malaysia / Community based management of beach litter in Itoshima Peninsula, Fukuoka / Wetland and Culture in Afghanistan / Fundamental research on residents' water use and consciousness related to river environment / Development of ESD program focusing on conservation ecology of Suaeda japonica Makino (Chenopodiaceae), a threatened wetland halophyte **[Wetlands and Biodiversity / Restoration / Reintroduction]** A 3D Voxel-Based Model of Peatland Hydrology / Community based migratory bird conservation at Mangalazodi in Chilika Lagoon Ramsar Site, India / Peat accumulating mountain wetlands of South Siberia: biodiversity and ecosystem services / Habitat Restoration: Bringing Back the Brackish Water in Guandu Nature Park / Biodiversity of The Kampar / Status of White Winged Duck in Kampar peninsula / Big Business & Big Wetlands, Can They Thrive Together? / Wetland Conservation in the Mai Po Inner Deep Bay Ramsar Site / The return of the smooth-coated otter to Singapore: distribution, growth, public perception and conservation management / The effect of benthos and fish habitat on the artificial tidal flat restration in urban canal area / High genetic diversity of Cottus pollux middle-egg type in Kyushu Island and related river topography / A Study on the Present Condition and Transition of Habitats of Freshwater Mussels in the Kikuchi River / Analyses and counter measures on the severe damages to the ecosystem of the Awase Tideland area of Okinawa Island, southwest Japan by a dredging and reclamation project / The effects of river modification to the spawning habitat of Ice Goby(*Leucopsarion petersii*) / The influence of agricultural activities on water chemistry and aquatic biota in the freshwater springs of Uchinada Dune, Japan / New fish fauna inventory and survey techniques for marine protected area planning: Environmental DNA metabarcoding / Corn and Cameras: Wildlife Management Issues in Restoring the Migration of Red-Crowned Cranes in Hokkaido, Japan / The environmental conservation in Yatsu wildlife protection area / Sustainable Forest Management for Soil and Water Resource under SGEC Certification



Organization of AWS2017

Title

8th Asian Wetland Symposium (AWS2017) –Wetlands for Sustainable Life–

Date

7–11 November 2017

Venue

Hotel Grande Hagakure, Saga, Japan

Organizers

Ministry of the Environment of Japan
Wetlands International Japan
Ramsar Center Japan
Japan Wetlands Society

Co-organizers

Saga Prefecture
Kumamoto Prefecture
Saga City
Kashima City
Arao City
Ramsar Regional Center - East Asia
International Lake Environment Committee Foundation
Wetland Link International Asia

Supporters

Ministry of Foreign Affairs of Japan
Ministry of Agriculture, Forestry and Fisheries of Japan
Ministry of Land, Infrastructure, Transport and Tourism of Japan

Collaborators

Ramsar Convention Secretariat
UNEP Regional Office for Asia and the Pacific
IUCN Asia Regional Office
Keidanren Committee on Nature Conservation
Domestic Committee for Ramsar Sites related Municipalities in Japan
Youth Ramsar Japan
Institute of Decision Science for a Sustainable Society of Kyushu University

Sponsors

Sekisui Chemical Co.Ltd.
Sompo Japan Nipponkoa Insurance Inc.
Maple Tours Travel Agency
INTEM Consulting, Inc.
TOKEN C. E. E Consultants Co., Ltd.
CTI Engineering Co. Ltd.
Asia Air Survey Co., Ltd.
Civil Engineering & Eco-Technology Consultants
Oriental Consultants Global
Mitsui & Co.
Maeda Corporation
IDEA Consultants Inc.
ITO EN Ltd.
Nippon Koei Co. Ltd.
ANA HOLDINGS INC.
APRIL International Enterprise Pte Ltd
Sumitomo Forestry Co., Ltd.

Grant Programs

Keidanren Nature Conservation Fund
Japan Foundation Asia Center Grant Program for Enhancing People-to-People Exchange

Asian Wetland Symposium 2017 Executive Committee:

Yoshihiro Natori (Wetlands International Japan, Japan)
Motokazu Ando (Ramsar Center Japan, Japan)
Yukihiro Shimatani (Kyushu University, Japan Wetland Society, Japan)
Masaru Horikami (Ministry of the Environment, Japan)
Gunji Aramaki (Local Organizing Committee, Japan)

International Steering Committee:

Ajit Pattnaik (Wetland International South Asia, India)
Atsuhiko Tanabe (Youth Ramsar Japan)
Bishnu Bhandari (Nepal Wetland Society, Nepal)
Chen Kelin (Wetlands International – China, China)
Chris Rostron (Wetland Link International, UK)
Gea-Jae Joo (Pusan National University, Korea)
Gunji Aramaki (Local Organizing Committee, Japan)
Hiroji Isozaki (Sophia University, Japan)
Kazuaki Hoshino (Kagoshima University, Japan)
Lew Young (Ramsar Convention Secretariat, Switzerland)
Masaru Horikami (Ministry of the Environment, Japan)
Mashhor Mansor (Universiti Sains Malaysia, Malaysia)
Motokazu Ando (Ramsar Center Japan, Japan)
Naoya Furuta (Taisho University, IUCN Japan Liaison Office, Japan)
Reiko Nakamura (Ramsar Center Japan, Japan)
Sanowar Hossain (Bangladesh POUSH, Bangladesh)
Sansanee Choowaew (Mahidol University, Thailand)
Seung-Oh Suh (Ramsar Regional Center – East Asia, Korea)
Yoshihiro Natori (Wetlands International Japan, Japan)
Yuki Arai (Japan Wetland Society, Japan)
Yukihiro Shimatani (Kyushu University, Japan Wetland Society, Japan)

Asian Wetland Symposium 2017 Executive Committee Secretariat

Chief of Secretariat: Emiko Nagakura

Deputy Chief: Reiko Nakamura

c/o Wetlands International Japan
2F Jono Building 2, 17-1 Nihonbashi-Odenmachi, Chuo-ku,
Tokyo 103-0011, Japan
tel: +81-3-5614-2150 fax: +81-3-6806-4187
E-mail: info@aws2017.org
<http://aws2017.org/>

Wetlands and Sustainable Development

Martha Rojas-Urrego

Secretary General, the Ramsar Convention Secretariat

The Ramsar Convention on Wetlands is unique in that it recognizes the importance of wetlands for the range of ecosystem services that they provide for both people and the environment. As a result, the Mission of Convention and work of its 169 Contracting Parties and partners is to promote the conservation and wise use of wetlands through collaboration at all levels as a contribution towards sustainable development.

The work of the Convention is more relevant than ever as it contributes significantly to the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals agreed by the United Nations in 2015.

The values and services provided by wetlands are outstanding, yet they are not sufficiently recognized and they are disappearing faster than other ecosystems.

Wetlands provide freshwater at the right quality and quantity for consumption, especially at times of scarcity (SDG6) and for farming systems feeding millions of people (SDG2). They regulate water in our landscapes and coastlines and protect communities against disasters (SDG11). Wetlands are the greatest natural carbon stores and help communities to adapt and be resilient to climate change (SDG13). Their protection, sustainable management and restoration support a wealth of freshwater and marine species and ecosystem services (SDG 15 and 14) and con-

tributes to combating desertification (SDG15). When they are sustainably managed wetlands provide the basis for livelihoods and for local to national economies (SDG 12 and 8). The conservation and sustainable use of wetlands is thus central to achieving sustainable development.

The Ramsar Convention provides a ready platform for the implementation of the 2030 agenda with its particular focus on priority wetlands that have been placed on the List of Wetlands of International Importance ('Ramsar Sites') the commitments from its Contracting Parties to conserve and use wisely all their wetlands. Presently, there are more than 2,285 Ramsar Sites worldwide covering an area almost six times the size of Japan. Whilst these sites are well known for the biodiversity, especially waterbird populations that they support, they also provide vital ecosystem services for people. Of the 399 Ramsar Sites in the Asia-Oceania region, approximately 45% provide food and water, 54% helps in reducing the risk from disasters, and around 70% are important for tourism and education.

The Asian Wetlands Symposium provides an important opportunity to raise the visibility of the outstanding values of wetlands and to mobilize the needed action to reverse their decline and to conserve them and use them wisely to ensure sustainable development to all.

Conservation Strategy on Wetlands and Biodiversity of Japan

Naohisa Okuda

Director, Biodiversity Policy Division, Nature Conservation Bureau, Ministry of the Environment, Japan

As the islands of Japan stretches from the subarctic to the subtropics with its geographical features extending from the south to north, there are various types of wetlands. Japanese people have long lived in harmony with nature, so wetlands are deeply rooted in our lives. However in the rapid economic growth period from the 1950s to the first half of the 1970s, many wetlands were converted into other land uses and their area had been significantly reduced.

In 1980, Japan joined the Ramsar Convention and Kushiro-Shitsugen (Marsh) in Hokkaido was designated as the Japan's first wetland of international importance under the Convention. In 1987, Kushiro-Shitsugen was designated as a national park, too. In the 1990s, the first Asian Wetlands Symposium in Otsu and Kushiro (1992) as well as the 5th Meeting of the Conference of the Parties (COP5) to the Ramsar Convention in Kushiro (1993) were held in Japan. Consequently, it was widely recognized in Japan that wetlands must be conserved as a significant ecosystem.

In the 2000s, Japan and Republic of Korea jointly proposed the Rice Paddy Resolution and it was adopted at the Ramsar COP10 (2009) and endorsed at the CBD-COP10 (2010). In addition, the International Partnership on SATOYAMA Initiative was launched based on a proposal by Japan during the CBD-COP10. Through these propositions, Japan has been sending a message on the relationship between humans and wetlands with the concept of "living in harmony with nature" to the World as a country of the Asian region.

Japan has made some progress in conservation of wetlands while accumulating experience and knowledge on that, and thus we have 50 Ramsar wetlands in Japan now. However, we have still a lot of issues to be tackled including new issues such as problems caused by invasive alien species. Taking the opportunity of holding AWS2017 in Saga along the Ariake sea which has a vast tidal flat, we hope that the measures for biodiversity conservation to tie humans and wetlands will be further promoted, as manifested in the word "wise use".

25th Anniversary of AWS and the Prospects for the Next 25 Years

Hiroji Isozaki

Visiting Professor of Sophia University

A variety of studies and proposals during the last 25 years have contributed to improve wetland conservation and management, and AWS has played a part in it. On the other hand, some proposals have not been fulfilled yet in spite of repeated call out for them. Therefore, RCJ is working on classifying the proposals of AWS and other relevant meetings into achieved and not achieved in order to identify unsolved problems.

Based on the analysis of the classification as well as the reports and discussions of AWS 2017, proposals for the next 25 years will be adopted on the last day of the symposium. This keynote presentation is going to suggest the clue for necessary actions for the future, based on the Ramsar Convention and the essential principle, criteria and procedure for wetland conservation and management, which have been developed internationally.

Restoration of Chilika Lake: A journey from Montreux Record to Ramsar Wetland Conservation Award, and the way forward

Ajit K. Pattnaik

Vice President of Wetlands International South Asia, Ex Chief Executive of Chilka Development Authority

The Chilika lake is the largest brackish water lake in India and a Ramsar site. The lake is a unique assemblage of marine; brackish and fresh water eco-systems with estuarine characters. It is a hotspot of biodiversity and a wintering ground for more than one million migratory birds. The lake basin and coastal process are integral factors determining the ecological integrity of this coastal wetland. The freshwater inflows drive the temporal and spatial salinity dynamics of the lake, which contributes to the mosaic of aquatic habitats for different plant and animal species, and the different life cycle requirements of these species. It is primarily this dynamic salinity regime that enables the lake to support high biodiversity and a productive fishery. The highly productive ecosystem of Chilika lake sustains the livelihood of 0.2 million fishers and 0.8 million in the watershed community. The lake encountered a combination of increased siltation due to changes in the land use pattern and degradation of the lake basin, as well as the partial closure of the outlet channel connecting the sea. The decrease in salinity caused proliferation of invasive species, increased turbidity, shrinkage of the water-spread area, loss of biodiversity, and depletion of fishery resources. Due to changes in its ecological character, it was included in the Montreux Record, maintained by Ramsar Bureau, in 1993.

In response to the action by the Ramsar Convention, Chilika Development Authority (CDA) was created for the restoration of the lake based on the Ramsar Guidelines and wise use principles by the Government. CDA initiated an integrated adaptive management process to address the complex ecological and socio-economic issues of the

Chilika lake based on the Ramsar guidelines.

It is an exemplary good-practice local action of the application of the various Ramsar guidelines, and the use of the Convention's tools and approaches, to address complex issues with an ecosystem approach. It is also a perfect example of how the restoration of a wetland with ecosystem approach can not only result in ecological integrity of the wetland but also, can contribute significantly towards the improvement of livelihood of the local community. This local action is a good demonstration how various guidelines and tools of the Ramsar convention have been successfully translated into action. In particular, this example could assist the Convention to develop further guidance in support of the whole ecosystem approach to wetland management and provide an example of adaptive management practices for wetlands.

The restoration strategy adopted by CDA derives its uniqueness from the firm participation by local communities, linkage with various national and international institutions, and intensive monitoring and assessment of the system and its global relevance. Chilika Lake was removed from the Montreux Record (first from Asia) in 2002, and Chilika Development Authority received the prestigious Ramsar Wetland Conservation Award for the successful restoration of the wetland.

Characteristics of the marine environment in Ariake Sea

Yuichi Hayami
Saga University

Ariake Sea is a semi-enclosed embayment located in western Kyushu. It has a length of 96 km, mean width of 18 km and mean depth of 20 m. It has a large tidal amplitude up to 6 m of tidal range in the bay head. Because of the shallow topography and large tidal amplitude, there are widespread of tidal flat which is about 40% of the total tidal flat area in Japan. The Chikugo River which is the biggest river in Kyushu discharges into the bay head. The area northward of the line connecting Takesaki Island and the Miike Port is called as the inner area of Ariake Sea. High concentration of suspended clay and silt in the Chikugo River water, shallow depth and large tidal amplitude generate high turbidity in the inner area of Ariake Sea. Most of the tidal flats in this area are soft mudflats. The typical ones are Higasiyoka-higata and Hizen Kashima-higata. Here "higata" means tidal flat. On the other hand, there are sandy mud or sandy tidal flats located along the eastern coast of Ariake Sea including Arao-higata. Ariake Sea has unique biota; for example, Mutsugorou (goggle-eyed goby) and Etsu (grenadier anchovy). There are 23 species which distribute only in Ariake Sea in Japan. Most of them are mainly distributed in the inner area of Ariake Sea. From October to April, many laver cultures are conducted in the inner area of Ariake Sea using the shallow topography and abundant nutrient supply from the rivers and mudflats. It is the biggest commercial fishing in Ariake Sea (About 99% of the gross fisheries production in Ariake Sea in Saga Prefecture). However, many environmental and fisheries problems are occurring in Ariake Sea now, e.g., the decrease of bivalves and demersal fish, increase of red tide and the formation of the hypoxic water mass (oxygen depleted water) in summer. More than 30 years ago, the inner area of Ariake Sea was the biggest production area of Tairagi (pen shell) in Japan. Its production sometimes exceeded ten thousand t/year. But its population

size became very small now and its fishing has been closed for 5 years since 2012. In the sandy mud or sandy tidal flats, the decrease of the production of Asari (manila clam) became a problem. From the mid 70s to the early 80s the Asari production in Ariake Sea exceeded 50 thousand t/year. It was a half of the total production in Japan. But it was less than 1 thousand t/year in 2014. There are two types of red tide problems in Ariake Sea. One is the toxic phytoplankton bloom in summer, e.g. *Chattonella* sp. The other one is the phytoplankton bloom mainly diatoms in autumn and winter. Usually they are not toxic. However, as the excess phytoplankton production consumes a lot of nutrients in water, the discoloration of the cultured laver is induced by the nutrient depletion. The formation of the hypoxic water mass is a serious problem since it induces the decrease in benthos and disappearance of fish. The bottom water in the inner area of Ariake Sea easily became hypoxic from the 1970s to the early 90s and the hypoxic water mass (less than 3 mg/L in Dissolved Oxygen) formed every summer since 2004. The main reasons for these problems remain unclear now. But many fishermen insist that the Isahaya Sea dike construction affected. In 1997, the inner 1/3 of Isahaya Bay was shut off by the dike and a fresh water reservoir and reclaimed land were constructed. Now the conflict related to the Isahaya dike construction became a big social problem.

Animals and Plants in Tidal Flat of Ariake Sea

Yasuhisa Henmi

Center for Water Cycle, Marine Environment, and Disaster Management, Kumamoto University

The Ariake Sea (1,700 km²) is an enclosed coastal sea with large tidal amplitudes of more than 6 m in the innermost areas during spring tides. In the Ariake Sea, huge tidal flats (188 km²) develop mainly in the estuarine areas of large rivers, and many salt marshes are located in the upper intertidal zones of estuarine and riverine areas. Different types of tidal flats are observed in various places, and animals and plants segregate habitats by the sediment type (soft bottom - pebble). In the northern (inner) part of the Ariake Sea (Isahaya - Yanagawa), tidal flats are huge and composed of very fine mud (soft bottom), and Mutsugoro (mudskipper), Sarubou (ark clam), Shiomaneki (mud fiddler crab), and Shichimenso (Suaeda sp.) etc. can be observed. In the middle part (Arao - Uto), many tidal flats are middle-sized and mud-sandy, and Asari (Japanese littleneck clam), Hamaguri (hard clam), and Hamamatsuna (Suaeda sp.) etc. can be observed. In the southern part (mouth of the bay; Shimabara, Amakusa), most seashore is small-sized and rocky, and small sandy tidal flats are found in inner parts of inlets, and Mategai (razor clam), Hakusen-shiomaneki (sand fiddler crab), and Hamasaji (autumn statice) etc. can be observed. Many dolphins (Minami-hando-iruka, Indo-Pacific bottlenose dolphin), over 100 individuals, inhabit and forage for fish on the sea of Amakusa Islands.

In Ariake Sea, many animals and plants are continental relicts, Oo-syamisengai (*Lingula* sp.), Umi-maimai (air-breathing snail), Haragukure-chigogani (dotillid crab), Etu (Japanese grenadier anchovy), and Mutsugoro etc., and they lived around 'Old Yellow River' 20,000 years ago. Now, the same species are found along the Yellow Sea, though the distribution of these species is restricted to the Ariake and Yatsushiro Seas in Japan. Nori (edible seaweed of red algae, mainly sold as a paper-thin, black, dried sheet) and Asari are major fishery products in the Ariake

Sea. However, Nori product is unstable and Asari product suddenly decreased since 1980s. Moreover, unfortunately, other commercially important fishery species, Hamaguri, Tairagi (pen shell), Agemaki (Chinese razor clam), Haigai (granulated ark clam), Kuruma-ebi (Japanese tiger prawn) etc., also greatly decreased and some of them become endangered species.

Like other coastal environments in the world, tidal flats in the Ariake Sea face high levels of destruction, due mainly to anthropogenic activities. Also in western Kyushu, many people lives in coastal regions, making coastlines highly vulnerable to human impacts. In addition, human activities affect tidal flats directly and indirectly through grazing, dredging, development, saltwater intrusion, dumping of chemicals into water systems and overfishing. Moreover, invasive alien species, Kara-mushiro (*Nassarius* snail), Shimamenou-funegai (onyx slipper snail), Higata-ashi (saltmarsh cordgrass) etc., represent a major threat to native animals and plants in tidal flats in the Ariake Sea. Finally, tidal flats are also exposed to the threat of a global rise in sea levels. Because of the environmental destruction like above, coastal biodiversity and the services to it underpins are greatly lost. For example, Kumamoto is the largest Hamaguri (*Meretrix lusoria*) producing prefecture. The estuarine area of the Midorikawa River is the largest producing area in Japan. But the production is greatly decreased since 1980s. The major causes are thought to be sand/gravel-digging in the river, construction of dam and overfishing. The sand/gravel-digging in the river, and construction of dam changed the bottom of river mouth from sand to mud, which the juveniles of Hamaguri dislike. Thus, the change of coastal environment gives serious influences on animals and plants in the coast areas.

Intertidal mudflats are highly productive ecosystems that impose severe environmental challenges on their occupants due to tidal oscillations and extreme shifts in habitat conditions. Reproduction on mudflats requires protection of developing eggs from thermal and salinity extremes, O₂ shortage, dislodgement by currents, siltation and predation. Mudskippers are air-breathing, amphibious fishes, and one of few vertebrates that reside on mudflats. There are five species of mudskippers in Japan, and two in the Ariake Sea (*Boleophthalmus pectinirostris* and *Periophthalmus modestus*). All the mudskippers so far studied lay their eggs in mud burrows containing extremely hypoxic water. If submerged in the water contained in the burrows, the eggs will perish within 48 hours due to suffocation. Therefore, the question of how the eggs survive had been an enigma to fish biologists. Through our 10-year field work in Saga, Japan, we found that the Japanese mudskipper *Periophthalmus modestus* deposits its eggs on the walls of an air-filled chamber within its burrow. To ensure adequate O₂ for egg development, the burrow-guarding male mudskipper deposits mouthfuls of fresh air into the egg chamber during each low tide. As a result, the O₂ concentration of egg-chamber will become high enough to satisfy O₂ requirement of the developing embryos during the subsequent high tide period, when the mudflat was covered by tidal water and the male did not add air. An artificial reduction of egg-chamber O₂ concentration revealed that the male sensed the hypoxia and recovered the O₂ concentration rapidly before the next mudflat inundation. When egg development is complete, the male, on a nocturnal rising tide, removes the egg-chamber air and releases it outside the burrow. This floods the egg chamber and induces egg hatching. Video records showed that flooding the chamber required the removal of an average of 103±42 air gulps, which gave an almost exact volume

of total egg-chamber air (47ml) based on the buccal-branchial capacity of *P. modestus* (0.46ml in an average-sized (2.6g) fish). Thus, *P. modestus* has developed a reproductive strategy that allows it to nurture eggs in this severe habitat rather than migrating away from the mudflat.

Data on the reproductive strategy of *Boleophthalmus pectinirostris* is fragmentary, largely because of more complex and variable configuration of their burrows. Nonetheless, the measurement of redox potential indicated that the egg chamber is exposed to much higher O₂ conditions than the other parts of the burrows. Observations of burrow-guarding male and the laboratory experiments of egg incubation in air and hypoxic water also agree with the assumption that *B. pectinirostris* eggs develop in air filled in an egg chamber.

The reproductive strategy of mudskippers requires that the eggs be specialized to develop in air and that the air-breathing capacity of the egg-guarding male be integrated in a complex behavioral repertoire that includes egg guarding, ferrying air to and from the egg chamber, and sensing O₂ levels therein, all in concert with the tidal cycle. Compared with the reproductive modes of other fishes that spawn at the interface between air and water, mudskippers have evolved the most sophisticated, but also the most energy demanding reproductive strategy, which probably reflects the most formidable nature of their habitat.

Wild birds in Ariake sea (past, present, and future)

Akiyuki Miyahara

Wild Bird Society of Japan Saga

I've heard that a lot of *Anas formosa* flew above Ariake sea flapping their wings before the war from the first branch chief of Wild Bird Society of Japan 25 years ago.

After that, there is the World War II, and recovery from the war, and rapid economic growth. During that, the coastlines in Japan were concreted. The tidal flats were 80,000 ha in 1945 but 51,433 in 2006, namely disappeared 36% in 60 years.

Now the tidal flats that remain in Japan or 19,206 ha are in Ariake sea. From this figure we can understand how important the tidal flats in Ariake sea are. But in Ariake sea the sluice gate of Isahaya bay was closed. Formally Isahaya bay was the number one landing zone. Now the number of *Anas formosa* landing decreases. *Anas formosa* became a rare bird.

The birds like *Anas formosa* continued to decrease but still a lot of birds go through Ariake sea. Ariake sea is the place where 33% of shorebirds come to Japan. This figure is derived from the maximum number of individuals in the survey monitoring-site 1000.

The site is consist of Core site (Arao Higata, Higasiyoka Higata, Kasimasinkago Kaigan) and General site (Rokkaku-gawa Kako, Hayatue-gawa Kako, Onoshima). The tidal flats in Ariake sea is the important one and in addition to shorebirds a various kind of birds (Ducks, Gulls, Herons) come there.

Chroicocephalus saundersi is the endangered species, and 45% of the bird in Japan come to Ariake sea and pass the winter.

20% of *Platalea minor* and 71% of *Tadorna tadorna* use there. A lot of *Calidris alpina*, *Pluvialis squatarola*, *Charadrius alexandrinus* use there not as a stopping point but also as a wintering spot.

38% of *Calidris alpina*, 21% of *Charadrius alexandrinus* that pass the winter in Japan use the tidal flat of Ariake sea. Also 42% *Numenius madagascariensis* and 36% of *Limosa lapponica*

supplement nutrition and pass there.

From these data you can understand that Ariake sea is No.1. Especially Higasiyoka Higata is remarkable. Higasiyoka Higata is an indispensable place to birds.

The reason why a lot of birds come there is that there are much food for example, Bristle worms, Crustaceans, fish and also their foods microbes, plankton.

That Ariake sea is sick now.

Every time I hear about the reduction of fishery resources, I am very sad.

We can not make the environment worse any further. Arao Higata, Higasiyoka Kaigan, and Kasima Shingomori Kaigan (the wetlands of international importance that are protected) constitute only 5% of the entire Ariake sea. We must link to the future to enjoy watching birds rest on this place, to arrest the deterioration of the environment. It is up to us to enrich the sea and also improve the sea.

Toward Restoration of Ariake Sea by Means of an Integrated Studies “CoHHO” Collaborated with Its Relevant Social Movement “The Sea is Longing for the Forest”

Masaru Tanaka
Kyoto University

The Ariake Sea previously showed the highest bioproductivity and biodiversity in Japanese coastal waters, being characterised by existence of many unique species of which distribution is restricted there. However both trends have been lost in recent years primarily due to accumulation of large-scale human impacts on the environment. Although there were many human impacts, following three problems appear to be the most serious impacts on the Ariake Sea ecosystem. 1) Disembarking huge amount of sand from the bottom of the Chikugo River which is the largest river inflowing to the Ariake Sea during the later half of 20th century. 2) Chikugo Ohzeki construction in 1985 at the lower reach of the Chikugo river in order to supply drinking water for Fukuoka city. 3) 7km sea dyke construction in 1997 to reclaim the wide tidal flat area in the innermost part of Isahaya bay.

Each of those human impacts on itself is serious, but we should make sure of the essence common to these problems. That must be human-dividing land (forest) system and sea system which originally connect each other. We could easily understand that tidal flat which needs continuous supply of mud and sand from land mainly by rivers; tidal flat appears to be deteriorated if its continuous supply was disturbed, causing resultant reduction of bio-purification ability by benthic organisms.

Japan has a unique natural structure characterised by combination of rich forest ecosystem with its coverage of 67 % and highly diversified marine ecosystem which is connected by more than 30 thousands rivers. This is recognised as positive connectivity in which forest ecosystem enhances marine bioproductivity by supplying nutrients and minute elements. However increased human population along riverside has destroyed it and changed to negative connectivity. This could be

typically found in Ariake Sea surrounded by many volcanic mountains like Unzen, Tara, Seburu, Kuju and Aso. Present critical situation of Ariake Sea is derived from destroying the forest-sea connectivity during the last 50 years.

In 1989 oyster-culture fishermen initiated tree-planting activity in order to restore the coastal marine ecosystem under a catch-phrase “The sea is longing for the forest” in Kesennuma, Miyagi prefecture. This grass-root social movement becomes to be nation-wide movement and has recently been got attention from overseas countries as a Japanese wisdom. Followed this social movement (Mori-Umi movement), an integrated studies covering from the forest to the ocean was proposed by Kyoto University in 2003, being named as CoHHO studies (Connectivity of Hills, Humans and Oceans).

We have tried to introduce the Mori-Umi movement and CoHHO studies to Ariake Sea for restoration, particularly tidal flat restoration since 2010. In order to disseminate the idea we have held annual symposium entitled “Ariake Sea restoration” in Fukuoka, Oita, Saga and Kumamoto prefecture. Combined with idea dissemination we have established a non-profit organization to start practical tidal-flat restoration experiment. One of the important our practices has been conducted in Tara, Saga prefecture under collaboration fishermen, citizens and researchers since 2011. This experiment has been carried out using an environmental restoring substance named as Chilate Marine (CM) composed of iron, bamboo chachole and chelate substance. This will be done under collaboration of young and senior generations as well as collaboration of local and urban people. Recent our particular concern is how we could invite school children into such field activities.

Efforts toward Revitalization and Creation of Ariake Sea

Yoshiyuki Kawakami
Ariake Bay Rehabilitation Organization

The Specified Nonprofit Corporation, Ariake Sea Revitalization Organization was established with the aim of contributing to the revitalization and creation of the Ariake Sea through “survey and research” and “NPO activities”, etc. mainly by university researchers in June 2005. Based on this, we have provided information widely through symposiums and lectures for citizens, and have been thinking about Ariake Sea together. In addition, we have also worked on the “Research Master Plan” showing a roadmap for a future survey and a research for the revitalization of Ariake sea.

We submitted “urgent proposal leading to future of Ariake Sea” to the related organizations of government and prefecture, and also actively participated in the problem of opening the Isahaya Bay reclamation project and strove for social contribution from scientific standpoint.

Today, we are gathering together with a common goal for “revitalizing and creating Ariake Sea”, and aiming to establish “Association to consider the revitalization and creation of Ariake

Sea and its coastal areas (tentative name)” composed by the administration of government and Saga prefecture, fisheries, researchers, NPO members etc. who cooperate toward this goal and implement concrete efforts.

In addition, we will recruit technology seeds for revitalizing Ariake Sea widely from all fields to discover new technology seeds, and will hold a workshop for technological suggestion. We will play a platform role for revitalization of Ariake Sea.

At least until ca 1950s, there were many traditional fishing methods existed in Ariake Sea. The numbers of the traditional fishing methods were about 100 including fishing boat fisheries and fishing activities on the tidal flat. However, their numbers fell to about one-half due to the degradation of marine environment and the decrease of the fisheries resources. The examples of the traditional fishing boat fisheries are the "Ankou-ami", the "Umitake-neji" and the helmet diving fishing of pen shell. The Ankou-ami fishing is conducted by a boat anchoring at the bay head area off the river mouth. The Ankou-ami is a fixed bag net with a width of about 20m which traps the fish and shrimp flowing into it by strong tidal current. It still can be seen off the mouths of the Hayatsue River and the Rokkaku River now. The Umitake-neji is a fishing to catch the bivalve *Barnea dilatata* (in Japanese "Umitake") which has long siphon and living in the bottom sediment using a long rod with an iron hook from a fishing boat. Now this fishing has been closed because of the decrease of the population. The helmet diving fishing of pen shell (in Japanese "Tairagi") is one of the typical fisheries in Ariake Sea but the history of it was not so old. It started in the Taisho era, at first by the divers from Jeju Island, Korea. This fishing is also closed now because of the decrease of population. The examples of the traditional fishing activities on the tidal flat are the "Mutsukake", the "Subokaki" and the "Takappo". The Mutsukake is a fishing of the goggle-eyed goby (in Japanese "Mutsugorou"). The Mutsukake fishermen sneaks up to a goggle-eyed goby on the mudflat and catch it by whipping with a long fishing rod. There are about 10 fishermen who are conducting the Mutsukake in Hama, Kashima City and so on. The Subokaki is a fishing to catch the goby *Odontamblyopus lacepedii* (in Japanese "Warasubo") in the mud using a rod with an iron hook. The Mutsukake and the Subokaki fishermen use the Oshi-

ita to move on the mudflat. The Oshi-ita is just like a snowboard or a wake board, but instead of zipping over snow or water, they slide over mud. The Takappo is a fishing of the goggle-eyed goby hiding in the burrow using traps made of bamboos or PVC pipes. Other than them, there are fishing methods using setnets or fishing weirs. The "Sukui", also known as the "Ishihibi" is a stone tidal weir. The Sukui fishing catch fish trapped in it using the sea level change caused by the tide. In the Meiji era, there were about 200 Sukuies along the coasts of Ariake Sea. However, there is only one is remaining now. It is located in Isahaya Bay and designated as a cultural property of Isahaya City. The other fishing method which is under threat of disappearance is the Takehaze. The Takehaze is the biggest setnet in Ariake Sea. It is a V or W shaped structure with a length of about 200 m in one side constructed with many bamboos and one or a few nets in shallow water. Just after the World War II, there were at least 100 Takehazes in Ariake Sea. But there are only one is remaining off Omuta City now. The traditional fishing methods disappeared in this 70 years after the World War II is more than 10.

Festival and culture in Ariake Sea coastal area

Gunji Aramaki

Specified Nonprofit Corporation, Ariakekai Gururin Net

Japanese people believe that "God" is inhabited in every nature, such as the sun, moon, water, ocean, forest. Okinoshima Island and Munakata Taisha Shrine where registration was decided to be a World Heritage this year, is celebrating the god of water and the famous Hurougu shrine, Koura Taisha shrine, Yodohime shrine in this area are celebrating the gods of sea and water.

"Hurougu Shrine Sea God Festival", a festival that sets up an altar on the tidal flat that the tide has drawn at low tides and prays for God the grace and peace of the sea, conveys the relation between the ocean and people. The "Umihiko Yamahiko Legend" written in "Kojiki", the oldest historical book in Japan, can not be established unless the background difference is large difference in the Ariake Sea. This strongly suggests that the origin of Japanese courtroom was in the coastal area of Ariake Sea.

150 years ago, the Saga clan was in charge of security at Nagasaki Port which was opened to a foreign country in Japan. The Saga clan who touched advanced Western science and technology had learned much from many foreigners and books and succeeded in making cannon and steamship with their own power. The former site of Mie Tsu Navy site which completed the first steamship in Japan was registered as "World Modernization Heritage" together with "Manda pit" (coal mining) in Arao City in 2015.

People in the coastal area of the Ariake Sea inherit the ancient festivals and at the same time create new festivals such as the "Kashima Gatalympics" and "Hot-air Balloon Festival" and deepen their relationship with nature. Kashima citizen came up with the idea to compete on tideland to widely advertise the flats' charm. Competitions are prepared such as how far you can fly with the rope and how fast you can run on a thin plate

with a bicycle not on the brake. The smiling face of muddy children in the "Kashima Goatalympics" shows that the mud deposited in Ariake Sea is clean and fun.

Saga plain has a mild climate, paddy field where hot air balloon can land, road runs horizontally and sideways. This natural condition makes it possible to hold hot balloon competitions. In "Hot-air Balloon Festival", people can feel that the direction of the wind blowing in the Saga plain changes delicately because the balloon which can be steered only up and down moves in different directions.

Let's think about the festivals and culture people have raised and inherited in the coastal area of the Ariake Sea.

The history of Nori farming in Tokyo Bay and trial to pass down it to later generation

Fumihiko Koyama

Executive Director, Nori no furusato kai (Omori Nori Museum)

[Omori Nori Museum] Omori Nori Museum is located near the Haneda airport of Tokyo and next to the park with the regenerated beach. You can learn about the history and technology of nori farming at this museum. Besides, you can get nature information about the regenerated beach.

Nori is a kind of seaweeds, which is one of the most popular traditional food stuffs in Japan. Omori was once well-known as a nori producing region, and the production technique developed here was emulated throughout Japan. Lots of different nori farming tools including 13-meter-long nori boat are exhibited at this museum.

[History of Nori farming in Tokyo Bay] Nori grows naturally on rocks or sticks in shallow areas of cold-water oceans. People have gathered wild Nori off rocks or sticks for thousands of years. Farming of Nori in Tokyo Bay became active around 300 years ago (Edo period), particularly in Tokyo's Ota Ward area. Nori farmers drove wooden sticks into the shallow seabed close to the mouths of rivers. In winter, they pick up Nori grown on the sticks from the boats. Then they made them thin sheets like papers on the land. Ota, especially Omori village soon became the main production center.

However, in 1962, Nori farmers agreed to reclaim farming places for the modern development of Tokyo port and history for 300 years came to an end. About 1,000 families were engaged in Nori farming at that time. After that, shallow sea was reclaimed. A local preservation group started collecting and preserving their nori-producing tools soon.

They never forgot their lives which had been with the sea. Although many years went by, Omori Nori Museum was opened by the Ota Ward government in 2008. With thanks to passions of local people. Management is entrusted to the NPO "Nori No Furusato Kai (Hometown of Nori association)":

[Museum's activities] Our goal is to pass down the local Nori history and the importance of wetland to later generation. The approach to goal consists of three elements.

1. History

We explain about history, tools, and so on to the visitors. Lots of local elementary schools come for learning their local history. Learning history of nori farming is related to thinking the relationship between human and wetland. In other words, wise use of wetland.

2. Nature

The most important thing of nori farming is to understand the function of wetland and sea. We need to learn them even now. So we offer natural environment programs about fishes, benthos and so on.

3. Experience

The museum's most popular attraction is a hands-on event that offers visitors a chance to mold dried Nori in the old way. Former nori farmers teach us practically. It's very valuable, because they're over 80-year-old. Experience is the most effective way to learn something. The traditional way usually includes wisdom which is forgotten now.

We actually try to cultivate nori by using with bamboo sticks and nets in the sea every winter. It's difficult to harvest because the tide there is very weak. But we continue, because our purposes are technical succession and reproduction of the old sea scene.



The Role of Wetlands for Disaster Risk Reduction Keynote

Naoya Furuta
Taisho University / IUCN

Since the Indian Ocean Tsunami in 2004, there has been a growing interest and recognition of the role that ecosystems play in disaster risk reduction and ecosystem-based disaster risk reduction (Eco-DRR) approaches globally. Eco-DRR is defined as “the sustainable management, conservation, and restoration of ecosystems to reduce disaster risk, with the aim of achieving sustainable and resilient development.” This trend was further accelerated after the Great East Japan Earthquake in 2011 and has Eco-DRR now become widely recognized in various global policy frameworks such as CBD decision XII/20 Biodiversity and Climate Change and Disaster Risk Reduction in 2014, Ramsar decision XII.13 on Wetlands and Disaster Risk Reduction in 2015, Sendai Framework for Disaster Risk Reduction 2015-2030 in 2015 and the UNFCCC Paris Agreement in 2015.

In the meantime, there is also a growing recognition of the ecosystem role for climate change adaptation. Ecosystem-based Adaptation (EbA) was defined by CBD as “the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change.” A number of similar concepts and terminologies have also been invented and being used to articulate these efforts such as ecological engineering, natural infrastructure and green infrastructure. Scientists started to argue the benefit of combining ecosystems or using ecological engineering approaches as part of disaster risk reduction and adaptation strategy instead of relying solely on conventional built structures. They argue that ecosystem-approaches can provide more cost-effective and low-regret solutions especially in the face of uncertain climate change scenarios. Scientific evidences have also been accumulated to back up these arguments. At the same time, there are many initiatives and projects started to test these concepts on the ground such as Building with Nature and Living Shoreline.

While disasters can happen in any place such as mountains, rivers, cities or coasts and can be caused by various types of natural hazards such as hurricanes, storms, flooding, tsunamis, sea-level rise, avalanches, landslides, droughts, earthquakes and volcanic eruptions, climate related hazards at coastal and river basins have become one of the most serious issues as a number of populations and economic activities are concentrated in these areas with the expected sea-level rise with extreme weather being caused by climate change. In this context, wetlands have a very important potential role to play. This presentation will overview these global trends in recent years and discuss challenges and opportunities for wetlands to play for the future ecosystem-based disaster risk reduction and climate change adaptation.

Carbon Retention in Sediment by Check Dams in Phayao Province, Thailand

Chotiwut Techakijvej, Jaroon Jakmunee, Chitchol Phalaraksh
Chiang Mai University

Since pre-industrial times, human activities have an important influence in the global climate change by using of fossil fuels and land use change altered the global carbon cycle especially increasing of atmospheric carbon dioxide concentration and other global greenhouse gas. One of significant factor in carbon cycle is soil that can reduce the atmospheric carbon dioxide by storage carbon from photosynthesized which is accumulated as soil organic carbon (SOC). Because twice of carbon stock in soil than in atmosphere, small losses of SOC storage could be significant impacts on atmospheric carbon dioxide concentration that altered to global climate change. Soil erosion is one of the important processes that impacts on soil carbon pool and global carbon cycle. In Thailand, the office of research and development for land management estimated the carbon losses from soil water erosion about 10.07 - 11.20 million ton C / year this is the highest carbon losses from soil compare to other process. Check dams have been widely used globally as human introduced structures for water management and soil erosion control. Moreover, check dams can store significant proportion of the eroded soil carbon along with the effects of sediment retention. However, there are few study of carbon retention of check dam.

This research was aimed to estimate the carbon retention in sediment by check dam and to consider check dam carbon retention potential at watershed-level. Check dam sediment, characteristic and watershed geographic data and land use data were collected from check dams in 3 watersheds include Nam Kham, Nam Pook and Nam Sala at Pong District, Phayao Province, Thailand. Three types of check dam included loose rock (3 check dams), wooden (2 check dams) and ferro-concrete (1 check dam) were collected samples to analyzed SOC and estimate the carbon retention. The check dam carbon retention

potential at watershed-level was analyzed by integrative carbon retention effectiveness index (ICREI) base on carbon retention amount, carbon retention intensity and mean carbon retention capacity of each watershed.

For the result, the estimated amount of carbon retention by all check dams equaled to be about 652.9 tons. The wooden check dam check dam has highest carbon retention amount 263.7 tons. Total volume of check dam is the most important influencing factor for carbon retention. However, when comparing potentials of sediment carbon retention by different types of check dam due to percentage of carbon content. The result showed that the highest carbon concentration was loose rock check dam type 0.95%, wooden check dam type 0.70% and ferro-concrete check dam type 0.32% respectively. At watershed-level, the correlation showed that total storage volume of check dam and the number of check dam was the main factors of check dam carbon retention at watershed level. The highest ICREI was found in Nam Kham watershed (0.74). Because of, Nam Kham watershed was got highest in number of check dams in sub watershed that related to high sediment carbon storage volume. In contrast, Nam Sala watershed has less effective to retain the carbon. This can be used as important decision for planning of new check dams in this watershed for more carbon retention capacity. The results of this research can be used as important decision support for check dam development planning in the future.

Evaluating the impacts of hydrological variations on carbon fluxes in tropical peatlands

Chandrashekhar Deshmukh, Dony Julius, Nardi, Adly Firma
Asia Pacific Resources International Limited (APRIL)

Tropical peatlands are complex and poorly understood ecosystems with largely unknown biogeochemical and hydrological regimes. In these ecosystems, waterlogged-anaerobic conditions slow down the decomposition of organic matter (OM) and favor their accumulation. Most of the tropical peatlands are typically ombrotrophic, where ground water table generally follows rainfall pattern. Increased frequency and intensity of climate extremes like El Niño and land-use change modify hydrology and thereby affecting biogeochemistry of these ecosystems. Over the last few decades, there have been increasing efforts to investigate carbon dynamics and water vapor fluxes in these ecosystems. Nevertheless, carbon and water balances in these ecosystems are still subjected to large uncertainties mainly due to the scarcity of the direct and continuous long-term measurements, particularly in Southeast Asia. To improve assessment of the role of tropical peatlands in global carbon balance, there is a clear and urgent need for more measurements and a better understanding of carbon and water balances in these ecosystems.

In this context, we have established a long-term direct monitoring network to quantify net ecosystem exchanges of carbon dioxide, methane and water vapor between the ecosystem and the atmosphere at ecosystem level using Eddy Covariance (EC) technique. Direct micrometeorological methods like Eddy Covariance (EC) provide measurements over large areas (typically more than few hectares), that can be analogous to ecosystem scale. Short and quasi-continuous integration intervals (e.g. 30 min), typical for the EC technique, are beneficial to capture temporal variability related to biological and physical processes underlying carbon and water vapor exchange. Although several studies have reported EC measurements at several agricultural sites, the EC measurements of carbon and

water fluxes over tropical peatlands are lacking, particularly in Southeast Asia.

In the context, we have installed EC towers in three major ecosystems distinguished by land-use in tropical peatlands of the Kampar Peninsula of Sumatra, Indonesia; (1) plantation forestry (PF); (2) mixed land cover (ML) that includes partly burnt degraded peatland forest and shrubland; and (3) restoration forest (ER). The EC instruments are installed on top of the towers at 43, 43 and 51 m above ground surface at the PF, ML and ER sites respectively. This offers much larger flux footprint area of more than 200 ha. In addition, automated soil CO₂ chambers are placed directly onto the peat surface to measure CO₂ emissions resulting from microbial decomposition of peat soil. Moreover, rainfall, ground water table, soil moisture, soil temperature, net solar radiation, photosynthetically active radiation (PAR), relative humidity, atmospheric pressure, wind direction and wind speed are being recorded at 30 min averages. Measurements have been started at the PF and ML sites since September 2016 and at the ER site since May 2017. The outcomes of this project shall allow a better estimation of regional carbon and water balance and help scientists and policymakers better understand how hydrological variations due to climate change and land use change affect carbon dynamics. This presentation will discuss the sampling strategy and preliminary results.

Lessons learned in building community resilience: 100 villages on the bank of 3rd largest river system of Peninsula of India in 5 years

Saswata Kumar Mohapatra
NET-COAST

River Mahanadi is the largest river system of State of Odisha and the 3rd largest river system of peninsula of India. It drains an area of around 141,600 square kilometers and has a total course of 858 kilometers through 3 states of India. The communities living along the bank of the river are highly dependent on the river system. Each year the river brings flood which affects the lives and livelihoods of these communities.

Project titled 'Partner's for Resilience' was launched in the year 2011, with its primary focus on Disaster Risk Reduction (DRR), Ecosystem Restoration & Management (ERM) and Climate Change Adaptation (CCA) frameworks. The project was lead by Wetland International South Asia and Cord aid. It was implemented by NETCOAST, a network of 8 NGOs working in different districts in the State of Odisha.

There was selection of 100 villages across the Mahanandi river system in different districts of Odisha. Following Eco-system management principles as the core strategy, these target villages were segregated in to 3 zones based on the landscape pattern and geographical locations, viz. i) Delta head zone, ii) Central zone and iii) Coastal zones.

Participatory Risk Analysis (PRA) was conducted in each of those 100 villages. The analysis included among many other variables, the village's evident problems, the extent of vulnerabilities, the available human & financial resources and the community capacities. This was final led to development of 'micro-plans for building resilience' for each of the villages. The activity plan thus prepared envisaged mobilization of resources from Govt. and other local stakeholders of the areas. The key challenge of this process was the difference of approach of these stakeholders who did not traditionally work together. Apart from measures to respond village specific issues, these

plans also included some of the activities due to its location in the respective zones, which ultimately influence the ecosystems of the other two zones.

One successful example from the project could be 'finding out local solutions to the issue of water logging'. The project has supported an activity called 'inlet/outlet clearing of Canal' in the Central Zone villages targeting the issue of 'water logging'. This eventually reduced the water logging days in the crop fields affecting across 113 acres of land in 12 villages, near River Rajua at Kanas, Puri. This further contributed in the introduction of timely crop management in the zone. Another successful outcome of the project was the "inclusion of Local Self Governance/ Panchayat Raj Institution (PRI) systems" in the process. DRR/ ERM or CCA has never been in the agenda for PRI.

The village level plans thus developed during this project were passed in the Pallisabha/ Gramsabha (hamlet/village meeting of local self elected Govt.) planning meetings with formal resolutions. Thus these agendas are now carried forward to the PRI/ Local Self Governance to take up further. Therefore, even the project was ended in 2015 the actions/ activities are still ongoing.

The project during the last 5 years has left behind a group of stakeholders with both the motivation and ability to work together to promote practical approaches towards better community resilience building.

While the Mahandi river system is the life line of many small and larger wetland systems of the State, the documentation and sharing of such cases stories will provide enormous inspirations in further mobilizing other communities, Govt. departments and other stakeholder's joint initiatives to resolve issues locally and having impacts on a broader scale.

Bangladesh is a land of wetlands, around 50% of the country is occupied by different types of wetlands. Due to climate change the wetland ecosystems area under threat. There are changes in rainfall and temperature that interfere the productivity of the wetlands. The inland wetlands which are the breeding ground of fisheries and the habitat for resident and migratory birds are being affected by extreme climate events and morphological changes. Community has been trying to cope with the changes by practicing different adaptation practices. In the wetlands the adaptive action by the community in agriculture and natural resource management are both proactive and planned. The Ecosystem based Adaptation is highly recommended action for the protection of livelihoods in wetlands and environmental wellbeing of the wetlands. The changes in the agriculture and fisheries, the main occupation of the wetland inhabitants of the country are significant. Community is practicing diversification of the agriculture. Short duration crops and its early varieties are more popular to cope with the changing climate. Climate smart agriculture is the main scope of adaptation action in an agrarian community. The paddy cultivation in wetland ecosystem is causing a risk of over harvesting of water for the irrigation that has consequences on the biodiversity of the wetlands. The wetlands in north-east flood plain basin are characterized by unique vegetation and fisheries, the flood plain in the central and northern part characterized by sand and regular flooding. Climate change events interfere the habitat and biodiversity stability and cause fragmentation on habitat. The coastal wetlands are habitat for migratory waders and sandbar vegetation; but the cost the most vulnerable ecosystem of the country due to climate change. Frequency of flood and cyclone has increased. There is displacement of people from the climate vulnerable areas. There is deviation in the char-

acter of seasons; population of fisheries is interfered. Climate change consequence on those wetlands is causing loss of vegetation which results fragmentation of the habitat. The conservation action requires more attention on the vegetation regeneration. In cooperation with the communities Bangladesh POUSH is working for participatory habitat development in the coastal wetlands. For the climate action government has taken number of programs and projects. The Nationally Determined Contribution has identified climate action which also works for the environmental wellbeing of the wetland habitat. Technology, legislation, educational knowledge, action plan strategy, conservation practices are required to manage wetlands. Bangladesh now needs a comprehensive approach, strategy and integrated system combining political, economic, social, technological and institutional supports to address sustainable wetland conservation and the newly added crisis, climate change. To cope with the climate change in wetlands knowledge management is an urgent.

Climate change is a reality and the community, development actors, practitioners and policymakers need to work in a comprehensive way with the knowledge from different intervention action taken and practised by the Government and non-government organizations. Wetland protection and conservation plans require identifying the climate impact and the vulnerability caused by the climate change. Ecosystem based Adaptation is the best option to make the wetland communities' climate smart.

Reducing Fire on Peatlands in Indonesia – Experiences and Lessons Learnt from an International Cooperation Project in West Kalimantan, Indonesia

Yuki Arai
University of Tokyo / JICA

Tropical peatlands, where peat deposits are often over 20 meters thick, are one of the largest reserves of terrestrial organic carbon. Indonesia holds 14.9 million ha of peatland with the largest share of tropical peatland carbon pool as a single country.

However, because of human activities such as converting swamp forest into farmlands by logging and draining, the tropical peatlands have been heavily destroyed since the early 1980s. When swamp forests are logged and peatlands are drained, the ground water level drops. As a result, peatlands become susceptible to fires. A large fire occurred in 1982–1983, followed by huge land burning in 1997–1998 destroyed over 10 million ha of peatlands in Kalimantan and Sumatra. In 1997, because of an enormous fire that occurred throughout the peatlands of Indonesia, between 0.81 and 2.57 Gt of carbon was released into the atmosphere, which is equivalent to 13 to 40 percent of the mean annual global carbon emissions from fossil fuels.

Peatland fires in Indonesia are considered to be mostly human-induced. Fires are used by local and immigrant farmers as part of their agricultural practices, such as land clearing and ash production for fertilizers. Fire is a cheap, fast, and easy method for land clearing for agricultural purposes. These fires often burn out of control and expand to become huge fires on peatlands.

Japan International Cooperation Agency (JICA) has been collaborating with the Ministry of Environment and Forestry of the Government of Indonesia (MOEF) for years in order to tackle this issue. From 2010–2015, a technical cooperation project was implemented by MOEF and JICA for the purpose of developing a methodology of community-based peatland fire prevention.

The project applied a collaborative planning approach called the "Village Facilitation Team Approach." Through this approach, emphasizing the importance of facilitation, the project formulated a team of six facilitators that mainly consisted of villagers

and district government officers. Intensive training program on village facilitation, providing sufficient opportunities for field training exercise at actual villages, was provided to the six facilitators. After receiving the training, the facilitators visited the 16 target villages one by one, and facilitated the villagers' discussion to develop a village activity plan to reduce usage of fire and to improve villagers' farming practices.

As a result, many villagers actively participated in the meetings since the discussion topics were directly related to their livelihoods. Through participating in the discussions, they noticed that land burning, which is prohibited by law, could pose a risk to them through legal punishments. In addition, they learned that they could improve their farming practices without using fire, through trainings on organic fertilizers and pesticides. Considering the risks of legal punishments, villagers seem to have decided to stop or reduce land burning by regulating themselves and by applying non-burning agricultural practices.

After project intervention, the number of local villagers who use fire reduced from 62.4% to 30.2% in the Benkayang District and from 69.7% to 41.3% in the Kubu Raya District in West Kalimantan. In April 2015, following these achievements, the project's collaborative fire prevention approach was officially adopted as a part of the national government's policy.

Based on the experiences from this project, it can be inferred that providing sufficient opportunities for local communities to discuss and make decisions through facilitation, and connecting stakeholders to enable access to locally appropriate knowledge may have promoted fire prevention activities by the community members. Further, it can be implied that initiating a discussion on livelihood-related topics and gradually sharing information on the risks caused by usage of fire may have enabled to mobilize community members toward fire prevention activities.

Interventions for wetland conservation in the Pampanga River Basin and Candaba wetlands, Philippines

Minerva J. Martinez, Joy M. Navarro, Biodiversity Management Bureau, Department of Environment and Natural Resources /
Lea Ivy O. Manzanero, Philippine Extractive Industries Transparency Initiative, Department of Finance / Daniel S. Torres, Independent Researcher

Among the numerous wetlands in the Philippines, this paper focuses on the Candaba wetlands which to date has not yet been recognized for its international significance. The Pampanga River Basin, which is the second largest basin in the country, is located in Luzon Island and covers a catchment area of 7,978 km². The longest channel spans of 265 km. A prominent feature within the basin is the 32,000 hectare Candaba wetlands: a complex of ponds, swamps and marshes surrounded by seasonally flooded grasslands and arable lands on a vast alluvial plain. As portions of the floodplains dry up from November to May, most emergent lands are planted to rice, corn and watermelon. During the rains from June to October, the wetland's ecosystem-based function is as a natural flood retention basin of overflows from several rivers.

The Candaba wetlands hosts 57 species of migratory birds with an abundance totaling to 10,000 waterfowl. Among the endangered species are the Streaked reed warbler (*Acrocephalus sorghophilus*), Philippine duck (*Anas luzonica*), Black-faced spoonbill (*Platalea minor*), and previously, the near-threatened Spot-bill pelican (*Pelecanus philippensis*). Such avian diversity supports local and visiting birdwatchers and nature lovers.

Large scale flooding is a major challenge. From 2003 to 2006, the series of typhoons of increasing frequency and severity caused flood damage to the surrounding provinces of Bulacan, Pampanga and Nueva Ecija. The 1991 Mt. Pinatubo eruption deposited ashfall resulting in shallower drainage networks. Voluminous eruption-derived sediments blocked river drainage systems feeding into the Pampanga Delta. Together with increased rainfall due to climate change, flooding is expected to worsen in future years. Infrastructure-based interventions over the past 25 years were designed to address flooding. For example, the 1993 JICA-funded Pampanga Delta Development Project (Phase 1) constructed a 14 kilometer floodway from the river mouth in Manila Bay upriver to Masantol thereby increasing channel flow capacity from 500 to 4,300 cubic meters per second. The Php 900 billion Megadike project built riverbank armoring to

prevent Pinatubo-eruption related material from covering the towns of Bacolor, Porac, Sta. Rita and Guagua in Pampanga.

Another form of intervention is non-infrastructure such as land use-related policy and the community-based flood warning and forecasting system established in 1981 through the assistance of the Government of Japan. In terms of policy, Resolution 51 series of 2004 declared the whole town of Candaba as bird sanctuary. Additionally, privately initiated efforts established the 72-ha Candaba Swamp Wildlife Reserve in Sitio Simang, Barangay Vizal San Pablo. Possessing such critical values for avian diversity and ecosystem services, the Candaba wetlands was identified as a candidate site for inclusion in the Ramsar List and as part of the East Asian-Australasian Flyway Site Network.

Future flood mitigation plans include river channel improvement along downstream areas of Pampanga River and construction of flood retarding basins in the Candaba and San Antonio swamps. Possible non-hard infrastructure interventions include nature-based approaches such as rehabilitating Pampanga River Basin's watershed, planting native species for riparian stabilization, and rehabilitating the protective dikes using ecologically-sound engineering measures.

With its vulnerabilities and exemplary values, the Pampanga River Basin and its component Candaba wetlands could become a showcase for the multiple benefits of adopting ecosystem-based approaches to disaster risk reduction (DRR) and climate change adaptation (CCA). In the overall strategy for DRR and CCA, the mix of infrastructure and non-infrastructure interventions using ecosystem-based approaches will be necessary for maintaining the unique biodiversity value, while enabling communities to take advantage of wetland ecosystem services that mitigate disaster risks and support adaptation to impacts of the changing climate.

Considering the foregoing discussions, this paper hopes to encourage further discourse on protecting the Candaba wetlands.

Huge Water Channel Construction Project with Nature and Human Friendly Approach in the Sendai River

Kiyofumi Kobayashi, Kyushu University Graduate School of Engineering, Daishin Co., Ltd / Hironori Hayashi, Kyushu University Faculty of Engineering
Yukihiro Shimatani, Kyushu University Faculty of Engineering

In the Sendai River basin which flows in Kagoshima prefecture, there was recordable heavy rain mainly in the northern part of the Satsuma region from July 19th to July 23th 2006. Total rainfall for 5 days exceeded 1000 mm at rainfall observatory. In particular, the damage of Satsuma Town was enormous. There were one person dead and three minor injuries, 214 completely destroyed buildings, 367 semi-collapsed buildings and 232 inundated buildings. This flood damage was mainly caused by unprecedented heavy rain. In the downstream part of the Satsuma Town Torai area, there was a narrowed section where the river channel was curved large. It was pointed out that rising of the water level of this greatly curved river channel part is one of the factors which caused the damage to be expanded.

On the other hand, similar floods had occurred in the area in 1972. As a result, the residents had a strong distrust against river administrators (MLIT: Ministry of Land, Infrastructure, transportation and Tourism). This project was accompanied by a remarkably large scale renovation that cuts waterways of about 250 m in extension, 65 m in average channel width and 700 thousand m³ of excavated sediment. In addition, the project site is adjacent to shopping districts and residential area in the Satsuma town. For this reason, we had to fully consider the impact of river improvement project extending to an extension of 2.0 km on the lives of the local residents. For that reason, it was necessary to inherit the history and culture of the area, to mitigate the impact on natural landscapes and ecosystems, and to fully consider the utilization methods after the reconstruction

in advance.

In this paper, we introduce the Sendai River improvement project which was carried out by participating residents in this Torai area. Specifically, the concept of planning

design, the landscape hydraulic model experiment used to evaluate the flood effect and the natural environment accompanying the division channel opening, the consensus formation process with the local residents, the maintenance management after the completion and the utilization. In the project site, floods occurred two weeks after the completion of the channel construction, but the water level observation station supports the safety of the region, such as a water level drop of 0.8 m is confirmed. Six years have elapsed after completion, flooding flows repeatedly from 3 to 5 times each year into the channel, and now a new wetland space that work as a habitat of aquatic organisms is also created. In the construction section close to the residential area, masonry bank protection utilizing construction generating rocks and a waterfront walking path incorporating universal design are in place. In view of the river environment, riffle and pool habitats and vegetation which are important for aquatic organisms were restored. In the Torai area, there are numerous regional event held by local residents and NPOs. Taking this opportunity, community development that connects the waterfront and daily lives of residents, tourism projects of nature experience, etc. are actively undertaken in the Sendai River basin.

The 2004 Indian Ocean tsunami devastated 12 countries including Indonesia, Thailand and Sri Lanka. As an immediate response AWS 2005 recommended, among others, "Prioritize the natural coastal defenses through greenbelt/coastal "bioshield" development..." In connection therewith, the Sendai Framework for Disaster Risk Reduction (identified as one of the four priorities the matter of investing in "disaster risk reduction (DRR) for resilience."

Not to be missed is the ASEAN Agreement on Disaster Management and Emergency Response (ADMER) with the intention of providing "effective regional mechanisms to mitigate impacts of natural disasters...through concerted national efforts and intensified regional cooperation."

In the light of scientific information that natural disasters are projected to intensify in Asia, the ADMER mentioned above could be utilized for disaster prevention and mitigation purposes even if the Agreement leans heavily on disaster preparedness and emergency response. In short, it could serve as the foundation for Asia's active role at DRR by incorporating wetlands' management legal strategies for climate change resilience.

ADMER is replete with provisions which could be used by Asian countries in refuting the claims that while emergency response is almost well attended to from the local to the national government level, much remains to be done in regard to prevention and mitigation legislation, regulations, policies, plans, programs and strategies.

In pursuance thereof, Asian countries could very well incorporate wetlands for DRR and build resilience in their legal agenda. For instance, the strategy of planting mangrove saplings should be a continuing year-round activity required by law in the extensive coastlines of Asia. Likewise massive plant-

ing of high quality and commercially productive bamboo could be introduced as a legal technique not only for protection but also to preserve and rehabilitate riverbanks and lakeshores and provide added source of income to people.

To these natural ecosystem-based solutions is a shift in disaster reduction approach, i.e. build better infrastructure increasing buffer capacity of the wetland landscape to absorb shocks and long term changes. This requires sharing available technology to build back better hurricane resilient house, or, in general, improve critical infrastructures in coastal areas. This would necessitate amendment and strict implementation of existing national building codes to ensure that all buildings are supported by a stable and strong base. The use of legal instruments and guidelines for DRR could be further aided by risk literacy and risk transfer for resilience via insurance coverage against disasters or "acts of nature."

Be that as it may, building a disaster resilient Asia needs partnerships among governments, private sector, NGOs, LGUs and other institutions with clearly defined roles in disaster prevention and mitigation. To begin with, a program on the values and functions of wetlands for DRR and onwards to consolidating endeavors among Asian countries could be embarked on and, in the process, highlight also the need to scale up adaptation to climate disruption.

Disaster risk reduction is an issue that deserves priority along with food security, poverty alleviation, population control, etc. so that the region can have its much-needed disaster resilient system.



China's New National Policy on the System of Wetland Conservation and Restoration Keynote

Yan FANG

Office of Wetland Conservation and Management, State Forestry Administration of the People's Republic of China

Wetland plays an irreplaceable role in water conservation, purification of water quality, flood control and drought resistance, climate regulation and biodiversity conservation. It is an important natural ecosystem and a part of the natural ecological space. Wetland conservation is an important part of the construction of ecological civilization in China, which is related to the national ecological security, which is related to the sustainable development of economy and society, which is related to the survival and well-being of future generations of the Chinese nation. To speed up the establishment of a complete system of wetland protection and restoration system, according to the CPC Central Committee and State Council issued the "Opinions on accelerating the construction of ecological civilization" and "ecological civilization reform program" requirements, the development of this program.

China plays an essential role in the maintenance of global ecological security with its abundant wetland resource. The Chinese government has taken large steps toward ensuring the conservation and wise use of wetland since it acceded to the Ramsar Convention in 1992, demonstrating a successful approach to wetland conservation and wise use for the majority developing countries. However, China is also confronting the common problems other countries have that have increasingly lead to wetland area decline, function degradation, biodiversity reduction, and the pressure with an increase tendency from the development of social-economy. For the purpose of fully conserving wetlands and the sustainability of wetland ecological functions, the Chinese government handles new tasks and challenges regarding wetland conservation in China and the current lack of a wetland conservation mechanism. The state council of China promulgated the Scheme of Wetland Conservation and Restoration on November 30th, 2016. It is a major decision in the construction of a system for wetland conservation and restoration in recent years from the perspective of maintaining the

ecological security of China and even the world, promoting sustainable development in the construction of an ecological civilization as the national strategy by deepening reform and governing states by law.

In light of the Scheme of Wetland Conservation and Restoration, the Chinese government issued the Implementation Plan on National Wetland Conservation on the 13th Five Year, from 2016 to 2020. The Plan claims that China will recover degraded wetlands amounting to 0.14 million hectares and increase wetland area by 0.2 million hectares, promoting the percentage of conserved wetland to above 50%. The Scheme also integrates wetland conservation into the agendas of all levels of local governments. The China green development indicator system regards wetland as a means to evaluate the performance of local governments at all levels. The Chinese government will settle down "the red line", namely bottom line on ecology by the end of 2018, bringing wetlands with important ecological functions into the protection scope of "the red line". China will establish a wetland classification system based on the ecology priority, ecosystem function and biodiversity. The system intends to divide China's wetland into three levels by national, local and general, creating the list of wetlands based on these categories and updating its regularly.

The Scheme includes 55 specific aspects, covering wetlands classification, wetland occupied and compensation balance, wetland ecological evaluation, water bird monitoring, alien species prevention, the carrying capacity assessment on the wetland utilization, wetland destroy investigation, wetland rehabilitation, converting farmlands to wetlands, wetland ecological benefits compensation, water security for ecological use, and wetland conservation volunteer. The establishment and perfection of the above all has determined the most priority tasks on wetlands conservation and restoration in the near future in China.

Ramsar COP as a turning point of awareness and the present activities: Some cases to promote local awareness through international collaboration and understanding impressing with the concept of Wise Use

Yoshikatsu Kikuchi

Kushiro International Wetland Centre

Kushiro Shitsugen is Japan's largest wetland. It was listed under the Ramsar Convention in 1980 when the first COP of Ramsar was held in Cagliari, Italy. Kushiro Shitsugen became the first Ramsar site in Japan. But with the exception of some experts and administrations, people's interest to the wetland was still limited.

Kushiro Shitsugen is located in the eastern part of Hokkaido. The history of cultivation in this island was comparatively new, because after Meiji Restoration of 1868, the new government placed great emphasis on Hokkaido's economic development, encouraging settlers to come from other other parts of Japan. But the scale and speed of cultivation were fortunately not larger, because of harsh environments and small population. So people thought there would be no crisis by destruction of the environment in their abundant and inexhaustible land. So as in Kushiro area. The wetland was left mostly untouched without large-scale developments, but open seams on the fort of nature have been growing as human behavior and the improvement of living standards has extended.

Kushiro Shitsugen has a rich habitat for a variety of precious flora and fauna, including the Red-crowned Crane. After it was listed as a national park of Japan in 1987,

Kushiro Shitsugen has known far and wide in the country, but it was still not enough to draw many people's interest to its eco-system. One of the reasons why wetlands didn't contribute to raise awareness to the importance of the wetlands in the past was that local people have regarded the wetland as barren or useless land from the old times of their ancestors. They preferred to live staying out of wetlands and they had no intention to evaluate their land's value, the importance of wetlands.

In 1993, COP5 of Ramsar Convention was held in Kushiro. It

was the first Ramsar COP held in Asia. Many people worked and hosted the meeting as volunteers. A lot of NGOs and nature-related organizations and groups gathered from all over Japan and they joined at the meeting and held many events. Then COP5 made them to recognize the important of wetlands in the area after the meeting, and many of nature-related organizations and NGO groups went home with enthusiasm of their activities. The time of COP5 in Kushiro turned to the turning point for many people to move to the next phase for wetlands.

After Ramsar COP5, Kushiro International Wetland Centre (KIWC) was established with the support of local areas. It aims at a network acting vigorously with members including national government agencies, wetland-related local governments, local universities and NGOs, experts and individuals. To enhance local people's awareness to nature and conservation of wetlands, we always arrange lectures, tours, environmental surveys and various other events to communicate the appeal and share the significance of wetlands are very effective. We attach weight to the wise use of wetlands - a concept by which all wetlands are treated as valuable local assets whose blessings are used to enrich people's lives and passed on the wetland to future generations. We actively promote international cooperation to advance the preservation and wise use of wetlands. Related work includes the organization of training programs (of JICA) and workshops for developing countries and the dispatch of experts to such nations. We also collect, exchange and provide up-to-date information on wetland conservation and biodiversity, and works to extend its international cooperative network. In the presentation I introduce some cases of our attempts to enhance the awareness of local people to conserve the environment being aware of international collaboration.

The Spoon-billed Sandpiper (*Calidris pygmaea*) is a long distance migrant, breeding in Russia and it regularly migrates more than 8,000 km passing through 14 countries and wintering in South and South-east Asia, South along the East-Asian Australasian Flyway, including major staging posts in the Yellow Sea, with approximately half of the global population is understood to winter in Myanmar. This species is categorized as globally Critically Endangered on the Red List of the International Union for the Conservation of Nature (IUCN), which is the highest category of extinction threat for any species still present in the wild. The current population decline could lead to its extinction within a decade. The population is declining by 26% per year, with a global population estimate of approximately 100 pairs. If the current rate of decline continues then the species will be extinct within a decade. The Gulf of Mottama (GoM) is one of the most dynamic estuaries and famous intertidal mudflat ecosystems in the world. The Gulf is bell-shaped and has dynamic estuary ecosystems. The Gulf is one of the world's most important wintering areas for the critically endangered Spoon-billed Sandpiper, hosting probably more than half of the remaining global population.

The local communities use the site for fishing, grazing, duck-rearing and paddy farming. However, the Gulf of Mottama is a vulnerable and changing environment where communities have lived by adapting to change over time. Surrounding the coastal area of Gulf of Mottama has 180 villages in this area and nearly two hundred thousands of people live there. Their main livelihood is fishing. The standard of their education is low and the condition of their health is still poor. The gulf of Mottama will be demarcated as one of the biggest Ramsar site in Asia. But due the different administrative government structure, Northern part of Mottama Gulf was designated as fourth Ramsar

site in 10 May 2017. The designation of this Ramsar site is of special significance because it is the first in Myanmar that is outside a legally-designated protected area. It therefore sets an important precedent for Myanmar's many other wetlands of global importance that merit Ramsar status. The Gulf of Mottama is meets six out of nine Ramsar criteria, a comparatively high proportion. On the other hand, the Gulf of Mottama is suffering. Fish catch has declined by 50-90% over the past 10 years as a result of overfishing, often due to use of illegal nets to harvest fish of all sizes, even juveniles. Small-scale fisher folk are being forced to either look for work in other sectors or migrate. The local fishermen catch the fish excessively by using drag nets which is also called wire mesh. So the fish stock is rapidly depleting in this area. The local people said that it has affected their livelihoods. Community involvement and management plan is crucial role for further sustainable of natural resources in Gulf of Mottama. Community-led Coastal Management Gulf of Mottama Project is pioneer project in Myanmar for enhancing coastal wetlands conservation.

The Montreux Record under the Ramsar Convention: An effective mechanism for promoting State Party compliance?

Tess Van Geelen, Evan Hamman

Queensland University of Technology, Faculty of Law

The world's wetlands are in decline. In Asia, and South-East Asia in particular, scientists estimate up to 50% of wetlands have been lost over the last hundred years. Other figures put the percentage of degradation and change in ecological character of wetlands significantly higher. Much of the degradation has been due to land reclamation, intensive agriculture, urban development and industrial pollution. Wetland decline in China's Yellow Sea region has been particularly catastrophic, despite the existence of over a dozen important Ramsar-Listed sites in both China and South Korea.

With the escalation of the impacts of climate change, the changing ecological character of wetlands is emerging as a key concern for decision-makers world-wide. But what mechanisms, measures and strategies do decision-makers have to address this? How can they appropriately identify wetlands at risk, and develop the strategies and mechanisms for restoring and managing them going forward?

In this paper, the authors provide a analysis of the Montreux Record (MR) under the Ramsar Convention. The MR is a list of Ramsar sites which have undergone negative ecological changes, due, for example, to excessive development or industrial pollution. The authors have undertaken a quantitative analysis of the MR, with a focus on the Asia-Pacific region. Using the data from their study, they consider, from a legal perspective, whether the MR is an effective regulatory mechanism for ensuring compliance and promoting good governance at wetland sites.

The authors suggest that the MR, whilst well-intentioned, has some flaws in its operation. There appears, for instance, to be no significant incentive for nations to voluntarily list their sites on the MR (despite many being in decline). A developed country

like Australia has refused to do so recently for several of its sites, presumably due to 'bad press' or a lack of administrative oversight (and competing concerns). Funding and expertise for developing countries might be available for future MR listing, but Ramsar, like other Protected Area frameworks, is stretched with current commitments as it is.

One suggestion from this paper is for developed states in a region to 'buddy-up' with developing states to propose MR listings and follow them up with a funded plan for restoration through collaboration and consultation with communities and other stakeholders. This approach meets the aims of multilateral environmental governance which is best practice the world over. Transparency around MR decision-making is another major concern. Whilst the Ramsar Secretariat holds detailed information about Ramsar sites, information about MR discussions, decisions and threats to specific sites is not easily obtained. Without proper transparency, States, non-states and other stakeholders lose confidence in the Ramsar system as a means of addressing wetland declines.

The authors conclude that the MR could be modelled on the In Danger List under the World Heritage Convention, which provides for a certain level of 'public naming and shaming' of States, but also the technical, financial and administrative support to remedy the challenges at the sites themselves. Similarly, for the MR to be more effective, its status as a compliance mechanism needs to be elevated and strengthened. This begins and ends with greater transparency and State Party support around the decision-making and remediation process.

The Establishment of Southeast Asian Limnological Society Network (SEAL-Net)

Mashhor Mansor, Luki, S., Wan Maznah, W.O., Muzzalifah, A. H. and Siti Norasikin, I
School of Biological Sciences, Universiti Sains Malaysia

During the 16th World Lake Conference which was held at Kartika Plaza Hotel, Bali, from 7th to 11th November 2016, the Southeast Asian Limnological Society Network or SEAL-Net was established. It should be noted that this historical event had taken place on the 10th November 2016 with 30 participations from various Asian countries. This is mainly due to a close political cooperation between the 10 ASEAN nations. The current geopolitical situation in the 10 nations is encouraging and moving fast in becoming the economic power in the global economic arena. Perhaps it is undeniable that the ASEAN nations are not only rich in biodiversity, but also rich in freshwater ecosystems.

For example; the Mekong River which flows through seven countries is the 12th longest river in the world and the 7th longest in Asia, passing through China, Myanmar, Thailand, Lao PDR, Cambodia and Vietnam. In addition there are several unique lakes such as Tonle Sap, Cambodia, Moeyungyi Lake, Myanmar, Toba and Matano Lakes in Indonesia. One of the widely recorded species in this region is the Irrawaddy Dolphin (*Orcaella brevirostris*). The populations are also thrive in coastal zones. Concurrently with the Bali declaration, the SEAL-Net was official adapted and recognized. Among the items insert were the sustainable usage of the river basins and lakes. The global water systems from tropical countries should be widely recognized. The scientists are urged to establish a common platform for sharing either globally or regionally.

International networking focusing on data requirement on river basins and lakes management are encourage. Unique complex issues facing nations should be addressed accordingly. The conference offered several solutions based on policies, scientific data gathering and crucial information were heightened. Therefore, at this junction SEAL-Net is looking forward

for further international cooperation with other agencies all over the world. Perhaps the tropical ecoregion is relatively different from other ecoregions such the temperate and polar zones. Based on the cooperation between Universiti Sains Malaysia (USM) and Lembaga Ilmu Pengetahuan Indonesia (LIPI), it is very encouraging and timely that a book entitled 'Lake Ecosystem & Services: Temengor Reservoir, Malaysia and Selected Indonesia Lakes' was published. Several issues on Malaysian and Indonesian Lakes are addressed. This book offers a strong guideline for further studies in the lakes ecosystems of Indonesia and Malaysia. It is interesting to note that Temengor Reservoir was morphometry studied in detail. The bathymetry mapping method based on acoustic findings was used in order to obtain a model on the surface topography and bottom water. This bathymetric survey apparently is the pioneer study on the deep and dark zone of a tropic. To date, there are 22 university networking among the universities in Mekong Delta. The cooperation between ASEAN universities, seems to be very encouraging. Most of the lakes in Myanmar, Thailand, Lao PDR, Cambodia and Vietnam have been surveyed by this team. The Limnological studies on deep lakes in Indonesia are initiated by LIPI. Meanwhile, the USM team is focusing on the biodiversity of the lake ecosystem. The detail information could be surfed; [http:// www.sealnet.forum.org](http://www.sealnet.forum.org)

Team SPOON:

Creating connection of people and nature for sustainable society and East Asia peace

Akane Tokorodani, Akihumi Shimada, Dai Machida, Masato Dohi
Tokyo Institute of Technology and Team SPOON

In wetlands, and especially tidelands, rich nature has fostered diverse cultures. However, there is history that such rich nature has been decreasing due to urbanization. At the same time, this also means that the relationship between the people and the wetland has been disappearing. On the other hand, there are still many great wetlands around the world, and they have diverse cultures. Especially wetlands in East Asia have many common aspects in its features and the relationship between the people and the wetlands. In other words, cultivated culture in a certain wetland would be a hint to solve other wetland issues. In order to achieve conservation and wise use of wetlands, it is necessary to bridge the gap between people and nature, cities and nature that has been growing due to modernization, and cooperate with East Asian regions that have common climate and culture.

In this context, we are engaged in activities to build peaceful foundations in East Asia by connecting people and nature, cities and nature, and at the same time connecting people across countries. This paper introduces our activities, Team SPOON.

Team SPOON is working with the Black-faced Spoonbill as a symbol of our activities. The Black-faced Spoonbill is an endangered species which are only about 3,900 birds around the world, and it is a migratory bird across East Asia such as Taiwan, Korea, Japan, and China. Some individuals of this bird are put a foot-ring to identify individuals for research, and Team SPOON makes a ring which is the same design of this foot ring for visualizing the connection between people and the Black-faced Spoonbill individuals. Additionally, Team SPOON is sending daily news of the Black-faced Spoonbills ("Daily Black-faced Spoonbill Times") on Facebook or E-mail to our members.

In the daily news, we report observation data of the Black-

faced Spoonbill, and introduce the relationship people and the Black-faced Spoonbill, people and wetlands such as mural paintings and songs about the Black-faced Spoonbill, lifestyle related to wetlands like fishery, sightseeing and foods, and events related to the Black-faced Spoonbill held in various places of its flyway. Since members can freely make comments and questions on the daily news, not only does it connects people with the Black-faced Spoonbill individuals, but plays the role of connecting people.

Team SPOON was established in January 2015. Currently, SPOON members are 254 people, mostly living in urban areas of Japan. SPOON plans to extend these activities to East Asia which is the flyway of the Black-faced Spoonbill. From June 26 to 30, 2017, we are going to visit Korea and spread these activities. Furthermore, we are going to research good examples of culture and wisdom produced by the relationship between people and wetlands in Korea, and plan to build a system that people thinking about the Black-faced Spoonbill in various regions can access and exchange such experiences. Through the Black-faced Spoonbill, people in East Asia are connected across countries to exchange the culture and wisdom cultivated in various places of its flyway for preserving habitats and protecting local communities culturally and economically. It will contribute to not only building diverse regions where people and nature coexist but leading to peace in East Asia.

The Yellow Sea wetlands are amongst the most important stopover areas for migratory waterbirds in the world and are used by millions of waterbirds for feeding and resting during the both northward and southward migration along the East Asian - Australasian Flyway. Waterbirds breeding in the Far East of Russia and Alaska, Mongolia and northeast and northern China migrate along the coastlines of the Yellow Sea region to spend the northern winter in the Yangtze River floodplains and southern China, while many others continue their journeys to south to Southeast (and South) Asia, Australia and New Zealand where they spend the non-breeding period. The coastal wetlands of the Yellow Sea also serve a very important purpose for shorebirds of the East Asian - Australasian Flyway, especially as the northern coast is the last stopover site for many species of shorebirds before they get to their breeding grounds.

With support of the Ministry of the Environmental Protection of China and The State Forestry Administration, a Yellow Sea Region (China site) Coordinated Waterbird Survey in April 2016 was organized jointly by the Wetlands International-China, The China Wildlife Conservation Association, The Northeast Institute of Geography and Agricultural Ecology of the Chinese Academy of Sciences and the Beijing Biodiversity Conservation and Research Center. Approximately 34 partners from institutions related to environmental protection, forestry, wetland reserves in the marine sector, wetland parks, universities and research institutes along the Yellow Sea Region (China site) worked together to undertake the survey. Altogether, 154 professional and technical personnel and volunteers along with international waterbird experts from Australia, New Zealand, the United Kingdom and the Netherlands participated in the survey. The survey was conducted from 18-24 April and lasted one whole week.

The total length of survey area stretches about 6500 km, from

the Yalu River estuary in the northeast (adjoining North Korea), along the sea coast to south of the Yangtze River estuary, covering six provinces and municipalities including Liaoning, Hebei, Tianjin, Shandong and Shanghai and Hangzhou bay in Zhejiang. The survey recorded a total of nearly 80,7000 waterbirds of 119 species in 18 major sites along the Yellow Sea Region (China site). The count was dominated by shorebirds, with about 656,830 recorded (81.4% of the total).

According to the global IUCN Red List of Threatened Species (2015), the survey recorded three Critically Endangered species, namely Baer's Pochard, Siberian Crane and Spoon-billed Sandpiper, six Endangered species, and seven Vulnerable species. In addition, 11 Near Threatened species were reported. Fourteen survey sites have been found to meet the criteria of wetlands of international importance in accordance of the Ramsar Convention on Wetlands. The survey found a total of 35 waterbird species reached criteria of international importance.

The results of the 2016 Yellow Sea-Bohai Region Waterbird Coordinated Survey highlight that wetlands of Yellow Sea Region (China site) remain crucially important for migratory waterbirds during their northward migration. However, the survey reinforces other recent studies that have shown that the region is facing threats including severe degradation and loss of wetlands due to rapid economic development across the region. This is resulting in further loss of migratory waterbird habitats that lead to loss of safe feeding and roosting areas for birds that are of crucial importance during their migration.

It is proposed by the organisers that such surveys need to be carried out regularly during different seasons to monitor the importance of these wetlands and to inform decisions for their improved management. The survey provided a unique opportunity to identify conservation issues for waterbirds and wetlands in the Yellow Sea and offers eight recommendations.

Opportunities to promote cooperation on the conservation and wise use of wetlands between Asia and the Pacific

Solongo Khurelbaatar, Lew Young
Ramsar Convention on Wetlands

The Pacific region comprises 23 small island nations and territories across an expansive seascape. Out of 12 independent states, six are Contracting Parties to the Ramsar Convention on Wetlands, i.e. Fiji, Kiribati, Papua New Guinea, Republic of the Marshall Islands, Palau and Samoa. With the exception of Papua New Guinea which acceded to the Convention in 1993, the remaining Pacific Parties are relatively young members of the Convention having acceded in the past 15 years.

Although the Pacific region is socio-culturally, demographically and geo-morphologically different to Asia, there are biological similarities especially in relation to wetlands ecosystems and the issues and challenges facing their conservation and wise use. This is especially for the coastal ecosystems such as mangroves, tidal flats, sea-grass beds and coral reefs. For example, the 'Coral Triangle', spanning across Asia and Pacific harbours more than 700 species of corals and supports essential ecosystem services. Cooperation between the countries that share the Coral Triangle has provided an opportunity to promote cooperation and learning between countries from Asia and the Pacific. The Secretariat of the Ramsar Convention on Wetlands, is strengthening their links with the Coral Triangle Initiative and other relevant bodies, to further support the countries in the 'Coral Triangle' to share experiences, work jointly to build capacities at various levels, and collectively address the challenges such as overfishing and land-based threats to these invaluable ecosystems.

In terms of species, Asia and the Pacific islands share a diversity of highly migratory marine species such as globally threatened sea turtles, whales, sharks and porpoises with the countries in the western Pacific Ocean. The conservation of these species therefore depends upon collaboration between

the countries in Asia and the Pacific.

The wetlands in the Pacific are facing similar pressures as those in many Asia countries. These include population growth, urbanization along the coastlines, and greater economic prosperity that entailed more intensive sometimes unsustainable use of natural resources. The impact on Pacific wetlands from these pressures can be most easily seen on the coastal wetlands. Many countries in Asia face the same challenges to an even greater extent and so there is a great deal of good practices and lessons learnt that to be shared with the Pacific islands in terms of conserving and sustainably using coastal resources. Well managed coastal Ramsar Sites in Asian countries and sharing the relevant experiences with coastal communities in the Pacific can be a good starting point.

On the other hand, the Asia-Pacific region is home to tens of millions of indigenous people engaged in subsistence fisheries and agriculture in rural areas often in harmony with the nature. However different they might be from one another, the principle of community-based conservation of wetlands and their resources applies to these indigenous communities invariably. One successful example of such community-based initiatives is promoting 'locally managed marine areas' (LMMA) across Asia and the Pacific. Other isolated examples of community engagement in the management of wetlands should be promoted, adapted and piloted.

The economic growth in many of the Pacific islands attracts foreign investment from a number of countries in Asia, most notably, from China. This is a potential avenue to strengthen partnership with the private sector in the area of attaining the conservation and wise use of wetlands.

Living in Harmony with Nature Keynote

Muneharu Nakagai
Toyooka City

The Oriental White Stork, an endangered species, is a large carnivorous bird that has an average wingspan of nearly 2 meters and a body length of 1.1 meters. The Oriental White Stork was once a common bird in Japan, but its population decreased dramatically due to man-made changes in the environment, and storks eventually disappeared from the wild in Japan. The last wild stork in Japan disappeared from Toyooka's skies in 1971.

After World War II, river modifications caused the wetlands to disappear in Toyooka. The disconnection of the Maruyamagawa River from the low-lying rice paddies, and the modernization of agriculture led to a sharp decline in the population of living creatures. The use of agricultural chemicals caused the living creatures' extinction and it also physically hurt the storks. In an attempt to save the storks, captive breeding started in Toyooka in 1965, before the complete local extinction of the species in Japan.

In 1985, six young storks from Khabarovsk Krai, a region in the Russian Far East, were sent to Toyooka as a gift. In 1989, chicks were hatched successfully in captivity for the first time since the start of the captive breeding program 25 years ago. From that time on, the storks have been hatching chicks every year. The first reintroduction of the stork was held in 2005. Two years later, some of the released storks mated and laid eggs. Chicks were hatched from the eggs successfully, and one left its nest to fly into the skies of Japan for the first time in 46 years. Twelve years have passed since the reintroduction of the Oriental White Stork. Currently, there is around 100 captive storks, and over 100 storks that are living free in the wild.

The stork is a bird that stands at the top of the food pyramid in our country's natural ecosystem. For the Oriental White Stork to be reintroduced into the wild, the restoration of a rich natural environment was essential. It was also necessary to educate people so that they are ready to welcome storks back into their

lives, and to make them change their habits, because the human lifestyle had already destroyed the environment and brought storks to disappear in the past.

To restore and preserve this environment in which humans and storks can coexist, Toyooka started an environmentally-friendly agriculture called 'White Stork-Friendly Farming Method' that does not rely on agricultural chemicals and chemical fertilizers. In addition, Toyooka focused on restoring the wetlands to increase the number of organisms to become prey for the storks in the wild. Abandoned rice paddies were converted into wetlands and into habitats for fishes and aquatic insects. In order to increase awareness and appreciation for the storks, special lessons have been established in Toyooka for elementary school students. The particularity of these lessons is that they take place outside, directly inside the wetlands.

These efforts represent a collaborative effort by local governments, universities and research facilities, residents of Toyooka and many corporations. The hard work was recognized when the wetlands of 'Lower Maruyamagawa River and the surrounding rice paddies' were designated as a Ramsar site. The wetlands have attracted not only storks, but also researchers and volunteers who have helped liven up the local community.

These efforts to bring back a once extinct bird have connected several fields together including agriculture, local economy, ecological conservation, community development and education.

Lake Urmia Restoration via Local Community Participation in Sustainable Agriculture

Neda Asad Falsafi Zadeh, Abolfazl Abesht, Mehri Asnaashari, Hamid Soltani
Iran Department of Environment, Government of Japan, United Nations Development Program (UNDP)

With an area of 5000 km², Lake Urmia (LU) is one of the largest inland lakes situated in North West of Iran. This vast hyper-saline lake which is a Ramsar Site, a UNESCO Biosphere Reserve and a National Park, has for long contributed to the biodiversity of the area, as well as livelihoods of local communities around it. There are more than 5 million inhabitants living in the basin and drying of this lake will have tremendous impacts on their daily livelihoods.

Over the past decade, Lake Urmia has been affected by severe droughts and increasing pressures of over-extraction of water which have disturbed the inflow-outflow balance of the lake. Despite the fact that in the past two years, the situation of Lake Urmia has been stabilized to a certain level, but the Lake still faces the threat of an irreversible drought where the dimension of its impacts would gradually spread from biodiversity to socio-economic, affecting livelihood and health of the surrounding communities. According to aforementioned points and considering the agriculture sector share of wetland basin water resources, "modelling public participation in Lake Urmia restoration through establishment of sustainable agriculture" project is being implemented in pilot villages of East and West Azerbaijan provinces from 2014 with the aim of reduction in water consumption.

In 2014, the high-level arrangements between the governments of Iran and Japan led to allocation of one million USD by the Government of Japan (GoJ) to address the issues of the critically endangered LU. Therefore, the "Contribution to Restoration of Lake Urmia via Local Community Participation in Sustainable Agriculture and Biodiversity Conservation" project was added to Conservation of Iranian Wetlands Project as a new outcome. Implementation of the first phase in 41 villages resulted in successful achievements in water saving, awareness

raising and biodiversity conservation which led to allocation of two million USD to institutionalize the process in 41 villages and scaling it to 49 new pilots in three further years until now.

The next phases of the project was developed based on the capacity built and lessons learnt from the previous phases of the project and effectively contributed to restoration of LU through local community and farmers engagement to bring together the pieces of the puzzle (promotion of sustainable agriculture and effective reduction of water consumption at farm level which would lead to increase of inflow to the lake, social mobilization and public awareness campaign, local water network initiatives, alternative livelihood practices aiming at water saving).

During implementation of the three phases, application of Sustainable Agriculture Techniques in 90 villages has been welcomed by more than 10000 local farmers, successfully covering 30% of villages located in the LU ecological zone encompassing 250 villages. The results of monitoring water consumption at project pilots for autumn/spring crops and orchards has shown significant water saving (by an average of 39.5%) as well as 40% saving of chemical agricultural inputs (Fertilizers and Pesticides) in treatment farms as compared to control farms.

During this period 200 local experts mainly in the form of local cooperatives were employed and trained on socio-economic as well as technical aspects of Sustainable Agriculture, 150,000 local communities were targeted in the awareness raising campaign and 800 local communities were involved in applying new tools and mechanisms as complementary elements of sustainable agriculture.

Response of freshwater farmers to the environmental changes: a case study of Thailand

Suvaluck Satumanatpan, Kamalaporn Kanongdate, Chumlong Arunlertaree, Anawach Saithong, Poonyawee Srisantear, Thiyada Piyawongnara
Faculty of Environment and Resource Studies, Mahidol University, Thailand

This paper examines factors influencing resilience among Thai aquaculture-farmers in Nakhon Nayok Province located upstream of the Bangpakong Watershed, the inner Gulf of Thailand. The area is defined as freshwater ecosystem but often prone to seawater intrusion. With regard to the aquaculture practice in the study areas, the main two types identified are: 1) Polyculture – this could be more than one species of freshwater fish or several fish species and the Pacific white shrimp or the Pacific white shrimp and the Giant freshwater prawn in one pond; and 2) Monoculture – this could be the Pacific white shrimp alone or one fish species in one pond. Generally, several aquaculture types are found in the area; polyculture of freshwater fish (37.9%), monoculture freshwater fishes (27%), Pacific white shrimp (24.3%), polyculture of freshwater fish and Pacific white shrimp (20.45%), and polyculture of the Pacific white shrimp and the Giant freshwater prawn (18%). On one hand, culturing a selected brackish-species (the Pacific white shrimp) instead of freshwater fish in some areas becomes a strength of freshwater farmers' adaptability to the seawater intrusion. On the other hand, apparently, the vulnerability to seawater intrusion and rising water temperature in Nakhon Nayok River during the dry seasons as well as droughts and floods has adversely impact the aquaculture productivity.

Aquaculture-farmers were randomly sampling for 206 cases and semi-structure face-to-face interviews was applied to the targets. The results revealed that farmers have adaptability to the change of environments in several ways. Changing type of culture from single species-culture comprising the Pacific white shrimp to polyculture of freshwater fish was reported as due to their higher resistance to diseases. Farmers also indicated that they adapted to the physical environment by enhancing farm-fa-

cilities. For instance, increasing pond height, storing freshwater, providing shade on water surface, and temporary avoiding culturing during severe environmental conditions. Response to deal with cost effectiveness, improving techniques of cultural practice by adopting multi-species culture such as a polyculture between Pacific white shrimp and Giant freshwater prawn, as well as between polyculture of freshwater fish and the Pacific white shrimp, were also evident in the study area.

In addition to the environmental changes that reflect aquaculture-farmers' resilience in the study areas, we first study measuring how farmers generally response or perceive to the future decline of aquaculture production. The results of principle component analysis revealed that farmers' perception to the future decline of aquaculture production is determined by four key resilience components including: ability to obtain work elsewhere; ability to cope when there is a change; ability to compete; and ability to plan for survival. Based on the results, we hypothesize that farmers' background (such as age, education, years of aquaculture, income), climate change awareness, level of satisfaction with aquaculture, types of aquacultures, and farmers' membership in aquaculture association have influence on farmers' perception of resilience. The findings of this study will contribute to structuring programs appropriate to existing farmers' characteristics, hence, enhancing the livelihood of aquaculture sustainability in Thailand and similar locations. External forces that may influence farmers responses to the changes have been discussed. Enhancing knowledge and stimulate important future research about aspects of adaptability in aquaculture-farming communities specifically with regard to their impact on future policy strategies are suggested.

National Reclamation Project and "Ariake Sea Disaster": "Open-gate survey" for the harmony of healthy fishery and agriculture

Tamotsu Sugunami

The Ariake Sea Network of Fishermen and Citizens

1. Ariake Sea is one of the highest productivity and biodiversity sea area around Japan. Especially, Isahaya Bay was highly important for spawning or growing up of fishes, so we called Isahaya Bay, "the womb" of Ariake Sea. The wide and muddy tidal flat of Isahaya Bay is also important for wintering or resting of migratory birds.

Japan has joined Ramsar Convention in 1980. From these days, Ariake Sea and Isahaya Bay has long been eligible for the criteria of Ramsar site. Now, in Ariake Sea, there are three tidal flat is listed as Ramsar site; Arao (Kumamoto pref. listed in 2012), Hizen-kashima and Higashi-yoka (Saga pref. listed 2015). However, we should have evaluated whole Ariake Sea ecosystem include not only now listed tidal flats, but also Isahaya Bay and other area, and implement "wise use" of Ariake sea.

We think the National Isahaya Bay Reclamation Project is an impediment to comprehensive evaluation and preservation of Ariake Sea.

2. Isahaya Bay Reclamation Project started in 1989 and 7km sea dike has completed in April 1997. The 3,550ha tidal flat and shallow sea was dried up and fresh water reservoir was created by building the sea dike.

The impact of the Reclamation Project for environment and fishery is far above the estimation of EIA. The catch of fishery declined in 1990s, according with the construction of sea dike. After the closing of sea dike in 1997, damage for the environment and fishery became clear. In December 2000, widespread red tide prevailed over middle to northern part of Ariake Sea seriously damaged seaweed water culture. Since then, in Ariake Sea, the red tide frequently happens and massive fish-kill because of poor oxygen water in bottom layer occurs almost every year.

The construction of sea dike may have change the tidal strength and direction, then stratification of sea water become stronger. Researchers explain the reason of the situation and call such structural crisis as "Ariake Sea Disaster".

3. We, Ariake Sea Network of Fishermen and Citizens are organized with approximately 600 fishermen from 4 prefectures around Ariake Sea and over 100 citizens which includes many scientists, lawyers and other expert from several fields. We are working for the restoration of Ariake Sea seriously damaged by Isahaya Bay Reclamation Project.

4. Now regarding Ariake / Isahaya issue, the focus is "open-gate survey". According to the court decision, Japanese government planed "open-gate survey". In this survey, government going to open the sluice gate to flow sea water with tidal exchange into the reservoir which is made under the Reclamation Project for agricultural freshwater supply. The purpose of the survey is to investigate the impact of construction of sea dike and reservoir, This is one of the wetland restoration activities implementing in other countries.

5. Actually, some people around Isahaya Bay who care the negative impact of "open-gate" don't agree with the survey, the government is going to give up to operate "open-gate".

However we think "open-gate survey" after impact reduction measures is reasonable and possible. We have been suggesting to make round table discussion with farmers and residents who have concern about the survey and cooperate to find out the way to "open-gate" for the future in which not only the restoration of Ariake Sea ecosystem, but the restoration of local community and economy based on the harmony of healthy fishery and agriculture.

Locally Managed Marine Areas (LMMAs) – a pathway to holistic and integrated island management and sustainable development: A Fiji case example

Alifereti Tawake LMMMA Network International, Fiji LMMMA Network / Margie Tabunakawai Fiji LMMMA Network
Jovy Cleof, Hugh Govan LMMMA Network International / Saimoni Waibuta, Roko Sau Josefa Cinavilakeba Fiji LMMMA Network

Coastal and wetland resources is the lifeblood and mainstay of most Pacific Island peoples livelihoods. However, its status have been dwindling rapidly over the last several decades. As a result, coastal communities are facing challenges to food security and are increasingly more vulnerable to disasters and climate change impacts.

Creating locally managed marine areas (LMMMA) is one such effort to reverse this trend that utilises community based adaptive management (CBAM) process, based on progressive participatory community-driven approaches informed by marrying scientific and traditional knowledge. Local marine management undertaken by communities has often achieved benefits that may have eluded well funded and top-down initiatives.

LMMAs in the Pacific have proliferated since 2000 motivating a growing global movement based on a learning network of communities, managers and practitioners. The approaches are built on a unique feature of the region – customary tenure and resource access – and often making use of traditional governance system. LMMAs in the Pacific are implemented by over 1000 communities spanning 17 independent countries and territories, representing a unique global achievement. Other examples also exist around the world. The spread and endurance of LMMAs is attributable to communities' perceptions that benefits are very likely to be achieved and is a pathway to addressing community aspirations and needs holistically such as water sustainability, adaptation to climate change, improving income, food security and sustainable livelihoods. The main innovation that has supported the proliferation of LMMAs is the operation of clusters of communities supported by islands, regional, national and sub-national umbrellas or social networks. The LMMMA Network International includes Fiji, Solomon Islands,

Papua New Guinea, Indonesia, Philippines, Palau and Federated States of Micronesia each of which have developed affiliated national and provincial sub-networks.

In Fiji for example, the progress of scaling up LMMAs to national level have reached 466 Fijian communities so far covering 79% of Fiji's customary marine areas. Both empirical and experiential evidences on successes and challenges of LMMAs also resulted in an improved household incomes by as much as 30%, fish catches increased, communities adaptive capacity enhanced, knowledge and attitudes improved and a sense of ocean stewardship, ownership and pride being restored back into communities. LMMAs have also transformed decision making for customary marine areas from a more traditional, autocratic style to a more participatory and democratic process of governance. In addition, social learning motivated by the CBAM approach is clearly evident in the adaptive measures implemented by communities and in policies and legislation put in place by provinces and the national government. In essence, Fiji through LMMMA is taking leadership role globally on the promotion and implementation of locally managed marine areas demonstrating the power of collective community efforts if given the chance. Fiji LMMMA Network in ensuring Fish for the Future Generations! is committing to scale up its work to cover 100% effectively managed and governed customary marine areas by 2025.

Key success and challenges facing LMMAs in other countries and their supportive social networks are also discussed. In essence, LMMAs serve as building blocks for integrated island management and sustainable development by communities.

New forest commons towards solving the underuse of Satoyama from fishers' initiatives in Japan

Shimpei Iwasaki

Department of Environmental Science, International College of Arts and Sciences, Fukuoka Women's University

Satoyama is commonly described as secondary forests nearby human settlements, and represents the socio-ecological production landscape. It used to be fundamental to the environment, people and living organisms so that the local people had been able to maintain the productiveness in its biodiversity by themselves. In response to modernization, however, underuse of Satoyama has been widely occurred especially in the depopulated areas of Japan. Stagnation of the forestry industry and the aging of the population resulted in weakening roles of forests to act as a variety of environmental functions. The underuse problem impacts not only forestry sector but also a wide range of stakeholders including fishery one. Soundness of the forests has been believed to improve the condition for fish growth in the coastal areas among the fishers in Japan. There is an urgent need to apply an integrated approach to forest conservation with active participation of various stakeholders in the modernized and aging society.

With this recognition, the paper highlights a case of new forest commons towards solving the underuse of Satoyama from fishers' initiatives in Japan. The research summarizes the outputs and challenges of fishers-based forest conservation at the regional and national levels, in terms of places, contents of forest conservation, planted tree species, and so on. Furthermore, it presents innovative cases of fishers' initiatives to cope with the underuse problem of Satoyama at the local level.

Findings revealed that forest conservation activities with active participation of fishes were reported in 539 areas of 39 prefectures out of 47 in Japan during the period from 2001 to 2012. Hokkaido is the most active region of these activities, amounting to 76 places per year. These activities in Hokkaido was mainly triggered by a movement entitled "fish-breeding forests plantation campaign" since 1988 by the initiative of fish-

er-wives. At the national level, the organizers of forest conservation activities vary from place to place, but 56% of forest conservation activities were hosted by fishers. Out of 14 categorized work, tree plantation was the major activity. As the years passed, however, forest management has been shifted from plantation to forest maintenance activities including weeding. It is important to note that tree plantation with multi-tree species at favorable habitat and fertilizable trees have been put into practice. In particular, around 81% of planted tree species was deciduous tree, in order to ensure soil and nutrient enhancement, which is expected to contribute to higher fishery production in the river and coastal ecosystems. However, the study also revealed that the fishers tend to face with difficulties in coping with such constraints as shortage of budget and manpower, maintenance of planted trees, and securing lands for plantation. In fact, around half of these activities were suspended. To tackle with these challenges, the lessons learned from successful case studies indicated that the fishers explored building collaborative partnerships among relevant stakeholders by sharing the advantage of their own resources to cover for each other's weaknesses. Based on these findings, this paper provides new insights on identifying potentials and challenges of new forest commons from fishers' initiatives in Japan.



Urban wetlands and Governance challenges in the two Indian mega cities of Chennai and Bengaluru Keynote

Sandhya Chandrasekharan

Centre for Biodiversity Policy and Law (CEBPOL) of the National Biodiversity Authority

Bengaluru and Chennai are two-major cities in the southern part of India which have population sizes of a few million people. While geographically, both are in the south and less than 500km apart, they are part of two distinct bio-geographic zones – the Deccan Peninsula, and the Coastal.

The key ecosystem service related challenge that has been the topic of considerable discussion in recent times in both rapidly growing urban regions pertains to the quality and quantity of fresh water. The Chennai Metropolitan Area is reported to have had 650 waterbodies till a few decades ago, since reduced to only 30 (Janakarajan cited in Laksmi, 2017). It also has two rivers – the Cooum and Adyar, and the artificially constructed Buckingham Canal. The city gets an average rainfall of 140cm every year, with recorded rainfall of less than 100cm (the anticipated ideal) having occurred only 5-6 times in the last few decades (Laksmi, 2017). As a city on the high-energy coast of the Bay of Bengal, it is also no stranger to extreme climatic events (Jayaram, 2015). From the Indian ocean tsunami in December 2004 to depression-induced heavy rains that caused flooding in the city in December 2015 and a super cyclone in December 2016, the city has seen it all. Delving into the management of its ample waterbodies and the denuded resilience that would otherwise be offered by its original ecosystems presents an interesting case of the story behind a city that is prone to both water stress and urban floods. The combined capacity of the tanks and reservoirs is estimated to be 80 thousand million cubic feet of water (80 tmcft), but their current capacity, owing to poor maintenance and lack of periodic desilting is only 11 tmcft (Janakarajan cited in Laksmi, 2017). Nearly 300 tmcft of rainwater drained into the sea in the 2015 floods as a result (ibid), leaving in its

wake the world's 8th most expensive natural disaster for the year, estimated to have cost a USD 3 billion loss to the economy (article in the Business Standard, 11 Dec 2015). New and post facto regularised urban infrastructure came sharply under the scanner from sections of academia, media and civil society – a new airport terminal on the floodplains of the River Adyar, a Mass Rapid Transit System constructed almost wholly over the Buckingham Canal and the erstwhile 50square kilometre Pallikaranai marshlands, an Information Technology (IT) corridor and engineering colleges constructed on waterbodies (Jayaram, 2015).

In Bengaluru, the story is not very different. A report by the Indian Institute of Science (IISc) shows that between 1973 and 2013 there has been an estimated 79% decrease in the total area of its many lakes and waterbodies, with over 50% of the area of lakes being built-up in violation of existing laws, and local government agencies being implicated in the same (Sengupta, 2016). The matter was discussed in the state legislature as well (ibid). The city too has witnessed a spate of waterlogging events after regular rainfall, and water shortages and dependence, as in Chennai, on the growing phenomena of private water markets, where private operators truck in water in tankers from peri-urban areas (Nelliyyat, 2016). Governance of the factors behind the transformation of urban wetlands and the undervaluing of their ecosystem service values is a complex matter, and is analysed in the paper. Areas for improvement include technical know-how and capacities in green infrastructure, as well strengthened synergies between government departments. Keywords: urban wetlands, ecosystem services, governance of ecological infrastructure

Making a wooden footbridge connecting nature and people in an artificial wetland

Akihiko Higuchi Faculty of Engineering, Kyushu University
Kazuhiko Ito TOKEN C.E.E. Consultants Co.,Ltd.

The purpose of this paper is to report the epoch-making process of realizing a twenty- five-meter-long wooden footbridge in Karatsu, Japan as a spatial and psychological connector of Downtown Karatsu and Nishinohama, one thousand meter-long artificial coast.

The bridge is also unique as one of the first examples of newly introduced funding system that is structured by citizen's contribution, municipal funding, and direct financial support from the national government.

Originally, the footbridge was planned and proposed by Karatsu Minatomachidukuri Konwakai, a local community group that had been active in the past decade to promote revitalizing Karatsu's waterfront. The organization argued that the footbridge would dramatically improve citizen's access to the artificial coast.

Many local citizens and organizations granted the value of the proposal, and donated about two million yen, one third of the estimated total cost of the construction of the footbridge.

Another feature of this project is that the bridge construction was mostly done by local citizens rather than by subcontracting construction firms. A design team that includes the authors and a local wood structure specialist carefully designed the bridge in order that amateur weekend carpenters could assemble the bridge easily on the site with saws and drills from their garages. Sugi, Japanese cedar, grown in a regional forest were chosen for structural lumbers of the bridge from an ecological point of view. Sugi has been used as a major shipbuilding material in Japan for its strong and flexible nature. In this regard, the bridge is a green infrastructure that is friendly to the natural environment. To enhance the durability, a latest preservative treatment that was harmless to the nature was applied on lumbers.

Historically, numbers of social infrastructures, such as

bridges, ports and canals have been built by funding out from local citizens' pockets and their direct participation in the construction process, particularly in Edo period in Japan. This kind of civic contribution was called "Fushin" in Japanese. Karatsu's footbridge could be regarded as a revival of the Fushin concept in the 21st century.

The revival of Fushin concept in Karatsu is an irony to the contemporary society that tends to believe that the social infrastructure is supposed to be built and managed by the government alone and the society has no responsibility on it.

It is also an alternative approach of vitalizing urban wetland that aids the local government that has been suffering from serious financial difficulty in managing urban wetland due to the long-lasting recession in Japan.

Thanks to the footbridge, the access to the coast is dramatically improved, and numbers of local citizens visit the precious coast through the bridge and enjoy experiencing the nature throughout the year. The city is now in charge of the maintenance work of the bridge. However, because of the long life of the lumber, required maintenance work is very limited. In addition, the simple shape and the texture of the bridge made of local Sugi lumbers fit well as a green infrastructure to the existing originally artificial but now ecologically natural wetland environment.

The authors and the volunteers who participated in assembling the wooden bridge wish that the bridge will be loved and supported by the local community for a long time.

Sustainable Management of Urban Lakes Environment and Ecosystem: A study on Lakes of Udaipur

Sonal Gupta
Lingaya University Faridabad Haryana

Water is one of the most important elements required for life on earth. The natural water bodies are vital for the survival of human civilizations. Among the water bodies, lakes are important and contribute about 87% of all the fresh water on the earth surface. Inhabitants living in and around lakes depend on it for water, food, recreation, tourism etc.

Lakes are generally of many types-Natural, Manmade and Ephemeral. Many lakes in India are categorized as wetlands by Ramsar Convention.

Udaipur city is located in the south west of Rajasthan State. It is the sixth largest city of Rajasthan. Due to lakes and water bodies, it is called the "City of Lakes or Venice of east". It is one of the most beautiful cities in the world. Udaipur city is unique in its own way. Being situated in a drier part of India, the city constitutes hilly soil and unmatched water resources.

The city holds great ecological importance. Lakes of Udaipur are the lifelines of the city as they not only add a picture perfect beauty to the city but also act as a boon for tourism that helps the local economy. However, these lakes are under immense threat of degradation as a result of catchment degradation, encroachments, urbanization and waste disposal.

My presentation includes the threats to these man-made lakes and the steps needed to conserve these water bodies. The impact of human activities and the change in the land use of the surrounding of the lakes is discussed in the presentation. The socio-economic and ecological issues are included in the presentation. The impact of tourism and growing industries on the lakes are discussed in this presentation.

Presentation includes the role of various agencies on the protection of wetlands. The paper includes the evaluation of various programmes and projects which are developed by various agen-

cies and the sustainable solutions for the protection of wetlands and urban lakes are suggested in the presentation.

The catchment area is very important for the protection of wetlands and the paper deals with the planning of catchment area and how this affects the water quality of the lake ecosystem.

The role of citizens in the protection of lakes and the role of youth groups and other groups of citizens is included in the presentation. The master plan of Udaipur for the year 2040 which includes the planning of the wetlands at Udaipur is also discussed. The economy of Udaipur is mainly tourism and fast growing industries and mining in the area. There is an impact of growing human population and the floating population in the area and pressures on the lakes. The discharge of effluent from the surrounding area in the lakes and the impact of eutrophication on the water quality is included in the presentation.

Conservation of Karang Mumus River and Swamps in North Samarinda: Efforts by Clean Karang Mumus River Movement and Stakeholders' Responses

Martinus Nanang
Mulawarman University, Samarinda, Indonesia

Samarinda, the capital city of East Kalimantan Province in Indonesia, is located in a lowland area. Its low altitude and very high annual rainfall contribute to the frequent flooding every year; many are massive in scale. One of the main factors contributing to the flooding is the reduction in the size and number of river swamps in and around the city, mostly due to conversion for housing areas. Karang Mumus River, which flows across the city and is badly degraded, urgently needs to be conserved along with the remaining swampy areas connected to it. The conservation is important as an effort to protect the riverine ecosystem and biodiversity, promote a healthy environment and hopefully a better livelihood for local residents (e.g. ecotourism, production of rice and other wetland vegetation), and prevent the city from further escalation of the environmental disaster.

It is a movement named Gerakan Memungut Sehelai Sampah Sungai Karang Mumus (GMSS-SKM, literally Movement for Collecting a Piece of Garbage from Karang Mumus River) that has initiated a civil society movement to clean the Karang Mumus River and to conserve the river and its surroundings (river space). GMSS-SKM operates an education center called Sekolah Sungai Karang Mumus (SeSuKaMu) or Karang Mumus River School. The movement projected and is struggling to get an area as large as 10 hectares in the northern part of the city, the size it believes to be a minimum level necessary to be conserved for the benefit of the entire city. The movement so far enjoys limited support from concerned academia and university students and from the limited number of concerned city government officials as well as local residents. It continues to be very active despite limitations and challenges it encounters. Then the question is: How can the movement survive? How can

it achieve the conservation goals?

This abstract is an initial result of a 4-year (2017-2021) ongoing research focusing on the environmental ethics and values of the people of Samarinda. The presentation itself explores the GMSS-SKM perspective, strategy and action and responses from related stakeholders to its effort to conserve the river and related surrounding swamps. To put it in a more operational way the particular objectives of the presentation are formulated as follows: (1) To identify the scale of the river degradation as perceived by GMSS-SKM. (2) To analyze the values and ethical perspective of GMSS-SKM vis-a-vis other stakeholders' perspectives; (3) To describe the strategy and action of GMSS-SKM, including financial strategy and how it interacts with local authorities, academia, and local residents. (4) To assess the willingness of local residents to cooperate with the GMSS-SKM in the effort to conserve the river and related swamps. This includes the reasoning of their thoughts in which cultural, economic, and political values and norms are assumed to be in play.

The results of the study have both strategic and practical implications in supporting the movement, or more precisely in achieving the conservation objectives, whoever or whatever organization taking the lead in the future. Strategic implication refers to overall approach that can be formulated based in the findings and practical implication simply means the way to develop encouragement, motivation, and cooperation among stakeholders.

The Horseshoe Crab (HSC) in Japan (*Tachypleus tridentatus*) was designated an endangered species in the 1990s. After World War II, recovery and economic growth pushed large-scale coastal development including reclamation and dredging, inducing water and substrate pollution and habitat loss. HSC habitat shrank to the western edge of its original extent, and is now limited to northern Kyushu. Interests of researchers have changed. Small beaches as spawning sites were examined. Micro conditions of spawning and embryo development were observed and measured. Next, beach material grain size and distribution were examined. Conditions in Moriyé Bay, Oita included coarse sand (d₅₀: about 0.7mm) and lower silt and clay ratios (about 3%), which ensures enough water circulation around eggs and embryos with tidal changes. Beach nourishment has been the standard method to restore sandy beach spawning sites, but it proved unsustainable due to erosion and siltation on restored beaches.

Beach morphology and sand transport and sedimentation dynamism were re-examined. Coastal engineering studies revealed the responses of sandy beach development, and the knowledge was utilized for restoration. Beach nourishment without predictions of littoral sand flow tended to fail. Continual supply and adequate natural sand sieving are essential to maintain sandy beaches. Specialists realized that involving enough space to allow influences from waves, currents and other natural external forces is very effective for maintaining sand dynamism. Awareness of zonation of the coastal zone was keen in the late 1990s, because by 1993, about half of Japanese coasts had become affected by artificial structures. The methodology and philosophy of Japanese coastal public works were criticized by the public, especially naturalists and surfers. Japanese land use policy was organized to protect the physical line of beaches

from erosion and severe outer forces like typhoons. Under the first version of the Seacoast Act, landscape and ecosystems were almost completely ignored. But in 1999, this act was amended to open the door to nature conservation and public participation. Furthermore, recognition of the importance of topographical continuity from sandy beaches to tidal flats to offshore areas in HSC life history became shared among related sectors and persons. Awareness expansion from point to line to plane was popularized. This evolution of conservation methodology migrated into coastal zone management perspectives. Beach erosion was worsening and became a pressing problem. Preservation of sandy beach topography demands sufficient, continual supplies of sand flowing from the mountains and moving as littoral drift at the shore. Dams and weirs disturb sand flow. Dredging river beds and coastal zones induces erosion. HSC spawning beaches also suffer from these problems. Thus, not only coastal but watershed management became a hot issue. Comprehensive sediment management was introduced to sectioned-off administrations. HSC habitat conservation started with only small-scale beach conditions, but evolved to acquire large-scale and long-term viewpoints which were understood conceptually and promoted step-by-step. If habitats for all stages of HSC life history are conserved, coastal disasters may be lessened. Coastal geomorphology like tidal flats and foreset slopes are known to have natural disaster prevention functions. HSC habitats are important buffer zones. Thus, in reconsidering coastal matters in the wake of tsunami damage HSC habitat conservation can symbolize integrated coastal management, especially land use.

Urban Wetlands and Mosquito Borne Disease Problem in Chiang Mai, Thailand

Panida Rahong, Chotiwt Techakijvej Environmental Science Program, Faculty of Science, Chiang Mai University

Nattawut Sareein, Yeon Jae Bae Division of Environmental Science and Ecological Engineering, College of Life Sciences and Biotechnology, Korea University
Chitchol Phalaraksh Environmental Science Program, Faculty of Science, Chiang Mai University / Department of Biology, Faculty of Science, Chiang Mai University

Water is the most important resource for every living things. On other hands, water is the one of problem on human life such as flood, storm, low quality of water and disease that coming with water. Mosquito borne disease also comes with water also. Anthropogenic environmental alterations, urbanization, global warming and habitat change that lead to mosquito outbreak and may be contributing to the spread of vector-borne diseases. Mosquito is one of the famous insects group in the order Diptera. Over 3,520 mosquito species that recognized in the world and 459 species in Thailand. Many species of mosquito were transmitted serious disease-causing viruses or parasites.

The study of their life cycle, habitat and their ecology were important to reduce the mosquito population. In this work, the ecology of mosquito was studied in term of their habitat, there enemies and the overpopulation problem of mosquito. There are many small wetland, freshwater lakes, ponds, retention areas and paddy field in Chiang Mai, Thailand. Six observation sites were divided into 3 groups of habitats include natural wetlands with low disturb areas, natural wetlands with high disturb and manmade wetland. Those habitats were recorded water physicochemical data, habitat data, and predator-prey data. Then, all of data were used to calculate the correlations between mosquito larva and other factors. The relation between predator and mosquito in natural wetlands were analyzed. For the result, *Culex quinquefasciatus* was the most common species that found in manmade wetlands. Number of mosquito data were given the negative correlation with dissolved oxygen and habitat quality score. In the natural wetland with low disturb, high diversity of predator and low number of mosquito were found. But the result was different between from the predator and prey in natural wetlands with high disturb. High number of

predator, low diversity and high number of mosquito larva were found in high disturb and manmade wetland. The predator that we found were classified in to two group 1) Dissolved oxygen demand predator such as fish, dragonfly larva (Odonata), diving beetle larva (Dytistidae), water scavenger beetles larva (Hydrophilidae) 2) Low dissolved oxygen predator such as diving beetle (Dytistidae), water scavenger beetles (Hydrophilidae), elephant mosquito (*Toxorhynchites* sp.), *Lutzia* sp. mosquito. In addition, high water velocity from rain storm was effected on the population of mosquito larva.

Chemical pesticide methods were used for short term mosquito management. The reason is high efficiency and fast. However, pesticide also eliminated other living thing. The scientist try to develop the natural enemy of mosquito to get rid of mosquito larva in natural wetland. Ecological friendly and sustainable were remarked point of this biological principle. Moreover, the mosquito predator should selected in a suitable environment. The environment should be change to the supporting of predator growth and suppressing the mosquito larva growth. Additionally, the number of predation should be introduced in the suitable amount that not become another problem. The efficiency and species selection will be study in the future. After finished the research, public education will be used to promote the management wetland and natural enemy method to reduced mosquito in sustainable way.

Wetland Services for Elementary Urban Planning: Perspective from Bangladesh

Abu Jubayer Graduate School of Engineering, Kyushu University / Md. Sanowar Hossain President, Bangladesh POUH
Md. Badrul Alam Core Team Member, CCECR, Stamford University Bangladesh (SUB)

Municipal areas in Bangladesh are dependent on the wetland beyond their city limits, but also get benefit from internal urban wetlands. Major planning of a municipal area is depends on better drainage management plan. This paper is focused on the benefits of wetlands in context of drainage management and impact analysis of mismanagement of urban wetlands. In context of Bangladesh major types of wetland around the municipality are rivers, oxbow lakes, dead hand of river called beel, canal (manmade and natural), pond and some large ditches are common. Due to the detail analysis 13 economically important municipal areas (Benapole, Bera, Charghat, Chua-danda, Chatak, Ishwardi, Joypurhat, Kishorgong, Magura, Muktagaccha, Nilphamary, Nougaoon and Shahjadpur) in Bangladesh were selected. Field visit with GPS tools, FGD and KII method were used for scrutiny analysis of wetlands in the selected areas. The regular exercise of wetland benefits are attentive to manage consistent rain water surface runoff, storm water management, drainage (primary, secondary and tertiary) management, continuous city household water supply as well as recreational services. Demerits of wetland mismanagement includes water logging (permanent and seasonal), environmental disruption, draw down of ground water table in dry period, disruption of household water supply systems, seasonal economic losses and recreational mega damages. Different types of master plan like drainage master plan and urban master plan are under planning are going on however there is no more wetland master plan is present in these municipal areas. Drainage master plan only focused on the wetland management and recommended that, without proper wetland management no sustainable master plan can play better. The basic hindrance to wetland conservation and management are focused like illegal encroachments (new housing, market expansion and dumping

yard), city extension (new satellite residential project, random bridge and culvert construction and market permission near the wetlands), unplanned city migration (people from other areas transformation for better living and low income floating people) and lack of awareness (no program of awareness and benefits of wetlands) are prime concerns. Commonly identified procedures of management of wetlands and urban planning are focusing, the understanding functions and value of wetlands. Like as drainage system continuation, fishing, grazing and other services along with addressing the importance of wetland in urban areas. By managing urban wetlands more important issues are to resolve the water logging (seasonal and permanent) program, urban household water supply, steady ground water recharge and waste water passing as well as treatment are common every municipal area. On the other hand raising the public awareness similar as monthly, half yearly and yearly campaign program and institutional like school, college, university, local government and NGO level program and other local government initiatives kind of law enforcement and systematic announcement can plan a significant role for wetland service sustainability. Most of the KII interviewee (70%) result reflect that they need a wetland management master plan according to national and international context and rest of (30%) have large water bodies and they don't have any problem to manage urban services at present. It is revealed that the locally generated wetland services have a substantial impact on the quality-of-life in urban areas and should be addressed in land-use planning. In turn, this research focus on the distinctive aspects of constructed wetland services can contribute to fundamental urban services planning.



The environmental activities of Youth Ramsar Japan (YRJ), NGO organized by students ranging from junior high school students to graduate students Keynote

Takuma Satoh, Tatsuya Togari, Atsushi Tanabe, Kohaku Hida, Karin Ishii, Yuma Sato
Youth Ramsar Japan

Youth Ramsar Japan (YRJ) is the NGO organized by “Youth” ranging from junior high school students to graduate students in 2013 for strengthening “CEPA” and “Wise Use” of the Ramsar Convention through activities such as learning about wetlands and planning and practicing conservation of wetlands conducted on a self-mobilization level. Core members of YRJ consist of youths who had participated in the Wetland Environmental Education “KODOMO Ramsar”. “KODOMO Ramsar” has been promoted by Ramsar Center Japan (RCJ) since 2002, targeting elementary school students, and has greatly contributed to the wetland conservation activities and network formation of children. But, until now, there were few opportunities for young people to make a network with members of the same generation and conduct capacity building, awareness-rising and communication at the self-mobilization level. Therefore, we wanted to establish YRJ, as young people are target groups and stakeholders of the Ramsar convention’s Programme on CEPA 2016-2024.

YRJ has conducted the following activities: (1) “Youth Ramsar CEPA Workshop (CEPA-WS)” to learn about wetlands and gain a wide perspective through communication with other youths, (2) “Youth Research Project (YRP)” to research wetlands and offer information of wetlands to public, (3) Participating and cooperating in environmental events for CEPA.

Here, we introduce our CEPA-WSs, “Youth Ramsar Exchange Meeting” for 1st and 2nd WSs and “CEPA Workshop” since 3rd WSs, as follows:

1. “The 1st Youth Ramsar Exchange Meeting in Fujimae tidal flat” focused on Environmental Education,
2. “The 2nd Youth Ramsar Exchange Meeting in Lake Biwa” focused on Relationship between Lake-Biwa and Human being,

3. “The 3rd Youth Ramsar CEPA Workshop in Kabukuriuma and its Surrounding Paddy Field” focused on Agriculture,
4. “The 4th Youth Ramsar CEPA Workshop in Hamatonbetsu” focused on Tourism / Facilitation,

5. “The 5th Youth Ramsar CEPA Workshop in Toyooka” focused on Tourism / Conservation of stork, 6. “The 6th Youth Ramsar CEPA Workshop in Tsuruimura village” focused on Staff training.

YRJ will plan and manage “KODOMO Wetland Exchange Meeting in Arao Tideland” for elementary school students at “The 7th Youth Ramsar CEPA Workshop in Arao” held on November 3-5. This is the new challenge for YRJ.

Youth Research Project (YRP) is the project in which youths visit wetlands in Japan, find the treasures of wetlands from perspectives of youths, and offer information of wetland. YRP was started last year. We are actively offering information through the YRJ official website and the SNS.

Through CEPA-WSs, YRJ has made opportunities for youths to learn wetlands and communicate with the youths who are active in wetlands in Japan. In YRP, we reviewed the values/treasures of wetlands from the position of the next generation of environmental managers. These achievements were appreciated by the organizing committee of Asian Wetlands Symposium 2017, and YRJ was entrusted with the management of “Wetland and Youth” session at 1st meeting of the international steering committee of AWS 2017 held at Suncheon, Korea on Feb, 2017. “Wetlands and Youth” is the session for youth by youth.

Fundamental study on conservation and restoration of river estuaries habitat — Classification of estuary and their transitions since 1900s

Atsushi Tanabe Graduate School of Science and Technology, Kumamoto University
Tomoko Minagawa Faculty of Advanced Science and Technology, Kumamoto University

Background Biodiversity conservation and management in a river estuary requires a thorough understanding the environments of the river estuary, which differ between rivers. Therefore, in order to establish a conservation and restoration plan, it is necessary to classify the river estuary by such as morphology and history. The morphology of river estuaries is related to river flow, tide, and wave (Galloway, 1975), and areas’ classification is based on these factors (Wells, 1995). In addition, there are many studies relating these factor and species to estuary habitats (e.g., Kishida et al., 2007; Itsukushima et al., 2017a; Itsukushima et al., 2017b). However, only a few studies associated local topographies in river estuaries with species presences. Heap et al. (2001) classified estuaries based on the topography, identifying areas such as the delta in Australia. Yet, because of the differences in the natural environment between Japan and Australia, we cannot extrapolate from their study to the environment of Japan.

Purpose The present study aims at classifying river estuaries in Japan based on their morphology, in order to contribute to their conservation and management. In particular, our objective is to identify the specific factors that determine the morphology in each river estuaries, as well as their relationships, and to study the transition since 1900s.

Method We classified 107 rivers in Japan based on their forms, such as sandbar and tidal flat. Aka-gawa and Ara-kawa were excluded from this study, because it did not have a river estuary until the 1920s to 1930s. We used 1/50,000 topography maps constructed around 1900, which seemed to contain few artificial structures. Furthermore, we investigated the characteristics of each class such as: 1) the river flow rate in correlation with river basin area data (Yoshiyama, 1990), 2) the tide level difference at

the observation stations that are closest to the river estuary, 3) the significant wave height around the river mouth, calculated using the coastal wave model (Japan Meteorological Agency, 2010).

We studied the geomorphological evolution of 107 river estuaries using the 1/50,000 topographic maps at five survey periods around 1900, 1925, 1950, 1975, and 2000.

Results and Discussion

The river estuaries are classified into two groups; open sea (68 sites) and inland bay (39 sites). In addition, the open sea group is divided into three subgroups depending on the presence or absence of a sandbar and a lagoon, as references to different physical environments (Hatano et al., 2007). There are no sandbars or lagoons in the inner bay group, and there are estuary tidelands in many points. The open sea group has a river basin of about 150–15000 km², a significant wave height of about 0.3–1.4 m, and a

tide level difference of about 20–200 cm. The inner bay group has a river basin of about 100–8000 km², a significant wave height of about 0.2–0.6 m, and a tide level difference of about 100–350 cm.

39 sites lost their sandbar or tideland, 44 sites showed a decrease in their sandbar or tideland sites. Among the open sea groups, the lagoon subgroup was lost in four out of seven sites, and the sandbar subgroup was lost in 19 sites. The inner bay group was lost in 20 sites, and it was decreased in 17 sites. There are many reasons for disappearance such as landfill (in inner bay group), landfill and port maintenance (in lagoon subgroup), and installation of training dike (in sandbar subgroup).

Conclusion 70% of the tideland sites in the inner bay and 50% of the lagoon sites were lost in 100 years.

The value of wetlands and what we students should do for it —take Hengshuihu wetlands for example

Yiqing Hu

Wetlands International-China

The importance of Wetlands in the lives and survival of many species of waterfowl, as well as humans, are greatly overlooked. When I first viewed a wetland I was ten. Apart from its lack of civilization and apparent vacancy, nothing else really stuck in my memory. The young me was unable to grasp the importance and crucial role that the wetlands played in the conservation of certain species. Last summer, I was able to visit Hengshuihu wetland reserve in Hebei during an internship with WWF China. The feeling and impression of wetlands was totally different from that of eight years ago. On the surface, the wetlands were just tall blades of grass standing in waist-deep water, with the occasional clearing with a few ducks wallowing in it. However, by taking a stick and parting the grass at the water's surface, my guide and overseer showed me an entirely new way of looking at this ecological marvel. This time, what we (my director and me) saw was not the empty, hollow world on the surface, but a refined ecosystem, overflowing with the quiet energy of life and possibility.

I also learned the sad part of the story—that these alcoves of hidden wonder and life were receding—how they were being demolished in the path of human industrialization. Upon that, I asked myself, and beseech you to ask yourselves: Do we not have enough factories already? Enough sources to pollute our water, poison our air, corrode our soil? Can we pause in our relentless pursuit of domination and glory, simply because we need some place, some time, to take a break? I realized the pressing need for me to take actions after coming back to the city.

- Made presentations at class meeting and association events to raise my peer student awareness and also argue with them the true values of wetlands.

- Reused water for multiple purposes at home, and passed on such knowledge to a larger community for water saving.
- Became very outspoken and advocated about wetland protection.

However, my actions for conservation alone were not sufficient to raise public awareness, but, as in the wetlands, a drop of water can cause a ripple, and that ripple can grow.

At end of my presentation, two suggestions were made for conservation. One is that relate governments should formulate sound policies and provide sufficient funds to wetlands conservation, while international organizations contribute to technical assistance. Second, more researches should be conducted for waterfowl diet.

Therefore, different food should be prepared at various stop points along the flyways. Finally, I also call for environmental protection. Mother earth is our host, and we are simply organisms living in or on it. If we begin to destroy our host, much like viruses in a human body, our host will react accordingly to expunge us. Either the virus kills the host, or the host kills the virus. No matter what, in the end, the virus dies. In order for our survival, and the survival of our future generations, please—don't hurt our earth.

My observation of status of Wetland

Wenling Kou

Beijing University Affiliated High School

My hometown is in Inner Mongolia, China. Every year, I go back to my hometown and visited beautiful wetlands there. I think that what makes the grassland so beautiful is because of it has a lots of lakes and zigzag rivers moisten it. When I was a tiny little girl, the definition of wetland in my mind is simply water and land mixed together. But when I grown up, I found that wetland is may not just a place, but an important ecosystem. There's a lots of different kind of bird inhabited there. Through my observation, I found that there are thousands of birds inhabit in Inner Mongolia wetlands in Spring and Autumn. So teacher told us that the wetland also called as "The cradle of biodiversity."

I grown up in Inner Mongolia where famous with vast and beautiful grassland of thousands of wetlands. I've seen changes of some of the wetland reduced the size and water level is lowered, and some of the beautiful birds reduced the population compared with what I saw in my childhood, thus it really impressed me greatly. Then I decided to do some observation under the guidance of my parent and teachers in the school.

Through my field observation, I found that there are less birds and some of the wetland and riverside covered with garbage and plastic bags. I feel sad and would like to find out the threats to wetlands in my hometown by observing the wetland during weekend and school vacations with the help of my parent and interview local people in and around the wetland. I found that the main problems that threat the wetlands are as follows:

1. Objectively, the Nino phenomenon leads global warming. (I have the analysis of the temperature in a wetland nature reserve, It's a broken line graph and I can show in my PPT).
2. Artificial factor:
 - 1) Large area of land reclamation (Not just only wetlands, but also grassland).
 - 2) Over grazing. The amount of livestock in the natural prairie is

increasing in recent years by local herdsmen;

- 3) Mining activities;
- 4) The construction of the industrial plant, wastewater is discharged into nearby rivers and wetland without proper treatment;
- 5) Urbanization takes up wetlands
- 6) There may be lack of proper coordination in different government offices involved with the utilization and management of wetland resources;
- 7) Conservation of wetlands outside the nature reserve are some what ignored.

(All of the following will be supported by examples and data and all of the data is my own personal interview of local people).

Every year, when I goes back to my hometown, the first thing I am going to do is always cleaning the garbage on the wetland, and talked to local people to explain the importance of protecting wetlands. But I think I should do more, I have some idea about how to do more to protect wetlands by our teenage:

- 1) Increase the awareness of the public by informing them the important functions of wetland played for daily life of human livelihood;
- 2) We will make wetland information connectivity through the Internet.
- 3) Publicizing the relevant laws and regulations of the protection of the wetlands and strengthening the enforcement.

I believe that when I grow older, I will have more insight of wetlands and I hope I can do more to protect wetlands to make the world a Better place to live!

It is a great honor to be here to talk about the significance of protecting the extinct wildlife. My name is Zhang Ruichen. I am a student of Beijing No.14 High School and passionate about field research, which I regard as lifelong ambition.

I've taken part in field researches for 6 times, and have been to many places with the teenage field research expedition teams. Monitoring ecosystem of Tonle Sap Lake was my first experience about such activities. For the first time I felt the difficulties of doing fieldwork, and appallingly, the living condition was worse than I had thought.

One year later, since I accumulate more knowledge and experience, I decided to go to Peruvian Amazon rainforest (flooded forest) in order to assist local scientists there, as Amazon is my dream land since I'm a little kid. During the field research volunteer expedition I spent on Amazon River, I finally learnt how to co-operate with others as a whole team, and on the other hand I tried to help the scientists as much as I could, also simultaneously learn the knowledge as much as possible. During this expedition, I first seriously consider the field research as my future job.

Last summer, I went to Alaska and it's really a magical place. The indigenous plants the animals and the environment really influenced me from inside to the outside. As we travel along the Dalton high way, we ran into a number of animals and also saw large oil pipes along the whole state, which worries me since the place is supposed to be a habitat of these animals. I wonder what would happen to the place when we don't need these pipes any more. It is nearly impossible to remove these pipes. There is little we can do if the oil leaks out and causes a catastrophic outcome. We also find some proof that our planet is getting warmer and warmer. It was the first time that I realized that how powerful the nature is and how tiny the human are.

If I have to describe the condition of the wildlife protection, I would say it is pessimistic. Dozen of species are dying out every day as result of human activities. For example, the Northern White Rhinoceros is announced to be functional extinction in May 2016. There are less than 30 individual harbor porpoises surviving in this planet. All of these is associated with human illegal capture activities. In another word, monetary motivation.

Some one may disagree with me because you may know that our ancestors, the homo sapiens, also caused massive wildlife extinction. Their action is due to their lack of knowledge and the hunting instinct. But in 21 century, we already know the the consequence if we don't protect those amazing creature which have the same right to live on the planet like every human beings. Some of us slaughter them for huge profit and most of us do not have the consciousness to protect the animals let alone put efforts to change the situation. To make things worse, as a high school student, I know that most school do not pay much attention to such subjects which educate young generation the right concept and conduct to protect the ecosystem. Nowadays majority of students can do nothing but shout out slogans. That is why I believe popularization teenagers' environmental education is vital.

It is only by doing so that our planet can be a better place for human being. It is never too late to save what we still have. Extinction is not eternal.

The Youth Frontier Transforming Waste to Wealth – A case of novel efforts by young entrepreneurs towards the struggle for depolluting the holy River Ganges

Sreeya Patnaik
Xavier Institute of Management, Bhubaneswar

Wetlands are among the most productive ecosystems on the planet, providing an array of ecosystem services that are vital for survival and wellbeing, hence forming a web of life. Today, the rate of loss and deterioration of wetlands is a matter of concern for all regions of the world. According to Wetlands International, wetlands are on the "front-line" as development pressures increase everywhere. This is likely to intensify in the coming decades due to increased global demand for land and water. The need of the hour is the willingness to make significant contributions to help prevent wetland loss and achieve effective restoration. Inculcating ideas about the importance of wetlands in young minds goes a long way in creating huge differences. Instilling into the students minds, the complexities and consequences of continued unprecedented loss of wetlands shall render deep understanding and collaborative efforts. This will not only encourage them to act as ambassadors for wetland conservation and restoration, but to share their views and knowledge with others in their communities. Today, the motivated youth are becoming responsible environmental stewards through their participation in wetland restoration. It is heartening to see a surge in startup companies driven by young entrepreneurs coming up with innovative ideas for successful wetland restoration. The inspiring endeavor of one such budding young entrepreneur to clean River Ganges is quite commendable. The Ganges, the third largest river in the world in terms of water discharge into sea, is India's holiest river and is deep seated in Indian culture and ethos. It supports the livelihood of more than a massive 500 million and cradles some of the rarest species on the planet including the critically endangered, Gangetic dolphin. Unfortunately, this vibrant River is now considered as the fifth most polluted river in the world, gasping for life. Over the years,

the Government of India has been investing in cleaning and restoring the river that serves as a labyrinth of life.

However, this is an onerous task that calls for substantial collaborative efforts over time for its success. Recently, two 26-year-old entrepreneurs have emerged with their innovative and creative solutions to join hands with Government to clean up 80 million tons of floral waste dumped every year in to the river every year by devotees, which is posing serious eutrophication problems. Their startup company "Help Us Green", currently collects about 9.5 tons per month and converts these wastes to wealth. They not only remove the floral waste from the River but process them, to produce incense sticks and manures, while providing employment opportunities for 1,200 rural families at the same time. Inspired by the success, they now plan to scale up the collection and processing of flower waste to 15-20 tons per month by 2019. They are also working on expanding their product line to more products to make the effort more credible and replicable. This case demonstrates a sustainable innovative solution to the restoration of an important wetland ecosystem. There are many other inspiring stories of thriving endeavors towards the Ganges restoration, which truly highlight how the youth are emerging to be the future guardians of our wetlands. Today the youth have been doing wonders through their contribution to wetland and environmental conservation.

Whether we talk about pollution, waste management or eco-tourism, they seem to have solutions for all. With the prodigious growth of urbanization and water scarcity in developing countries like India, these startups can become a much-needed panacea for successful wetland restoration.

We were working in Osaki city, Miyagi prefecture. There are 3 Ramsar Convention wetlands in Miyagi prefecture. 2 of them are in Osaki city.

Osaki city has many natural environments such as about 20,000 rice field and vast forest.

We belonged Osaki Ikimono Club.

It belonged to about 200 members, and went to the wetlands and the river and forest ,rice field in the city and was learning about the creatures once a month.

When we are studying plants, we pick and deep-fry edible plants. These experiences were very precious.

We presented what we learned to people living in prefectures other than Miyagi as well as people living abroad and exchange opinions on the matter. We went to many Japanese regions such as Tokyo University and Fujimae mudflat in Aichi prefecture.

The places we went abroad include Thailand and South Korea. We were surprised to learn that some species that are rare in Japan are sometimes common in other countries. In some places abroad, building man-made roads and water channels are forbidden to protect the ecosystem. I was amazed by their strong mindset to protect the ecosystem.

We are doing activities to make biotope near the rice field. We want to increase the number of creatures living around paddy fields and want to help. So we started making biotope. The beginning of that was one of the plans we thought at the workshop held in Toyooka city was the idea of making a biotope.

Before making a biotope, we first discussed what shape a biotope would be. After that, we decided the shape based on our opinion and started to create it. The place to make first grew grass, so we started digging after mowing. Digging the rice paddy under the scorching sun was difficult.

In biotope, we are doing creatures research. It was a glad to

see that the types found each time we surveyed increased.

Through making biotopes, I felt that human power is necessary to protect paddy fields and creatures living there. In order to protect paddy fields, I think it is important to investigate and understand the present condition of the rice paddy now. Actually digging the rice paddies and conducting surveys allowed us to feel the rice field closer than ever. I began to think with a sense of realization that we should seriously think about the idea about the environment that was only finished with knowledge. Because rice field is an important place to connect nature with us.

I live on a remote island called Ama in Shimane prefecture. The people of Ama do rice field work, but not many people are interested in learning about animals. Furthermore, there are not many people who are researching the animals in Ama, so there are still many things to do. Thus, I want to utilize what I learned at the damp grounds in Miyagi and present what I learned to the local people of Ama. I want to be able to inform people of the importance of the ecosystem.

CEPA activitise of Taishi high school science club

Takahiro Fukushima, Sakai, Kouki, Ishibashi, Fuuta Takasaki, Towaki Ide, Haruki Kume, Taiyou Kiyota, Yukito Yoshimoto

Kumamoto prefectural Taishi high school

The Kumamoto prefectural Taishi senior high school is close to the Arao tidal flat which was designated a Ramsar wetland site on July 3, 2012. We present Taishi senior high school student's activities in the Arao tidal flat following four points 1.

Scientific research, 2. Outreach activities. 3. Volunteer activities, and 4. Future prospects.

1. Scientific research

Until last year, we were researching the Arao tideland biodiversity with the goal of understanding its ecosystem. We have illustrated the ecosystem of the Arao tidal flat as well as the ecological map of the high school biology textbook. This research won the top award presented by the senior high school science and math department for the West Japan, Tyugoku, Shikoku, and Kyushu region.

In addition, last year we presented our research on the topic "Growth and burrows of *Upogebia major* living in the Arao tidal flat" at the poster session of the Japanese Association of Benthology.

Currently, we have recorded temperatures in the sediment, on the tidal surface and at 1 m above the floor of the Arao tidal flat. We have analyzed the relationship between daily tidal cycles and temperature and the relationship between benthos and temperature. The results were presented at a Kumamoto prefectural science research exhibitions.

We participated in marine biology workshops in Amakusa at the mouth of the Ariake Sea and also participated in wild bird observation on the Arao coast. We participated in a tour of the Sungcheon Bay on July 29th too.

2. Outreach activities

In the "Water National Senior High School Student Forum" held in Kumamoto City on October 9, 2016, we provided information about the importance of the ecosystem and the purification

effects of the Arao tideland. The event was broadcast on local television.

At "The 7th Ariake Sea Revitalization Symposium", we asked participants to eat "Japanese mud shrimp" tempura, and we did a statistical survey about whether there was a delicious yellow part with developed ovaries.

Even at Taishi High School's Cultural Festival we conducted PR on Majak, a Japanese mud shrimp with food and a mascot.

3. Volunteer activities

As for our volunteer activities in the Arao tidal flat, we have participated in the local tideland observation sessions and environmental education events for elementary school students. Moreover, we have cooperated with "Taishi Juku", an event at our high school. At Taishi Juku, we supported the hands on learning of elementary school students.

4. Future prospects

We are conscious that we are the closest senior high school to the Arao tideland and we want to transmit the importance of the Arao tidal flat to elementary and junior high school students in this area.

Currently, we believe that our research results will be part of the exhibition materials of the Waterfowl and Wetland Center, which is being planned by the Ministry of the Environment and Aroa City.

Furthermore, in cooperation with the activities of this Waterfowl and Wetland Center, we would like to develop our above three activities, including promoting our Arao tidal research.

Activities of Yonago Waterbird Sanctuary Jr.Ranger Club to foster mind for protecting wonderful our local nature to the next generation.

Hiromi Hayashi

Yonagoj waterbird .sanctuary, Ranger Club Yonago city,Tottori prefecture

Yonago Waterbird Sanctuary Jr.Ranger Club(Below JRC)is a volunteer club composed of junior high and high school students working in Yonago Waterbird Sanctuary in Yonago city, Tottori prefecture with 19 members.

We are active once a month, and the content of the activities will be decided by ourselves in the discussion done in April. Its content is various, including water quality survey, habitat survey of Great Reed Warbler, making islands for waterbirds, exchange between wetlands, etc. And all these activities are based on the desire to protect the environment surrounding the Yonago Waterbird Sanctuary.

The chance for the formation was that the children who graduated from Ramsar club acting as elementary school student's club gathered and wanted to continue activities related to environmental activities in the suburbs of Lake Nakaumi since then. Then we continue the activities, it will be the ninth year in this year. Children who were active earlier have already graduated from this club, going to university, becoming a member of society. Some members are married and build their families too. And again this year, members with the same thought are participating one after another.

Lake Nakaumi including Yonago Waterbird Sanctuary was the rich brackish lake boasting the fifth largest in Japan. However due to landfill construction that began in earnest in 1970's, its environment was greatly impaired. And the Tundra Swans that lost their roost one after another got into a form escape to the place the current Yonago Waterbird Sanctuary with shallow water which was made during the reclamation work. However the Yonago citizen who saw situation carried out conservation activities, and as a result, the paradise of Tundra Swans of Lake Nakaumi was to be left as Yonago Waterbird Sanctuary.

And finally, this valuable paradise of Tundra Swans was registered in the wetland of the Ramsar Convention in 2005, and the world recognized the importance as wetland.

Now, Lake Nakaumi where the Yonago Waterbird Sanctuary is located, it is known by many people as the most southern migratory place in Japan for Tundra Swans and also it is wonderful environmental place where many kinds of ducks representing Common Pochard will fly more than 20,000 regularly every year. And many observers come to observe the appearance of wild birds flying to this wonderful environment every year. More recently, as a place to learn environment, many schools have come to visit.

JRC aims to foster a mind to care for local nature by doing activities related to wonderful natural environment of Lake Nakaumi. What experienced when people were children will never be forgotten even after becoming adults. Because the body is remembering.

We think that we want to increase such are friends even one person who will be able to connect this wonderful nature to the next generation. And what is the necessary activity for that? While thinking about, we will cooperate with my colleagues and continue to the activities of JRC in the future.

In this session, we will introduce you the activities of JRC like this. And by thinking with our colleagues who have the same ideas spreading all over the world, we hope that we can learn better environmental preservation ways and tell local colleagues.

I'd like to talk about the wetlands subjects and environmental with the people of various regions.

An Assessment of Species Diversity and Abundance of Waterbirds in Gulf of Mottama Wetland, Myanmar

Min Thiha Zaw

Biodiversity and Nature Conservation Association (BANCA)

Water birds serve a very important role in ecological systems and are often used as indicator species of ecosystem vigor. Water birds often quickly respond to changes in their habitat and can provide valuable insights into habitat health and stability. Wetlands play a crucial role as bird habitats and birds use them for nesting, breeding, roosting, and rearing young ones and for feeding, resting, shelter, social interaction and wintering grounds for both locally and millions of migratory water birds. Monitoring water bird species density, richness, and associations with habitat and environmental variables can help inform management and restoration decisions. Thus, water birds are often used as a metric for assessing habitat health and restoration success. The Gulf of Mottama or Martaban is one of the coastal zone and as the newly designated Ramsar Site, the most extensive intertidal mudflats and is one of the largest of its type in south-east Asia. The objective of this paper is to assessment of the species diversity of water birds and their number and distribution. The investigation of water birds at six sites and mid-winter in January and February flyway coordinate count along the route of Gulf of Mottama estuary wetland from 2015-2016. Survey was conducted in an effort of observing the overall landscape to stratify the habitat for line transects segments and setting point count stations. Direct counting was adopted for areas for large assemblage of water birds and group number counting a suitable vantage point was selected and all visible birds were counted. Total bird counts were conducted for water birds and species richness, evenness and Shannon-Weaver species diversity indices were calculated. Overall, a total of 66 individual species of water birds belonging to twelve families and an estimate population 100,000 water birds were recorded during the study. The waders were most prominent with 31

species being recorded. Scolopacidae was the richest family by 24 species (46%) followed by Charadriidae family 4 species (8%), Pluvialidae family 2 species (4%), Laridae family 3 species (6%), Sternidae 5 species (10%), Ardeidae family 6 species (12%), Threskiornithidae family 1 species (2%) and Falconidae family 4 species (8%) recorded to the sum of Glareolidae 1 species (2%) and Podicipedidae 1 species (2%). This site has been found to be the key wintering area for the Critically Endangered Spoon-billed Sandpiper (*Calidris pygmeus*), hosting an estimated 180-220, more than 50% of the world population. Also, the six other globally threatened species Painted Stork, Black-headed Ibis, Black-tailed Godwit, Eurasian Curlew, Nordmann's Greenshank and Great Knot. Thus, a strong conservation action with harmonized and alternative promising sites should be needed to increase bird diversity in such kind of Gulf of Mottama estuary wetlands areas. Also need continues intentional improvement and awareness creation to the local community regarding of intertidal mudflat or adjacent mangroves conservation has any formal protection.

Youth-in-Action for Ecosystem for Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Ecosystem-based Adaptation (EbA)

Darry Shel M. Estorba, Amy M. Lecciones, Aaron Julius M. Lecciones, Zenaida M. Ugat, Jose Carlo H. Quintos
Society for the Conservation of Philippine Wetlands, Inc

Laguna de Bay is the country's largest lake and third biggest inland water body in Southeast Asia where around 100 rivers and streams drain water into the lake. Conservation of Laguna de Bay and its resources has been a long-standing advocacy of government and civil society organizations including the Society for the Conservation of Philippine Wetlands, Inc. (SCPW). In 2003, the SCPW, in partnership with the Laguna Lake Development Authority and Unilever Philippines embarked on a Youth Ecological Camp (YEC) to provide an experiential learning venue for lake conservation for High School students in the Laguna de Bay lakeshore towns. In 2013, the United Nations World Food Programme (UN-WFP) as part of its umbrella program on "Disaster Preparedness and Response Programme" (Building Resilience Against Disasters and Climate Change), recognized the merits of YEC as a vehicle for teaching High School students about disaster risk reduction and preparedness and its link to the integrity of ecosystems, particularly wetlands.

The YEC is a 3-day live in curriculum that incorporates concepts on environmental protection and wetlands conservation in relation to disaster risk preparedness and climate change adaptation and mitigation in the local context of a municipality. The curriculum is designed for High School Students, preferably those in 8th and 9th Grade. It employs experiential learning methods and approaches such as knowledge sharing sessions, field exposure visits, role playing, workshops, action planning, games and other activities that make it interactive and full of fun. Moreover, the Eco Campers get actual training in presentation and resource mobilization skills.

Learning does not end at the actual camp but is in fact practiced through implementation of municipal or school-based projects and activities that the Eco Campers craft during planning sessions. Among the accomplishments of the Eco Campers include conduct of municipal and school-based Eco Camp,

clean-up of rivers and canals back-to-back with information campaigns, Sachet Recovery Project, solid waste management projects, community lake monitoring, and other Communication,

Education, Participation, and Education (CEPA) activities. The Eco-Campers also raised funds to support the implementation of their initiatives through various innovative means such as selling personalized and environmentally-themed water tumblers to reduce the use of PET bottles, selling other recyclable materials such as used paper, and many more.

This YEC curriculum has been tested as an effective tool for increasing the awareness of the youth in wetlands conservation for the past ten years, and lately, on disaster risk reduction and management, ecosystem-based adaptation, and other climate change-related issues. It has empowered the youth to become an important community actor in wetland conservation and disaster risk reduction, management, and preparedness. Moreover, prior to the conduct of Eco Camps, the teachers were trained on how to conduct the YEC to ensure that the youth will continuously have a pool of trainers who can pass the learnings to other sectors of the community. The UN-WFP and SCPW also produced a YEC Training Manual to provide a guide to people and organizations on doing YEC.

So far, the results of YEC have been outstanding. In more than a decade of conducting YEC, the growing number of the youth continuously doing actions for wetlands conservation branched out with more projects and activities that also aided multi-sectoral involvement and partnership in their schools and communities. To date, 20 Eco Camps have been conducted directly benefitting about 550 students and more than 100 high schools. The number of students participating in the activities have expanded to more than a thousand and has been organized into a Youth Network. Truly, the YEC is an effective instrument towards engaging youth for the wise of wetlands in the Philippines.

The Study of Grey Water Footprint of Inorganic-Rice Cultivation for The Lower Central Plain Management in Thailand: Case Study in Nakhonchaisi District, Nakhon pathom Province.

Nichakant kerdnamchai, Werachat Chatpanyacharoen
Faculty of Environment and Resource Studies, Mahidol University

The lower central plain of Thailand is one of the plain areas that suitable for rice cultivation because of the suitability of geography and the productivity of water body. The area used for rice cultivation is approximately 381,856.8 hectares. It is the third or 14.50% of land used in Thailand. (Rice Department, Ministry of Agriculture and Cooperatives, Thailand, 2016-2017)

By the rice cultivation, there are many factors that important for rice growth. One of the essential factors is the plant nutrition which is from nature or the form of fertilizer. A popular type of fertilizer in Thailand is chemical fertilizer. The trend of using them is increasing every year because rice cultivation is required more load of chemical fertilizers than other plant cultivation. Used chemical fertilizer and pesticide are estimated around 312,375 kilograms/hectare (Department of Agriculture in Thailand). The information from Rice Department, Ministry of Agriculture and Cooperatives of Thailand has been shown that imported chemical fertilizers since 2005-2009 added up to 3.3, 3.5, 4.3, 3.7 and 3.8 million tons, respectively. Rice cultivation is one of the most agricultural activities that occurred in the lower central plain. Hence there is much more load of pollutants contaminated in the water and drain into the natural water body and widely effect on the area.

This study focuses on the quantity of water, especially the grey water footprint of inorganic-rice cultivation. The grey water footprint is one of water footprint types. It is defined as the amount of fresh water required to assimilate pollutants to meet specific water quality standard before released to the environment (A.Y. Hoekstra and A.K. Chapagain, 2011). The study area of this research is located in Nakhonchaisi district, Nakhon pathom province which is the part of the Thailand's lower central plain.

First of all, the water samples in this area were collected 3 times related to land preparation phase, the first vegetative phase (15-20 days of rice growth), and the second vegetative phase (50-60 days of rice growth), respectively.

Then, all of the water samples were analyzed the concentration of Nitrate-Nitrogen (NO_3^-) at the laboratory. The Nitrate-Nitrogen concentration and some information that asking from the farmer about the amount of chemical fertilizer used in the cultivation area are 61.125 ton/hectare have been used for the calculation of grey water footprint. After the calculation, the result shows that the calculation of grey water footprint of the inorganic rice cultivation is 193.08 m^3/ton which is rather higher than the standard of Thailand's grey water footprint that is 116 m^3/ton (A.Y. Hoekstra and A.K. Chapagain, 2010). It shows that chemical fertilizers applied have an effect on the grey water footprint. If the rate of using chemical fertilizer for rice cultivation is rather high, the grey water footprint will increase. It means that the volume of fresh water that used to dilute pollutants is also increasing. By the result, the grey water footprint can be used as the indicator for managing water resources in the lower central plain of Thailand to achieve sustainable water management.

River Continuum Concept and Ecological Health Monitoring of Loei River, North- Eastern Thailand

Thanayaporn Katesuja¹, Panida Rahong¹, Chotiwt Techakijvej¹, Atinut Joradol², Rungnapa Tagun², Tatporn Kunpradid² and Chitchol Phalaraksh^{1,3}

¹Environment Science Program, Faculty of science, Chiang Mai University,²Department of Biology, Faculty of science, Chiang Mai Rajabhat University,³Department of Biology, Faculty of Science, Chiang Mai University

One most important mission of university student, apart from formal studying in class, is to learn as practical work in field. There is one main concept that I have to follow that "any of scientific research should be transferred back to the local people as the responsibility". When the research concept has set, the local youths and people should get the benefits from that research. That is why I become a member of the Loei River Project.

The Loei River is an important tributary of "Mekong River", the international ASEAN River, which located in Loei Province, North-Eastern Thailand. The headwater of Loei River is from Phu Luang National Park, Phu Luang District pass through Wang Saphung and Muang District before connecting to Makong River at Chiang Khan District, Loei Province. The Loei River Project was the 2 year ecological health monitoring project. Apart from measurement of physico-chemical parameters, the key living organisms have been selected as bioindicators for "Loei River Biotic Index". This index would also be simplified and published as scientific monitoring method for local schools and people. Generally, most activities of the local people relate to the river and living creatures along the river. The entire length of the river has been received effects from human activities in various fields including agricultural, industrial, domestic and mining impacts. Less management, no monitoring program and no community involvement may cause the human health and environment of surrounding areas.

According to the importance and the situation of Loei River, there should be the environmental project in terms of biodiversity along 231 kilometer length of Loei River, under the river

continuum concept and ecological health monitoring concept.

The living aquatic organisms had been seasonally collected according to seasons of Thailand. The statistic correlation was selected to analyze the land uses, water quality and Biological data. Then, the key species, including red algae, mayfly (Family: Prosopistomatidae), a ray-finned fish (*Hemimyzon* sp.), were related to water quality. The final activity of the project was to organize the workshop for local University staff and students, staff of local NGOs, government officers, community development officer, staff of the Department of Environmental Quality Promotion and local people. The changes along Loei River, the importance of the Loei River and the impact of the Loei River from human activity were discussed in the workshop. During the workshop, a lot of questions were raised from participants. Impact from mining activities and flooding problem were the most interesting topics from participants. Water quality monitoring technique was simply demonstrated. According to the research and

workshop, the Loei River environmental awareness would be encouraged for the young generations and local people and would be transferred to the next generation.

Not only the Loei River Project, but also other rivers in Northern-Eastern, Northern and other regions of Thailand would be targeted to monitor in the same techniques. Local schools and organizations would be key organizations to create a "River Ecological Health Monitoring Network". According to the youth activity, we believe that "little things that start by children will become the bigger power to protected the environment and change the world in the future".



Entry Fees for Environmental Services in Community Based Ecotourism: An Experience from Bishazaari Wetland of Nepal Keynote

Maheshwar Dhakal Ministry of Forests and Soil Conservation
Chiranjivi Prasad Pokhrel, Satosh Bhattarai National Trusts for Nature Conservation

Wetlands are the most attractive destination to national and international visitors to observe natural beauty, photography, jungle safari and many others. Wetlands productive ecosystems and produce provisioning, regulating, cultural and supporting services and their importance are wider than other ecosystem. Ramsar listed wetlands have additional values as these sites are combination of social, economical, ecological and cultural services of international importance.

The Bis Hazaari Lake is located in the Chitwan district, adjoining with Chitwan National Park, the oldest national park of Nepal, listed in the Ramsar site in 2003. The local communities largely for irrigation purposes use the wetland water. This wetland provides a habitat to mega fauna like tiger, rhino and elephant, and many national and international tourists visit to the site to observe these species on annually basis.

This paper aims to explore the community-based ecotourism initiated by the local communities at Bis Hazaari Lake in Nepal. Though the Chitwan National Park has a long history of ecotourism, the local communities of Bis Hazaari wetland initiated an separate entry fee to both national and international tourists. The entry fee is collected in the community fund first and used for lake cleaning, security of the tourists, development of observation site, development of foot trail and many others.

As assessment of entry fees, follow of visitors based on the seasons and their main attractions and activities were performed. An interaction with local community members and government officials were made on collection of entry fees as a part of environmental services and its impact on wetland conserva-

tion activities. The biodiversity profile and water quality observations are also performed during the study.

After an initiation of entry fee and its use in ecotourism activities, the income and livelihoods of local communities is gradually improved. The job employment opportunities in terms of nature guide, driver, and hotel entrepreneurs are constantly increasing. The National trust for Nature Conservation together with national park authority is provided training and exposure visits to local communities as apart of capacity building activities of ecotourism. Bird watching and jungle drive are the major tourism activities. Similarly, jungle walk along with nature guide is the most attractive activity to the area. The private sector is equally benefited from the wetland conservation activities. In the meantime, allocation of some government funding together with buffer zone activities is observed crux to sustain the ecotourism activities. Higher level of government ownership is in spiral to local communities to increase their participation. However, security of tourists from the wildlife attack is another serious concern to promote the ecotourism activities win the areas. Promotion and advertisement of the site could be another factor to increase the visitors number in the following days. Further study is suggested to understand the satisfaction of the visitors as their satisfaction is fundamental to increase the park entry fees. The coordination with local government agencies, private entrepreneurs, civil society organizations like non-profit organization are equally important and recommended for a long term and sustainable community based ecotourism in and around the wetland area.

To bring awareness of appreciation for the culture & environment by providing low impact activities that promote conservation & preservation through socially responsible and environmentally sensitive interaction with people, landscape and ecosystems

Kasimiro T. Taukeinikoro, Kelly Bricker, Nate Bricker
Ramsar Convention on Wetlands - Ramsar site number 615, Rivers Fiji Ltd

The Upper Navua Conservation Area (UNCA) is the first and only Ramsar Site in Fiji (Ramsar Site no.615). The Upper Navua River cuts a narrow gorge in the central highlands of Viti Levu, the main island of Fiji - the gorge itself is some 75 meters deep and 5 to 25 meters wide. The Ramsar Convention is an intergovernmental treaty and international cooperation it has however, approve to ratify the UNCA as a Ramsar Site despite being owned privately due to its importance in the conservation of one of the three largest drainage ecosystems in Fiji.

The UNCA Ramsar Site is 615 hectares and covers 200 meters on either side of the Navua River. It is the home to local and different endangered and vulnerable species of birds, reptiles, freshwater fishes and flora which are endemic to the Upper Navua and Fiji as a whole. A freshwater goby species is altogether new to science and is in the identification and naming process. Fiji has 17 endemic species of birds and 15 are found in Viti Levu and also found in the UNCA. Notable are the vulnerable pink-billed parrotfinch (*Erythrura kleinschmidti*), Kadavu parrot (*Prosopeia splendens*) and black-throated shrikebill (*Clytorhynchus nigrogularis*); near threatened masked shining parrot (*Prosopeia personata*); and endemic giant forest honey eater (*Gymnomyza viridis*) etc. The endangered Fiji banded iguana (*Brachylophus bulabula*) and endangered endemic sago palm (*Metroxylon vitiense*) are also found in the UNCA. The UNCA plays a critical and vital part in the conservation of biodiversity in Fiji and wider Pacific region. It is indeed a fragile ecosystem that must be handled with absolute care and any unscrupulous management could see the destruction of the environment and the extinction of our very own wildlife.

Rivers Fiji is an ecotourism and rafting venture operating in Fiji since 1996. It aims at combining the protection of the wetlands and the associated ecosystem with sustainable tourism. The company provides the local landowning units financial ben-

efits with minimal impact to the environment. The essence of the company's operation is based on its vision which is "To enhance visitors and indigenous peoples awareness of appreciation for the culture and environment by providing activities that promote conservation & preservation through socially responsible and environmentally sensitive interaction with people, landscape and ecosystems which makes the Fijian Highlands so distinct and unique." Furthermore, the company operates on "leave no trace policy" which means that the impact is bare minimum that visitors never leave visible behind.

In its bid to actively advocate, promote conservation and the preservation of the UNCA Rivers Fiji continues to visit communities and carry out awareness programmes on environment protection among local communities and in schools. It offers river trips to local villages and schools, and carry out community discussions whenever possible.

Every year Rivers Fiji gives cash prizes for drawing competitions, essays and poster making to local schools on topics of conservation and protection the environment.

Rivers Fiji's positive contribution to the environment has impelled the Department of Environment (DOE; Ramsar Administrative Authority) to allow the company to sit in the National Wetlands Steering Committee and the Protected Area Committee which the DOE is the secretariat of.

Currently the landowning units profits from lease monies, and 10% of Rivers Fiji annual gross revenue as payment of land-use fees. Furthermore, Rivers Fiji assists the remote villages through free transportation, free medical evacuation and coordinating community medical clinics. Rivers Fiji continues to search for other low impact recreational, socioeconomic activities which directly and comprehensively contribute to the conservation of Fiji's natural resources and enhance the livelihood of the landowners.

Promoting the Implementation of Environmental Treaties for Sustainable Tourism: In the Light of the Ramsar Convention

Shiina Suzuki

Sophia University Graduate School of Global Environment

This presentation focuses on how the Ramsar Convention recognize and organize "tourism", especially under the "sustainable tourism" in relation to wetland conservation, from legal aspects.

There are no treaties directly targeting tourism, but some environmental treaties have articles related to tourism under the international environmental law. In order to materialize the article, the related guidelines are adopted by using terms such as "tourism", "ecotourism", "recreation" and so on to achieve compatibility between tourism projects and environmental conservation. When applying the guidelines, it requires the elements such as nature, economy, society, and culture to be in an appropriate balance.

The Ramsar Convention covers the four elements mention above, targets for wetlands and plays a role in connecting the local community and its outsiders. Therefore, it is necessary to consider the four elements of wetlands integrally rather than grasping each element individually. Such recognition can be found in European regional conventions, but recently not only environmental treaties, but also national conservation laws in each country are drawing attention. By combining the elements, unique values of the area are created. In order to maintain its value, it is necessary to emphasize the role of the local community.

If the wetland is a Ramsar Site, the necessary conservation management based on the Convention will be carried out under the domestic laws of each country. Even for unregistered sites, the State shall implement necessary conservation management according to the Convention as well. However, if there are tourism activities that cause wetland ecosystems to be adversely affected at unregistered sites, conservation management by the country may not be successful. In such a case, the opinions and experiences of local people who know that the act adversely affects the wetland ecosystem are indispensable not only for wetland conservation but also for sustainable tourism. It will be possible for

the local community to propose that appropriate regulatory control should be given to the government of that country and the community will play a role in leading to a more desirable way of tourism. Regarding the point that participation of the local community also contributes to the tourism field, the Convention responded and realized under the mechanism of CEPA.

As described above, for sustainable tourism, it is indispensable to comprehensively grasp aspects of wetlands and participatory management based on local communities.

A geographical indication (GI) that externally shows the unique value to the area is one of effective schemes that boost sustainable tourism. GI system is trademarked based on traditional agricultural products and manufacturing methods and related ecological, environmental and traditional knowledge, and it is expected to produce added value. Therefore, the system has the economic expansion effect, strengthening the production base of local producers and expanding profits, contributing to improving the living environment of the local community.

However, some issues remain about GI. Traditional foodstuffs including GI sacrifice environmental, cultural and economic values and become one of the factors to purposes of tourism. In such a case, it is possible to positively make a GI and to sell at places other than the local. On the other hand, there is a way to increase the number of visitors by allowing GI items can be purchased only in that area. It is a difficult question which position matches sustainable tourism. However, since the sustainable tourism what the Ramsar Convention is supposed to include "bringing beneficial experiences to visitors", the latter which the unique value to the products and tourist areas including GI as one thing is considered appropriate.

[Acknowledgement]

This study was supported by MEXT Sophia Research Branding Project.

Biodiversity value of Meinmahla Kyun Wildlife Sanctuary Ramsar Site and development of ecotourism for the communities

Zau Lunn

Fauna & Flora International-Myanmar

Meinmahla Kyun Wildlife Sanctuary Ramsar Site, situated in the Ayeyarwaddy Delta Region at the rivermouth of Ayeyarwaddy River of Myanmar is designated as wetland of international importance on 2nd. February 2017 because of its prominent biodiversity values of about 190 species of birds including resident and migratory birds, non-avian species including mammals and mangrove species. The area of Ramsar site is about 50000 hectares including wildlife sanctuary and surrounding water bodies and islands. Wildlife Sanctuary is covered by mangrove forest and surrounded by Bogalay River in the east and Kadon kani River in the west. NgamannThaung and Kadon galay islands situated in the southern part of the Ramsat Site are important habitats for turtle nesting and migratory bird wintering grounds. Because of importance of biodiversity value and habitat, Meinmahla Kyun was announced in 1889 as Reserved Forest and designated in 1994 as Wildlife Sanctuary and declared as ASEAN Heritage Park in 2013. According to IUCN list, 13 bird species are threatened species including spoonbilled sandpiper. Among 29 species of mangrove, IUCN global critically endangered species, *Sonneratia griffithii* and global endangered species, *Heritiera fomes* can be found in the Ramsar site. 53 types of medicinal plants and 7 kinds of orchid species are surviving in the wildlife sanctuary. Among the mammal species, wild boar, otter, crab eating macaque, wild dog, wild cat are recorded. Irrawaddy dolphin can be seen in the surrounding water bodies. About 100 species of fish, 12 prawn and shrimp species and 9 crab species are recorded around the wildlife sanctuary. The site is only one strong hold area of estuarine crocodile, *Crocodylus porosus* in

Myanmar.

The important sacred site for the fishers communities, U Shin Gyi nat shrine and historic pagoda namely Myauk Tayar is also situated on the island. Because of good habitat for spawn and nursery ground for the aquatic organisms, the Ramsar site is also supporting daily income of local communities for fishing and crab trapping around the Ramsar site. Because of good fishing ground, many migrant fishers come and settle temporarily and fish in the surrounding water bodies. The impoverishment of local communities, some impacts are being happened such as illegal logging in the wildlife sanctuary. To reduce impacts to the Ramsar site, development of livelihood in collaboration with local communities and concerned government departments is very important for the sustainability of biodiversity values, sustainability of livelihood of local communities and management of the Ramsar site. If there is no alternative livelihood development option for the local communities, to maintain biodiversity values will be difficult. The site is good potential for the development of ecosystem based tourism because of biodiversity value and accessibility and included in the plan of development of ecotourism sites in the forest department. For the attraction of tourist, not only biodiversity values, but also daily livelihood of fishers communities is interested product. Kayaking trips can be arranged in the tributaries of wildlife sanctuary.

Therefore, development of ecotourism is very important for the sustainability of biodiversity values of the site and livelihood of local communities and that will support to the sustainable management of Meinmahla Kyun Ramsar Site.

Initiative by the reformed bird hunters of Mangalajodi Marsh, Chilika Lake, India for successful conservation of biodiversity and sustainable tourism.

Ajit Kumar Pattnaik
Wetlands International South Asia

Mangalajodi marshes on the Northern fringes of Chilika Lake, a Ramsar site in India, is an excellent habitat for both resident and migratory birds. It has been designated as an Important Bird & Biodiversity Area (IBA). Mangalajodi marsh supports 97 species of water birds and 33 wetland dependent birds that includes 30 species which breed here. Black-tailed godwit *Limosa limosa*, (near threatened as per IUCN Red list) is the flagship species of the marsh. Mangalajodi witnessed a remarkable journey from the indiscriminate poaching of birds to a responsible ecotourism site, steered by the local reformed bird hunters. Once known as an infamous poacher's heaven, Mangalajodi is now transformed into an endless source of fascination for those, with the inclination to enjoy and appreciate the nature and biodiversity. In early 1990s, local communities used to indiscriminately hunt, eat and sell the meat and eggs of birds and had adopted it as a means of livelihood. 80 defiant professional bird hunters used to rule the area till 1997. With long persuasion of Wild Orissa, a local NGO and Chilika Development Authority (CDA), these reformed bird hunters abandoned poaching and adopted eco-tourism as a means of livelihood. They use non-mechanized small boats with oars, to conduct the tourist in Mangalajodi marshes. Now their earnings are much better than what they used to get from poaching. Most importantly now they live with dignity and left behind their bad image of poachers. At the same time, they have joined hand with the Forest Department in protecting the area and in apprehending the outside poachers. The case demonstrates how the reformed poachers can play a key role in containing poaching and conservation of biodiversity and create employment opportunity sustainably. The indicator of success has been the increase in bird population from a meagre, 4277 in 90s to 0.15 million in 2016

due to successful protection by the communities. Amazingly it has emerged as one of the best site for the wildlife photography. The average annual income of the local communities increased by 1000 US \$ and migration out of the village in search of employment is also significantly reduced. To take this initiative to the next level, Indian Grameen Services (IGS) a NGO facilitated the constitution of Mangalajodi Ecotourism Trust (MET) in 2010. IGS in collaboration with MET developed cottages, dormitories and tented accommodation with dining facility, interpretation centre cum souvenir shop for the eco-tourist which are run by the local communities. For marketing and dissemination of information a website "mangalajodiecotourism.com" is developed. A conservation team involving the boatmen & guides is constituted within MET. The marsh is divided into six zones for regular patrolling and conducting the tourists. During patrolling and birding tours, they also keep a watch on the nesting sites and ensure that the area remain undisturbed. Mahavir Pakshi Surakhya Samiti, has been the first community based initiative, which could achieve major success not only in containing poaching and conservation of biodiversity but promotion of responsible tourism. The community now clearly understand the connect between biodiversity & livelihood, which is key for sustainability. It is an excellent example, how community led initiative to conserve biodiversity can create huge opportunity for sustainable tourism and create livelihood opportunity for the communities.

Pagatpatan Mangrove Wetland Learning Center: Towards Wetland Conservation, Climate Change Adaptation and Education for Sustainable Development

Romell A. Seronay, Rowena P. Varela
Center for Research in Environmental Management and Eco-governance

Mangrove is known as the breeding and nursery site for many marine species and a shelter for the juveniles. The unique blend of freshwater and salt water in the various microhabitats in the mangrove ecosystem results to a high biodiversity. Mangroves serve as a buffer against surging waves and as a windbreak during typhoons.

Mangroves are regarded among the major carbon sinks due to its dense canopy which absorbs solar radiation and atmospheric carbon that are converted into biomass.

Mangroves play a very important role in climate change adaptation, not only due to its capacity to absorb atmospheric gases but due to its life-giving capacity to people. The livelihood derived from the mangrove ecosystem can build the adaptive capacity of the people, leading to sustainable development. However, these characteristics of mangrove are known only to a few. Thus in spite of the many ecosystem services of mangroves to humanity, the majority of mangrove areas is not protected. In fact, they are generally badly disturbed due largely to human activities.

In Pagatpatan, there are 14 species of mangrove reported. *Sonneratia obovata* (Blume), locally known as Pagatpat, is the most dominant species. The dominance of this species gives the name of the place, Pagatpatan. In the area, mangroves provide habitats to fireflies, which make firefly watching a component in mangrove-based ecotourism. Mangroves are generally converted into fishponds and for housing purposes. Oftentimes, these are destroyed for fuelwood and for tannin harvesting.

Considering the historical, ecological and economic significance of the mangroves, proper management of the mangrove wetlands in Pagatpatan should be the first step towards the development of this ecosystem as sites for scientific and cultural

studies. Therefore, people of varying ages, social and economic status need to know and understand these characteristics inasmuch as these are essential in raising people's awareness for the protection of the mangrove ecosystem. The local government, academe, civil society organizations and the tourism office converge to empower various working groups in establishing the Pagatpatan Mangrove Wetland Center. The initiative includes building the capacity of various groups in mangrove biodiversity assessment, zoning for ecotourism purposes and biodiversity conservation strategies. The local stakeholders in Pagatpatan (LGU, fisherfolk, women and youth) were likewise trained to perform in various roles in mangrove-based sustainable ecotourism, including tour guiding as one of the key activities.

A mini-museum will also be developed where ecological functions of mangrove will be displayed. The exhibits will include native species of mangroves and other plants and animals found in the Pagatpatan Mangrove Ecosystem. Storylines for key plants and animals with significance to the lives of people will be written and be part of the information for dissemination. A seminar room will be used for pre-tour orientation about the Mangrove Wetland Learning Center. The pre-tour lecture will be conducted to give the tourists an overview of the Mangrove Wetland Center through a multi-media presentation and also to orient about the house rules of the park. No tourist is allowed to proceed to the Wetland Center without the pre-tour orientation. The Pagatpatan Mangrove Wetland Center will be designed to attract tourists and young student-learners. Walkways (paths and board walk) will be established passing through strategic areas where special features of the center are showcased. Signages (billboards, directions) will be set up to guide tourists and young learners along the way.

This paper introduces crab banks being operated by several coastal communities in Thailand, presents some good cases of the integration of visits to crab banks in tourism programs, and highlights potential contribution of crab bank visits to sustainable tourism.

Along both sides of Thailand's coastline, the Bay of Bengal and the Gulf of Thailand, the decline in fertility of aquatic resources is of great concern. The crab bank approach was introduced to Phang Nga Province since the late 1980s. Since 2002, several crab banks have been established in coastal provinces and become widely well-known for blue swimming crab and mud crab conservation. Crab banks set-up and managed by fishing communities with support from public and private sectors aim at restoring and increasing crab population, ensuring the future fertile crab stock, improving crab fisheries and increasing income from crab harvesting. Egg-bearing crabs are collected and raised in hatcheries. One female crab may lay 200,000 – 500,000 eggs depending on the crab size. After laying eggs, 'mother' crabs are sold and the income is used for operating expenses, crab feeds, system maintenance, and common funds for crab bank members. New crabs hatch and 'baby' crabs are raised, fed, and allowed to float back into the sea. Various techniques and tools such as floating nets, baskets, tanks, ponds, pens and cages of different designs and sizes are developed and applied for crab raising and fattening to suit different localities. The juvenile crab population increased after 4 – 8 months of crab bank implementation in Prachuab Khiri Khan Province. Increase in crab catch rates was reported at other sites.

Crab banks has drawn the attention of domestic and foreign visitors and tourists to come to learn and share experience. Collaboration between relevant sectors, agencies, and communities has started. Study visits and study tours were organized for specific and various groups of visitors and tourists. For exam-

ples, a trip to visit the crab bank of fishery community at Ko Teab Village, Pathiu District, Chumphon Province was organized by Chumphon Provincial Office in collaboration with the Tourism Authority of Thailand, for 30 journalists in Chumphon and other provinces as part of public relation and tourism promotion activities. The East Asia Department, Ministry of Foreign Affairs of Thailand brought the officials and staffs to visit Crab Bank Learning Center at Bang Sra Kao Sub-district, Chanthaburi Province, to learn and to release crabs back to the sea. This Learning Center offers 2 days technical trainings for those who are interested in crab bank establishment and livelihoods of fisher folks. At the Kung Krabaen Bay Royal Development Study Center, Chanthaburi Province, visitors experience the crab bank using solar cells to save energy and cost for aerators. Many representatives of local communities inside and outside Thailand pay visits to crab banks for knowledge transfer and experience sharing.

Crab banks have the potential contribution to sustainable tourism in various aspects. Crab banks offer attractive ecotourism and educational resources and are included in many coastal tourism programs. Local communities operating crab banks offer the Thai ways of hospitality and take part in tourism management. Public awareness of both local communities and visitors on sustainable coastal resource use, responsible fisheries, and strength of community-based management capacity has been raised. Visitors and tourists benefits from knowledge and life experience sharing gained from locally developed techniques in crab conservation, raising and fattening. They experience local livelihoods and life style from homestays and enjoy seafood. Meanwhile, local stakeholders benefits from knowledge sharing with visitors and their livelihoods is enhanced via the opportunity to improve source of income stemmed from their own biodiversity conservation awareness and efforts.



Wetland Culture in Conservation: Meaning, Concept & Application Keynote

Bishnu B. Bhandari
Nepal Wetlands Society

The primary objectives of the paper are to make conceptual clarity on concept and meaning of wetland culture in the wise use of wetlands and identify the possibility of its contribution to the concrete, measurable and replicable conservation of wetlands and associated resources on the ground. In order to address these issues, the paper has been structured around the following three questions.

1. After all, what do we understand by the phrase “wetland culture”? How is it different from the widely used phrase “culture of wise use”? Why we attach so much importance to wetland culture?
2. What is the difference between a natural dimension and cultural dimension of the wetland conservation?
3. What are the existing activities that have led to the positive as well as negative contribution to the conservation of wetlands?

Meaning and concept: Culture means many things to many people and varies from place to place. It is a composite concept. Human actions produce culture. So, any human action that occurs repeatedly over time is called culture. The culture that occurs in and around a wetland site is called “wetland culture”. The paper does not take into consideration civilization, refined culture, abstract art or fossil culture but only the existing knowledge, religious belief, spiritual values, attitude, practice, norms & values, heritage, secular (non-religious) activities and traditional customs. Thus, wetland culture may contribute to both negative as well as positive conservation of the wetland site and associated resources.

On the other hand, the “culture of wise use” and “culture of conservation” give rise to the meaning of only positive contribution to the conservation, management and sustainable development of wetlands and associated resources.

Therefore, the phrase “wetland culture” conceptually differs from the phrases “culture of wise use” and “culture of conser-

vation” but intercept with each other as long as the former makes positive contribution to the conservation and sustainable utilization of wetland resources.

Catalyst of Wetland Conservation: Wetland culture catalyzes the conservation of wetlands as follows.

1. Creates social and spiritual energy and enthusiasm
2. Attracts visitors, provide local income and contribute to local economy & conservation
3. Strengthens the identity of the communities living about and around wetlands. Contrast between a natural dimension and cultural dimension of conservation: In fact, these two perspectives are just like the two sides of the same coin. One can't move ahead without the others. The natural dimension of wetlands includes, for example, ecosystem services, functions, species distribution, habitat, ecology & behaviors, reproductive habits, lifecycles & others. On the other hands, cultural dimension includes human activities, management, uses, protection, consumption and others. Example of cultural practices: The existing cultural practices contribute both positively and negatively to the conservation, management and sustainable development of wetlands and associated resources. A few of representative examples are mentioned below.
 1. Those practices providing negative contribution to conservation include (1) dredging up of river, (2) inappropriate methods of fishing virtually killing every aquatic species available there and (3) religious bathing and immersing of flowers and idols after the festival is over.
 2. Those providing positive contribution are (1) sacred pond and people's collective work for protecting water sources at catchment and (2) rice farming as a good example of land use planning like making terraces using stone wall at the steep slope, annually maintaining these terraces and gradient slope, stabilizing soils and producing rice and other side crops.

Bio-cultural diversity and flood control in the Kameoka Basin floodplain

Katsue Fukamachi
Kyoto University

Land adjacent to the Hozu River, which flows through the Kameoka Basin in Kyoto Prefecture, has traditionally been developed for use related to water transport, farming, and forestry. Traditional villages along the river were built on terraces, thus making good use of the topography to avoid floods. Villages are surrounded by planted bamboo groves, an additional protection against floods.

Bamboo is also widely distributed along the river. *Madake*, a bamboo species of superior quality, has traditionally been used for various purposes. It can be used for bamboo poles for boats and for bamboo crafts, or serve as material for flood protection works. Bamboo was also shipped to Kyoto on rafts made with bamboo. In addition to bamboo, the palm species *shuro* is also seen in the area.

Shuro has traditionally been used to make string for boat paddles, thus linking the natural environment with the unique characteristics of a village with a boat culture.

The Hozu River flows in big meanders, and features rapids, deep pools, and fluvial lagoons in a wetland that links the river with the surrounding rice paddies. The floodplain has become a freshwater fish habitat that is important even on the national scale. A large number of freshwater fish species have been confirmed, among them endangered species such as *ayumodoki*, *ichimonji-tanago*, and *medaka*.

Under heavy rain, the area is subject to floods. Floods occur when under heavy rain, the increased flow of the river hits the narrow bottleneck of the Hozu Gorge, and water flows back and overflows the upstream river banks. Traditionally, various river-related flood control techniques have been developed. For example, one of the bridges built over the river is a sunken bridge that can serve during floods, and there are stonewalls

that guide the river flow in order to ensure safe transit for boats.

The floods are also a blessing for the surrounding land since the river sediments make the soil fertile. Both sides of the river are used as farmland for rice paddies. After the autumn rice harvest and with the start of the dry season, the well-drained floodplain becomes ideal for growing wheat. Wheat harvested in the floodplain came to be called 'Hozu Wheat.' Always aware of the risk of floods, villagers own rice paddies on terraces in addition to those on the low-lying wetland to make sure that they can harvest at least some rice in the case of floods.

This unique riverside cultural landscape created by a combination of nature's blessings and nature's threats deserves to be passed down to future generations. Yet today, lifestyles and industries have significantly changed, new flood control measures have been developed, and large public projects for urbanization are in full swing. This report aims to discuss strategies that equally value the need for flood control and the importance of bio-cultural diversity while taking into account the rapid changes that have been occurring in the wetland environment of the Kameoka Basin during the last few years.

Afghanistan is a landlocked country with 650,000 km² area in central Asia and is famous for its cultural and natural richness. The natural and cultural heritages suffered not only from decades of war and conflicts but also from the continuous drought for years.

Three types of wetlands that are reported includes rivers, lakes, marshes and reservoirs. The wetlands play a significant role in maintaining human livelihood and in creating pristine ecosystems in the desert. Unfortunately, due to draught and war, three rivers, Sistan River, Qul Bagrami and Abchakan were turned into wastelands. Many of these wetlands are located in the area rich in natural cultural heritages. The Government of Afghanistan not only attempts to protect and conserve these wetlands but also has initiated special efforts to restore them along with the revival of cultural values, both tangible and intangible. Danbura, a Afghan concert is being planned to be held in Band Amir in July 2017. The purpose of this concert is to (1) encourage and attract internal and international visitors there for creating employment (2) support renovation programmes and (3) protect the environment from further damage and degradation.

With the growing popularity of ecotourism, there are a good use of the wealth of wetland and cultural heritage to attract more tourist as well as to improve the livelihood of the people living around and about the site with the all-out support of the concerned parties e.g. government, the private sector, non-governmental organizations, conservation bodies and local communities.

Water and wetlands play an important role in Islam. Water is indispensable as the Muslim need to perform Wudu (ablution) prior to prayer. Water has been mentioned in the Quran over 60 times. Therefore the Quran outright rejects wasting of water.

According to the Quran, "God made all the things from water". But water needs to be contained in a space that is what is called wetland. Therefore, both water and wetlands are very important in the Islam religion and culture. And the conservation activities are drawn from the principles of Islam. Another point that is quoted in the Quran is that "Mose chose 12 springs and instructed each tribe to go to one spring". Likewise, in Lake Hamun, people make a long reed boat to navigate the shallow water. The conservation of Lake Hamun depends on the conservation of reeds. In other words boat culture needs to be protected by the conservation of reed, which can be protected only when wetlands are protected.

The management of resources is one of the humanity's most ancient activities and has left its traces in cultural settings. From management point of view, there are three governmental departments; National Environmental Protection Agency, Ministry of Irrigation and Agriculture, and Ministry of Culture. Each agency has its own responsibilities. In addition to the governmental bodies at the highest level, there are a few non-governmental organizations at the grassroots. To create sustainable solution for wetlands related problems and better understanding of cultural, emotional, moral, social, and spiritual dimensions, the government is planning to involve both local communities and authority as well as in the conservation and management of al resources along with a strong focus on traditional culture, customs, values and norms.

In this paper, cultural values, cultural activities and challenges that directly affect the conservation of wetlands in Afghanistan are discussed. Additionally, the integration of natural and cultural values and attributes that is indispensable to catalyze the conservation, wise and sustainable development of wetland are also discussed.

People's Perception towards Wetland Culture

Puspa K. Pokhrel

Department of Geography, Tribhuvan University

Wetland ecosystems are the most distinct, diverse and productive ecosystems on the Earth. They are rich in natural resources, cultural values, livelihood means and recreational ways. However, population growth, over exploitation and development activities have contributed to the degradation of wetlands and associated resources as clearly indicated by their numbers, coverage, ecological health and change in the resource patterns. Wetlands in Nepal have played a vital role for the subsistence of the community, especially those living around and about them. It is in this context this study has been conceptualized solely to assess the people's perception about the change in wetland situation during the past 50 years.

In addition to various techniques, the study employed the survey of 350 households asking each 48 questions on culture and management of wetland resources.

Major findings, among others are that the respondents were asked to compare the condition of wetlands between 50 years ago and now. Their memory shows that the responses are full of surprises and curiosities. For examples, the wetland area was full of bogs, fens and grasses. The sinking of the buffalos was a common case, where people were called upon to rescue them. The cold springs were common in the area. Fishes and turtles were very common. The area was dotted by tall and huge silk cotton trees (*Bombax ceiba*), that were used by a large number of Lesser Adjutant (*Leptoptilos javanicus*) for nesting and roosting. The common saying is that "the Dhimal people assemble in the stream for fishing when rain begins to fall down". So much was told about them that they would put their Kasaudi (traditional rice cooker) with rice on the oven and then go to the stream to catch fishes and return back to the kitchen with good harvest before rice got fully cooked. The respondents said that streams for the Dhimals were like the kitchen garden for the

farmers.

But to the contrary now in fifty years later they responded that those wetlands are shrinking gradually. They say that 60% of the wetlands have either disappeared, or been converted into rice fields or others. If this trend continues, the future generation would not be able to see this beautiful land landscape. Rather, they would see only in the cadastral map. Fishes and turtles are rare and the Dhimal people eat fish rarely. To have fish in their meals, they would have to buy them from local markets. Thus, the availability of fishes has changed their food habits. The recklessly felling of simal tree also has caused the decline of the population of the Lesser Adjutants as these three are the roosting and nesting places for these birds. It was further reported that wetlands around the foothills of the Chure range are highly vulnerable particularly near the road, settlements, rice fields and market centers.

The study shows that the local people are aware of both the importance and deteriorating state of wetlands. Consequently, they have initiated various activities such as prohibiting the use of pesticides, drying out of the wetlands for fishing and bird hunting. Annually they also remove water hyacinth and alien invasive species. Local committees have been formed for their management but not been effective on the ground. It is in this context that there is a need for institutionalization and immediate intervention for the better management of wetlands.

The papers conclude with some policy suggestions for the sustainable management of wetlands and their associated resources.

Culture is interactive result of ecosystem. Bangladesh is a land of wetlands; here cultural practices have influence of wetland. Presence of wetland is common in native songs of Bangladesh. The Bhatiali is the song of wetland. In the proverbs of Bangladesh presence of wetlands is very common and mostly because of the rapid changing character of it. Good number of names of people, place and institution are also after the name of rivers and other wetlands. Based on current and wave character of the wetlands the gender of the wetland is identified and it has reflection on the name of that wetland. The festivals are very season specific in Bengal culture and are mostly representing of the changing characters of the wetlands. The Hindu and other aborigine culture have god and goddess for the wetlands, the carrier of those god and goddess are wetland species. The communities who are living on fishing believe some traditional norms which have conservation value. A study on the Medir Haor areas of eastern part of Bangladesh has identified 11 wetland species who are conserved because of the cultural believes. Sacred wetlands and land sacred due to adjustment holy wetlands are helping conservation of biodiversity; around 70 species of biodiversity were recorded from the sacred wetlands of the study area. One third of the identified festivals of the country are related to wetlands; almost all the cultural ritual has use of wetlands. There is cultural acknowledgement and religious worship of wetland biodiversity. In the folk rhyme, folk song and folk ritual of the study area the presence of the local wetlands and rivers was found moreover common. Folk medicine of the wetland areas has the use of almost every floating weed and in chant the description of the hazards. The material culture and folk technology of the wetland basin is based on the aquatic biodiversity and are source of livelihood a significant number of inhibitors. The folk festival,

belief and superstition of the fisher and the boatman are distinctly different from others; even in some cases the occupational influence is dominant than religious practice. There are sports that are for the celebration of livelihoods of wetlands. The bangle literature is extremely influenced by wetland and livelihoods in this ecosystem; many renowned novels and films are based on the life and livelihoods of wetland community. The character of water in wetlands is also a sign of weather and disaster assumption; climate change and environmental degradation are interfering the accuracy of the traditional knowledge. Some cultural practices also create pollution and over harvesting; also the folk food is a risk to the ecosystem. Wetland influences the folk language. The paper aims to analyze the influence of wetland on the local culture, norms and practices of the community living in Brahmanbaria district specifically in the villages in the Medir Haor area. Because to environmental degradation and other challenges wetlands are under threats; it was found that as there is change in wetland ecosystem community was deviated from tradition. Process of the transformation of traditional knowledge is interfered. The paper also attempts to analysis the consequences of wetland degradation to the local culture.

Traditional conservation strategies in botswana's wetlands

Tidimane Ntsabane

University of Botswana

Botswana is a landlocked country with an area of 582 00-sq kms. It shares borders in the north with Zambia, in the northeast with Zimbabwe, in the east and south with Republic of South Africa, and in the northwest with Namibia. Its climate is semi-arid to arid sub-tropical with fairly poor soils. It is located in the interior of the Southern African sub-region.

The country is environmentally a country of two. On the one hand is the vast tableland, forming about 80% of the country, covered by Kalahari sand beds, whose uppermost member consist of Aeolian sands. Much of this tableland has no surface water, except for very ephemeral small pans. On the other hand is the Okavango Delta, situated in the northwest part of the country and is one of the world's largest inland deltas. Its area is estimated at between 10 000 sq kms and 18 000 sq. kms. Like other wetlands it has over the centuries provided sustenance to families and communities with a wide range of products, such as drinking water, food, forage for livestock, and fish.

The challenge to communities around the delta has always been that of how to maintain an intimate organic relationship with the delta to ensure a greater sensitivity to its workings as a natural ecosystem. Key in this living with nature attempt has always been the society's culture by way of its institutions, norms, values and beliefs or more broadly culture.

Social institutions in this early traditional Tswana society have through decades been teaching children and adults the value of conserving, protecting and sustaining their resources. As most people could not read and write use was made of the traditional educational system which transmitted its environmental knowledge through the society's cultural infrastructure.

The ecological system was balanced, as it was not losing products faster than these could be generated by the system. This living with nature resulted in a greater sensitivity to the

workings of natural ecosystem. There now however is increasing evidence that the global unsustainable consumption patterns and the ever increasing population are putting ever increasing stress on the land, water, air, energy and other resources (Oakes, 1998). Developments such as industrialisation, urbanisation and rapid population increases have disrupted humanity and nature's harmony of earlier periods. Botswana has been no exception to these challenges.

It is now widely accepted that new initiatives in environmental education and awareness are an essential requirement for the future of humanity that will create new patterns of behaviour of individuals, groups and society towards the environment in general and wetlands in particular. The need is for more than legislative changes.

This paper, mainly using historical data, aims at looking at Botswana's traditional knowledge, cultural practices, values, norms, and strategies for the conservation of natural resources in general and wetlands in particular. We note that the past is key to the present; studying the past shows what worked and what failed and minimises the possibility of repeating similar errors.



Localizing ESD Best Practice for Wetland Conservation- From Mai Po Nature Reserve to South China Region Keynote

Lydia Pang, Yamme Leung
WWF-Hong Kong

WWF-Hong Kong has actively developed ESD programmes for Mai Po Nature Reserve since 1983. Every year, over 10,000 students visit the reserve and participated in immersive education programmes, aim to enhance their motivations and skills to conserve wetland and natural resources in their daily life. Students were equipped to support the wetland conservation management work, at the same time educators were trained to maximize the efficiency of our efforts on educating the next generation. Mainstreaming ESD in the education system serves as a crucial further step to mobilize the community towards a more sustainable lifestyle.

The experience gained from Hong Kong is replicated in different important wetland sites in China. The conservation management standard in these sites is raised and public awareness increased. From year 2006 to 2017, WWF-Hong Kong has established 5-year cooperation projects with three regionally important protected wetlands in South China region. This article focuses on the key achievements of the ESD works of the three projects. Lesson learnt will be discussed during the presentation.

2005-2010 Zhangjiangkou National Mangrove Nature Reserve, Fujian Province

The Reserve has the largest area of natural mangrove forest in Fujian Province with a wide variety of wildlife and was designated as a Ramsar site on 2 February 2008.

Achievements on ESD work:

Capacity building of reserve staff and educators: Through training courses in Hong Kong and on-site training at local reserve, school teachers and reserve staff were trained on ESD and were aware of the importance of ESD.

Education programme development and implementation: Over 3,600 students from 11 local partner schools participated in the education activities; an ESD textbook was also published as education material for secondary school students.

Construction of education facilities: Education centre, birdhide and educational trail were constructed to support the delivery of reserve-based education programme.

2006-2012 Haifeng Bird Provincial Nature Reserve, Guangdong Province

Over 20,000 migratory waterbirds use the Reserve as a wintering site, including rare birds such as Dalmatian Pelican, Purple Swamphen, Nordmann's Greenshank and Black-faced Spoonbill. Haifeng wetlands was designated as a Ramsar site on 2nd February 2008.

Achievements on ESD work:

Master planning: Local educator and nature reserve staff developed an ESD strategy which is incorporated into the five-year management plan, act as guidance for the reserve on executing ESD work

Capacity building of reserve staff and educators: Through training courses, school teachers and reserve staff were trained on ESD and were aware of the importance of ESD.

Education programme development and implementation: Over 3,400 students from 6 local partner schools participated in the education activities; small fund was distributed to partner schools for school-based environmental education work enhancement.

Construction of education facilities: Education center and boardwalk was established to support the delivery of reserve-based education programme.

2012-2017 Minjiang Estuary National Nature Reserve, Fujian Province

The Reserve is home to over 50,000 waterbird individuals and 14 globally threatened bird species, such as critically endangered Chinese Crested Tern and Spoon-billed Sandpiper.

Achievements on ESD work:

Master planning: An ESD strategy was developed to act as guidance for the reserve on ESD work, also to act as the directional document for the retrofitting work of the wetland museum.

Capacity building of reserve staff and educators: A working group was established among local educators and reserve staff, a practical educational pack was published with the endorsement of local education bureau to aid the delivery of in-school environmental education in a city-wide level.

Education programme development and implementation: Particular education staff of the reserve was further equipped to design and deliver new reserve-based activities with hands on and citizen science elements.

Building capacity of the local communities towards conservation and wise use of wetlands through CEPA approach in Eastern part of India

Durga Prasad Dash
PALLISHREE, Ramsar Center Japan

Bhitarkanika and Chilika lagoon are two important Ramsar sites along Bay of Bengal having international importance. It has increased vulnerabilities due to anthropogenic pressures and local issues. Along with these important wetlands, there are other national wetlands such as Ansupa, Kanjia, Haripur lake, Bahuda estuary, Devi River mouth, where PALLISHREE has undertaken different conservation and wise use activities as a part of CEPA approach. Rapid declining of bio-diversity is occurring due to the high scale silting up of wetlands, detrimental practice of fish catch using different nets, massive deforestation in the catchments and shifting of sea mouth. Apart from these, indiscriminate uses of chemical fertilizer and pesticides in the agricultural fields latter drains into the wetlands and thus polluting the water. Illegal construction of shrimp ponds have been increased by demolishing the existing mangrove forests and rice fields by the local community. Dumping garbage, plastics including industrial waste and urban sewage water into the wetlands are the other causes of increased pollutions.

PALLISHREE has mobilized financial support to undertake activities through CEPA approach to address the issues, since the last two decades. Japan based support agencies such as JFGE, KNCF, NALAPO, TOYOTA, AEON and JWF and Ramsar Center Japan has played important role in extending both technical and financial support.

There was a phase when PALLISHREE has to face financial challenges in continuing its work with the same approach in the same thrust areas, while the other contemporary NGOs has shifted their focus to other issues, which was easy to raise funds for their NGOs at that point of time. But PALLISHREE continued on CEPA as its core focus area so far. As a result, PALLISHREE got recognition as a state level resource NGO in the sphere of CEPA. Later on, it organized a pioneer network called as NET-COAST involving other local NGOs and Conservationists in the east coast of India.

PALLISHREE has promoted 52 Centers of Environmental Awareness & Education in the local schools. Further it has facilitated building capacity of its students, teachers and other stakeholders. These centers have been acting as the focal points. The messages has been passed by the students to their families and further percolated to the respective communities. The role of women and its participation in the conservation activities has always been given paramount importance in the CEPA approach.

The organization used to carry out several field based activities involving different stakeholders under CEPA approach. Some of are as follows.

Communication: Publication of Books on birds, fishes, plants and eco-system in general. The other communication materials are posters, booklets, leaflets and news letter. Apart from these the wall paintings displays the local issues and its solutions in pictorial form.

Capacity building: Organising various training programmes for students, women and community leaders. Besides, it also organise workshops and nature camps.

Education: Class room education has been provided to the students regarding conservation and wise use of wetlands. The facilitator used to provide sessions four times in each week. The curriculum of SUPW (Social Useful Productive Work) periods was redesigned based on the CEPA programme in these schools.

Participation: Demonstration activities were carried out in these schools providing ample opportunity for participation of deferent stakeholders. At the community level local fishermen were involved in a similar process.

Awareness: Organising street play, celebration of World Environment Day and World Wetlands Day, Students Rally, painting and essay writing on wetland conservation and issues in the schools.

Penang Seagrass Project – An Environmental Education Project to Encourage Volunteerism & Field Education

Ng Hong Jing, Wong Yun Yun
Nature Classroom, Malaysia

Penang Seagrass Project – An Environmental Education Project to Encourage Volunteerism & Field Education

Most Malaysians do not aware of 'seagrass bed', which is one of the most important tropical marine ecosystems. This near-shore ecosystem helps stabilising sediment, preventing coastal erosion, sustaining high fisheries productivity [1] as well as to work as biological indicator of environmental health [2]. The seagrass bed enhances the diversity and served as feeding and/or breeding ground for threatened species such as sea turtles, dugongs and seahorses [3].

The second largest seagrass bed of Peninsular Malaysia is unfortunately included in the Penang Structure Plan in year 2007 as reclaimable land [4]. To date, there are scientists, researchers and environmentalists spoke out to support the idea of turning the seagrass bed into a protected marine park, instead of sacrificing for mass development [5]. However, lack of public awareness and involvement is always a challenge in handling nature and environmental related issue. Many locals do not know the existence of this natural system nearby their homeland.

Therefore, in order to promote public awareness of the Penang's seagrass bed, we initiated Penang Seagrass Project (PSP, www.facebook.com/penangseagrass/), which is an interest group established under the financial support from Eco-Peace Leadership Centre (EPLC, <http://www.eplc.asia/>), based at Kangwon National University, South Korea), an organization which help to set up human resources network and leadership training in environmental field.

Since November 2014, we worked with different parties to educate general public, especially younger generation, through volunteer training, site survey & documentation and public education. We conduct 2 field trips to seagrass bed per month and had organised several successful public events at Penang State of Malaysia. Besides, using the photos and data provided by volunteers and students, we managed to publish a handbook - Biodiversity of Penang's Seagrass Bed in July 2015 which served as a guide to organisms that thrive at Penang's seagrass bed.

In September 2016, PSP as the only representative from Malaysia,

had secured a second phase funding from EPLC due to our outstanding performance and achievements. While continuing our efforts in conducting exhibitions and expeditions, we reached a new milestone where we assisted 2 education institutions in Malaysia to form "Seagrass Action Team". The action team from INTI International College Penang had carried out a two days seagrass awareness campaign (21st - 22nd February 2017) in the school and support the WWF Earth Hour official event (25th Mar 2017). More events are in the pipelines by both action teams, including the Talk and Exhibition of Penang's Coastal Ecosystem in Aug 2017 & International Green Carnival in Sept 2017.

In AWS Saga 2017, we hope to share and discuss experience on

1. How to set up an environmental education project for local communities
 2. How to involve teachers and students in volunteering wetland education & conservation
 3. How to create awareness among general public in a more effective way
1. Bell, J. D. & Pollard, D. A. (1989) Ecology Of Fish Assemblages And Fisheries Associated With Seagrasses. Biology of Seagrasses, Amsterdam: Elsevier, 565-609.
 2. Dennison, W. C., Orth, R. J., Moore, K. A. & Stevenson, J. C. (1993) Assessing Water Quality With Submerged Aquatic Vegetation. Bio-science, 43, 86-94
 3. Choo, C. K., Sainol, A. S. & Wong, Y. Y. (2006) Seagrass and macrobenthic invertebrates composition at the Merambong Shoal, Johor. KUSTEM 5th Annual Seminar on Sustainability Science and Management, Kuala Terengganu, Malaysia.
 4. Chiam, C. S. & Tan, Royce (2014) Precious Marine Bounty. The Star. George Town, March 4. Available: <http://www.thestar.com.my/News/Community/2014/03/04/Precious-marine-bounty/>
 5. 10. The Star (2014) Protect seagrass bed, urges marine biologist [Online]. Available: <http://www.thestar.com.my/News/Community/2014/03/05/Protect-seagrass-bed-urges-marine-biologist/> [Accessed: 5 March 2014].

How to promote Flyway-wide activities and involve key national stakeholders

Tomoko Ichikawa, Eugene Cheah, Minjae Baek
East Asian-Australasian Flyway Partnership

World Migratory Bird Day (WMBD, 10 May) is an annual global campaign to raise awareness on the conservation of migratory waterbirds. The East Asian-Australasian Flyway Partnership (EAAFP) has been one of the main WMBD partners since its launch in 2006, and has been supporting the implementation of WMBD in the East Asian-Australasian Flyway (EAAF).

The EAAF stretches along 22 countries with various social, cultural and economic backgrounds. In this Flyway, habitat loss and degradation are threatening the survival of many migratory waterbird species. The key to reversing this trend is prompt and cooperative actions to raise awareness and the prioritization of waterbird conservation.

WMBD has been playing an important role for EAAFP's Partners and colleagues to join in and disseminate our messages of conservation, engage with stakeholders, and promote the partnership within each nation. We have gathered details of the events conducted in the EAAF from the WMBD's global campaign website, EAAFP's website, and from emails that the EAAFP Secretariat has received. There is, however, some data we could not obtain, especially from events held in the early years, but in general, the number of WMBD events conducted in the EAAF has been increasing along with the numbers of the countries joining the WMBD. In the past ten years, eighteen countries have organised activities, involving around 26,000 individuals, a figure that does not include indirect beneficiaries such as consumers of radio/TV programmes, visitors to exhibitions, people passing by the rallies, etc.

The EAAFP Secretariat has been promoting WMBD by providing and improving Flyway-wide WMBD support in a number of ways:

1. Developing a special webpage to act as an online platform to share information across the Flyway;
2. Developing and providing EAAF specialised materials;
3. Providing materials in various languages to help overcome language barriers;
4. Collecting and sharing WMBD event ideas to inspire Partners and relevant organisations;
5. Developing materials together with National Focal Points to grow

their ownership for WMBD;

6. Communicating with National Focal Point and relevant national NGOs to together promote a national partnership;
7. Providing small grants to encourage the planning of annual WMBD events;
8. Creating Flyway-wide activities that can be applied easily at Flyway Network Sites and visitor centres;
9. Utilizing the growing readership of EAAFP's newsletter and Social Networking Services to disseminate messages.

The events organised across the Flyway include lectures, exhibitions, contests, discussions, training workshops, media programmes, and field trips. The target audiences include not only local communities and students, but also government officers and media crews. Through interviews, it was found that materials in local languages were especially welcomed by the Focal Points and NGOs. Also, small grants for funding have been shown to encourage implementers to plan events and actions.

Through such attempts, we have discovered some key factors that help implementation at the national level.

1. Active participation and willingness of Focal Points;
2. Good national partnership and key national NGOs that can support the implementation;
3. Suitable methods and timing in each country.

However, there are some issues that make it difficult for some countries and organisations to either join WMBD or continue activities.

1. No birds are visiting the area in May;
2. Materials are developed a little bit late to plan something on the local level in advance.

By introducing our observations, this presentation will share the methods we have developed to engage and mobilise various actors on a regional scale, list the findings and successful factors, and encourage suggestions to further expand and ensure the continuity of WMBD in the EAAF.

Adventure Time in Shezi Island, Tamsui River: Explore Our Hometown

Szu-Ting Hsu Guandu Nature Park / Iris Hung Bamboo Curtain Studio
Clare Wang, Nelson Chen Guandu Nature Park

In October 2016, Guandu Nature Park (GD Park) collaborated with Bamboo Curtain Studio (Bamboo Studio), took the kids whom living in Shezi Island to discover their homeland with different eyes. This project incorporates environmental education and art education. We lead children use the scientific way to discover the nature in their homeland, and using the artistic way to tell a story about their hope.

GD Park, Bamboo Studio, Shezi Island are three beautiful sites where are located in Tamsui River watershed. But this beautiful watershed is face on much pressure on city develop, and polluted by many factors, like wastewaters from factory or ordinary household water. Many people living in this watershed, felt they should protect their "nature" environment. But how to protect? Where needs to protect? Are their homeland is natural environment? Most people do not know. So, we plane this project to call for their heart to rediscover their hometown, and link the beautiful memory between old and young people to love their hometown again. Find the way to protect.

This project draws on the knowledge fro Project WET education program that Guandu Nature Park has been promoted, and the art education from Bamboo Curtain Studio. The students will go on a field trip and learn to observe the environment around the school through this water resources course. Furthermore, they will share what they find in the course of this project through art, and eventually the past and the present of Shezi will be presented.

We use the environmental education to lead children to dis-

cover their home, their school. Hope they can use scientific methods to observe their hometown. That's why in the beginning, we guided them to make observations, like, looking at the color of the soil in the wetland, or looking for natural objects in the campus. Every natural observation will be followed by an artistic creation. This is led by artists who are doing

Efforts and Challenges for Coastal Stability and Conservation with Proper Natural Resources Management in Sundarbans Region, Bangladesh

Hideki Sato, Md. Maksudur Rahman

Japan Environmental Education Forum (JEEF), Bangladesh Environment and Development Society (BEDS)

The Sundarbans is the single largest mangrove forest in the world, lies on the delta of the Ganges, Brahmaputra and Meghna rivers on the Bay of Bengal. A total area is 10,000 km², 60% of the property lies in Bangladesh and the rest in India. Sundarbans in Bangladesh is the UNESCO declared Natural World Heritage as well as RAMASAR Wetland site.

Sundarbans mangrove flagship ecosystem in Bangladesh is the natural safeguard for protecting from natural disasters and livelihood support by providing rich fishing resources for 3.2 million climate vulnerable coastal people. It is the home of various types of species including many rare and endangered flora and fauna such as the critically endangered Royal Bengal Tiger, estuarine crocodile, turtle, dolphin, wild birds etc. Most of the local people living near Sundarbans are obviously dependent on the nature blessings such as fish, shrimp, honey, tree fruits by producing the rich mangrove forest and wetland on the SATOUMI. However, it is considered that the mangrove forests in this region has been reducing year after year because of human interference by over-exploiting mangrove resources.

In these circumstances, we have to consider two main problems of the Sundarbans coastal communities.

- (1) Insufficient of biodiversity conservation education for local people and lack of proper natural resources management due to the unsustainable and overexploitation of its' resources by forest dwellers.
- (2) Difficulties in making earnings due to the poverty and lack of alternative livelihood scopes in the limited life environment.

Bangladesh Environment and Development Society (BEDS), and Japan Environmental Education Forum (JEEF) have taken initiatives to mitigate those problems by living good harmony with nature, creating community based organization for ensuring local participation in nature conservation and livelihood improvement, starting from January 2013.

Especially, we have conducted the following main activities focused on the viewpoints of Education for Sustainable Development (ESD);

- (1) Capacity buildings and human resource development on biodiversity conservation to elementary school students, parents and teachers through developing educational materials on Sundarbans nature environment, cooperating with Ministry of Education and Khulna University, etc.
- (2) Participatory tree planning like mangrove and Moringa, drawing contest on the topic of Sundarbans biodiversity, targeting at fishermen, eco-clubs in schools, etc.
- (3) Efforts on dolphin and turtle conservation, home garden, crabfattening targeting at fishermen, cooperating with Ministry of Environment Forest, community leaders, etc.
- (4) Challenges on developing and selling Non-Timber Forest Product (NTFP) of natural honey by honey collectors, mangrove pickle by fishermen, handicraft products made by *Nypa fruticans* and mangrove thatch by community people.
- (5) Challenges on developing community-based eco-tourism in Sundarbans through the capacity buildings of the local people.
- (6) Efforts for building the collaborative networks to support Sundarbans by multi-stakeholders.

The main goal of any activities is to conserve Sundarbans mangrove biodiversity and to reduce society based poverty through efforts for harmonizing between nature and human beings properly utilizing natural resources in the area, in order to reduce unsustainable resources harvesting practice and environmental impact on mangrove regeneration process by community people.

In this symposium, we would like to introduce the previous activities, and to suggest one of the future directions for creating community development with natural symbiosis in Sundarbans, Bangladesh, through the outcomes of efforts and challenges about for five years having been implemented by BEDS and JEEF.

BioBlitz is a collaborative, open source, citizen science survey of all forms of life in a set area over a set time, popularised in the U.K. by Bristol Natural History Consortium

as national BioBlitz coordinator. In 2015 the Hong Kong Environment and Conservation Fund, Environmental Education and Community Action Projects sponsored Hong Kong's first large scale 30 hour BioBlitz at Tai Tam Bay (Inner Harbour) SSSI, site of the last mangrove forest on Hong Kong island. The authors wish to share achievements, practices, progress and challenges towards better understanding of this CEPA tool adapted for Hong Kong and wider Asia regional contexts.

The author is a Hong Kong registered charity established in 2012 with the aim of educating to inspire action for sustainable development in Hong Kong young people and a registered member of Wetland Link International (WLI)'s network. The author's wetland education programmes were initially developed for UNESCO Hong Kong's Education for Sustainable Development Learning Programme.

While there was considerable interest from schools and outdoor education providers, such approach was found unsatisfactory in terms of level and extent of engagement, as well as lack of long term follow up action. The authors were inspired to try a BioBlitz as an exciting citizen science event with many collaborative partners as proven popular in the U. K., U.S. and elsewhere, such event was successfully concluded late October 2015.

In 30 continuous hours, approximately 300 participating students, teachers, volunteers, and expert naturalists recorded 680 species including two rare endemic species of moth, first sighting of juvenile mangrove horseshoe crabs on Hong Kong island, and first sighting of coral off Hong Kong island. The event brought together 10 environmental NGOs collaborating for the

first time including WWF-Hong Kong, Ocean Park Conservation Foundation, Conservancy Association, Hong Kong Birdwatching Society and others, with 20 student groups from diverse schools, for many their first such scientific survey or field training. Surveys included coastal forest, wetland, intertidal, and marine habitats. Thereafter, two university groups won funding and organised BioBlitz events, and another NGO was awarded HK\$34.8 million (approximately US\$4.5 million) for revitalising a heritage building into a BioBlitz training centre expected to attract 16,000 students a year from 2019.

A condition of the funding was to not allow public participation beyond pre-registered student groups and there were fears expressed during the funding process, that encouraging unsupervised exploration in the survey area would lead to injury and damage of wildlife and participants, that the large apparent number of species would confuse, that unscrupulous participants would decimate local wildlife, that many local species are toxic, poisonous or otherwise hazardous and other concerns.

In 2016 Hong Kong published its first Biodiversity Strategy and Action Plan (BSAP) 2017-2020 fulfilling its obligations under the Convention on Biological Diversity with central aims to ensure public is aware of biodiversity and its values, and also to support China's National BSAP. Towards this aim the Agricultural, Fisheries and Conservation Department of Hong Kong has approved funding for the author to organise another BioBlitz which is planned early November 2017.

In this context, the authors wish to explore BioBlitz as a tool for wider wetland CEPA in Hong Kong and Asian contexts, in particular their collaborative structure, including learnings from the 2017 BioBlitz which it is hoped will be the first coordinated Pearl River Delta BioBlitz.

Development of Wetland School in China

Xiuzhi Yang, Kelin Chen

Wetlands International-China

Although wetlands are irreplaceable asset that provide water and food for human being, they have often been sacrificed for industrial development. Low recognition of wetland values in general public is one of the major reasons to this. Nowadays, rapid development is resulting in significant wetland loss and degradation in China, which is one of the rising nations. As a fundamental solution to this problem, environmental education is an urgent task there.

Wetlands International-China (WIC) has been practicing "wetland education" through international exchange events etc. to increase wetland awareness for students and teachers since 2002. Wetland School originated from "Asian Wetlands Week - Children and Wetlands", a regional awareness campaign especially targeted to children, initiated by Ramsar Center Japan. In Dec. 2004, the 3rd Asian Wetland Week (AWW) Celebration Event was held in Dafeng, Jiangsu Province, China. During this event, the Dafeng No. 4 Middle School was designated as "Wetland Experimental School" by WI- China. The first Wetland School established in China.

From 2005 to 2015, supported by the Japan Fund for Global Environment (JFGE), 3 three-year projects were organized by RCJ, Wetlands Korea, WI-China and WI-Japan, named "China, Japan, Korea Wetland School Programme: Wetland Awareness Campaign for Children and Teachers in Three Nations" (2005-2007), "Wetland School Network Programme Popularized in Asian Countries along the East Asian-Australasian Waterbird Flyway" (2008-2010), and "Promotion of Wetland ESD (Education for Sustainable Development) in China" (2012-2014). Through more than 10-year's development, 19 schools have been named as Wetland School in China. These wetland schools spreading over 10 provinces formed a Wetland School Network and growing stronger. Depending on local wetland nature

reserves, they guide children and teachers step into and enjoy hands-on experience at wetlands, and take an active part in wetland exchange with wetland schools in East Asia and South-east Asia. A new wetland environmental education modal with Chinese characteristic has been initially formed.

The implementation of these projects effectively enlarged the influence and demonstration effect of Wetland School in China. We can see that we are making changes on wetland conservation. More and more students and teachers know wetland and they influenced the people around them. The number of Wetland School and member of Wetland School Network steady increased. Teacher's capacity on wetland education enhanced through teacher's training course and national and international education experiences exchange. More and more teaching materials developed and series of wetland conservation and awareness activities conducted by Wetland Schools. Government of different levels, education sectors and schools pay more attention on wetland environmental education. The concept of Wetland ESD is accepted and popular in China. Wetland School has become a famous brand in China and plays a significant role to increase awareness on wetland conservation and wise use among teachers and children even the whole society in China.

From 2016 to 2017, in order to strengthen Wetland School Network development, supported by Shenzhen OCT Hua Club Ecological Environment Protection Foundation, WIC developed Wetland School Construction Guidebook and Wetland School Management Measures. We hope 100 schools join Wetland School Network and each province at least has 1 wetland school.

Present status and future prospects of the nature restoration in coastal lagoon Lake Nakaumi, Japan Keynote

Hidenobu Kunii

The Nature Restoration Committee of Lake Nakaumi

It may be a fate of estuarine and coastal lakes to suffer numerous local and global environmental problems such as eutrophication, landfill, land-reclamation, or the sea-level rise. Coastal lagoon Lake Nakaumi, a fifth largest lake in Japan (85.7km²), was once a fertile lake with prosperous fishery products and extensive seagrass beds.

However, this lagoon lake had been suffered many detrimental effects by human activities, such as sewage effluent, runoff of chemical fertilizers and herbicides, land reclamation, dredging, construction of lock gate and dykes and so on, for more than 40 years since early 1960's. As a result, lake ecosystem had been deteriorated severely and no significant catch had been reported. The rich coastal lagoon lakes are the most vulnerable habitats and ecosystems in the world. Due to public opinion, controversial national public works subject to land reclamation and desalination of the lake terminated in 2002, and the president of Shimane Prefectural Government expressed to designate the lake for inclusion in the list of wetlands of international importance in July 2003, and Lake Nakaumi was soon after then registered as a 26th Ramsar site in Japan together with its neighboring Lake Shinji in 2005.

The new national biodiversity strategy of Japan, which was approved on March 2002, proposed the promotion of nature restoration projects in order to actively rehabilitate degraded environments. Nature restoration projects do not simply mean to recreate the natural environment that has been impaired by development, but rather are intended to recover the resilience of local ecosystems, through the careful removal of human influences and the rehabilitation of nature. This long-term project, incorporating good management planning practices, such as adaptive management, fits well with the restoration of

Lake Nakaumi in which severe alteration occurred in the past.

To achieve the restoration of Lake Nakaumi, local non-profit organization established the Nature Restoration Committee of Lake Nakaumi in 2007 to act upon the law for the promotion of nature restoration, and the Nature Restoration Committee of Lake Nakaumi drew up the implementation plan for the nature restoration projects in Lake Nakaumi in 2012. Since then, the Nature Restoration Committee of Lake Nakaumi has been addressing the following four main projects such as 1) conservation and restoration of seagrass beds, 2) conservation and restoration of lakeshores, 3) rehabilitation of depressed lake bottom resulted from dredging, and 4) removal and utilization of overgrown sea weeds, under the slogan 'revive richer friendly clean Lake Nakaumi', a general statement about desired project outcome.

Five years have passed since the launching of the nature restoration projects in Lake Nakaumi, and of these third and fourth projects were progressed satisfactory while first and second projects were not. Based on these results, the Nature Restoration Committee of Lake Nakaumi is now drawing up the succeeding implementation plan which encourages not only the conservation of biodiversity but the utilization of ecosystem services of Lake Nakaumi. For its conservation and sustainable development, every person living around the should do extremely careful investigation and step-by-step decisions or adaptive management.

Haor of Bangladesh and Present Scenario

Md Golam Rabbi

Nature Conservation Society

Bangladesh is located in the transitional zone between the South and Southeast Asian flora and fauna biomes, which contributed to its historically rich biological diversity. Bangladesh possess about 7-8 million hectares of wetlands in different forms for instance, rivers and streams (480,000ha.), estuarine and mangrove swamps (610,000ha.), shallow lakes and marshes (120000-290000ha), large reservoirs (90,000ha), small ponds and tanks (150000-180000ha.), shrimp ponds (90000-115000ha) and seasonally submerged flood plains (5,770,000ha.). Haors are bowl-shaped depressions between the natural levees of a river subject to monsoon flood every year, are mostly found in the eastern region of the country. There are about 373 haors comprising an area of about 858460ha. dispersed of Sunamgonj, Sylhet, Moulvibazar, Hobigonj, Netrokona and Kishoreganj district. Beels are comparatively large surface water bodies which accumulate surface runoff water through internal drainage channels; these depressions are mostly topographic lows produced by erosions and are seen all over Bangladesh. There are thousands of beels of different size are present in Bangladesh for instance, Chalan beel, Chanda beel, Arial beel, Baikka beel etc.

Wetlands always support maximum number of life including

District	No of Haor	Area of District (ha.)	Area of Haor (ha.)	% of Haor area per District	% of Stakeholder Dependency
Shunamgong	95	367,000	268,531	73.17	95
Sylhet	105	349,000	189,909	54.42	23
Hobigonj	14	263,700	109,514	41.53	28
Moulvibazar	03	279,900	47,602	17.01	37
Kishoregong	97	273,100	133,943	49.05	62
Netrokona	52	274,400	79,345	28.92	41
Bramanbaria	07	192,000	29,616	15.37	43
Total/Average	373	1999,800	858,460	42.93	47

wildlife, fisheries, aquatic plants and invertebrates. Most of the wetland in Bangladesh possesses resources for migratory birds especially in the winter season. Around 400 species of migratory birds visited Bangladesh. Huge numbers of migratory birds visit Hakaluki Haor, Hail Haor, Ramsagar and Tangur Haor which is an important Ramsar site. Tangur Haor has outstanding conservation value, being a natural freshwater wetland in the country, seasonally harbouring up to 60,000 migratory waterfowl along with many resident birds. Tangur Haor resources especially reeds and swamps support wildlife and fish for instance, 141 fish species, 11 amphibians, 34 reptiles (6 turtles, 7 lizards and 21 snakes), 206 birds, 31 mammals and 12 butterfly species. Recent survey has recorded 104 plant species under 88 genera and 51 families in this wetland. Local communities are solely depended on wetlands for its resources specially fish but they also used to cultivate paddy in the dry season. The flooded fields in the monsoon became rich with minerals and are very fertile. Wetlands habitat of Bangladesh is under constant threat due to increase of population, flash flood, intensive agriculture, overfishing, siltation, pollution, ill-planned infrastructures, lack of institutional coordination, lack of awareness, etc which play tremendous impacts on both biotic and abiotic components of wetlands. Additionally, industrialization as well as agriculture has resulted in serious levels of pollution due to ineffective environmental policy and policy implementation. In order to balance human needs and wetlands conservation, a mainly community-based wetlands management approach has been taken in Bangladesh, but this is not enough to prevent the degradation of wetlands.

Therefore, Bangladesh now needs a comprehensive strategy combining political, economic, social, and technological approaches to stop further degradation of wetlands.

The Ryukyu Islands of Japan are located on the northern limit of the coral reefs. Many places were lost by coastal development however healthy coral reef ecosystem remains around Henoko and Oura Bay, located in the northern part of the east coast of Okinawa Island. At this biodiversity rich place however, currently a plan to landfill the area to build an US military airfield base (Futenma Replacement Facility) is under way..

The whole area of Henoko and Oura Bay are the regions with high biodiversity which has been recognized as one of the hot spots of biodiversity in the world. According to the environmental impact assessment report of the Ministry of Defense, 5,334 species have been recorded from the coastal waters, including 262 endangered species. In addition, through subsequent surveys, a undescribed species of a huge sea cucumber and many undescribed or unrecorded species of sponges, ctenophores, gorgonians, sea slugs, crabs and so on have been reported one after another. Many undescribed species have been recently reported.

Henoko and Oura Bay has the largest area of seagrass beds around Okinawa Island.

These are used by the dugong (*Dugong dugon*), Japan's Natural Monument (Kasuya& Abe 2014). The dugong is listed as "Critically Endangered" on the Red List of the Ministry of the Environment and as "Vulnerable" on the IUCN Red List. The number of the dugong in Okinawa has been declining to a critical point.

A massive stand of the blue coral (*Heliopora coerulea*) (50m long, 30m wide and 14m high) was discovered in 2007 which is listed as "Vulnerable" on the IUCN Red List.

The value of the biodiversity of Henoko and Oura Bay has been recognized widely. The Japanese Ministry of the Environment listed the AREA in its "Ecologically or Biologically Significant marine Areas identified by Japan". It has also listed Oura

River and its estuary in the "Ecologically or Biologically Significant wetland Areas identified by Japan." The Okinawa prefectural government designates the coastal area of Henoko and Oura Bay as "Assessment Rank I" (the highest) in its Guidelines on the Conservation of the Natural Environment. The Japanese Ministry of the Environment also listed the area in its list of potential Ramsar Sites in 2010 as it recognized that the wetlands in the area meet the Convention criteria for wetlands of international importance,

In 2014, 19 Japanese scientific and academic associations including the Ecological Society of Japan submitted the "Joint Petition by the 19 Society Groups calling for Environmental Conservation of the Highly Remarkable Biodiversity in Oura Bay, Okinawa" to the government of Japan.

The project to build an US military airfield base is proceeding. The project for 160ha reclamation requires 21 million cubic meters of soils and rocks, of which 17 million cubic meters would be exported from outside of Okinawa island which could be a trigger to alien species problems; IUCN had given a recommendation to the government of Japan last year to strengthen pathway management of alien species for the protection of island ecosystems. The process of the Environmental Impact Assessment (EIA) was mired with many issues and problems.

The previous governor of Okinawa prefecture had given the landfill permit to the business operator (Ministry of Defense, Japan) in December 2013. The present governor has been tried to stop however the reclamation project has officially started since April this year.

Therefore urgent measures are needed to be taken before we lose the richness of the irreplaceable coral reef ecosystem forever without many people being aware of its value.

Introduction to configuration concept of aquatic acrophytes in lake ecological restoration —An example of ecological restoration in Gonghu Bay

Liyan Qi, Zhongren Xiong, Hongxing Zhang
Research Association of Wuxi Wetland Protection and Construction

Eutrophication is a serious problem in the ecological environment of shallow lakes currently. Ecological restoration by using aquatic macrophytes becomes a good method to solve this problem. This research takes Gonghu Bay in Wuxi as an example, mainly discusses the process of aquatic plant allocation in the process of ecological restoration of shallow lake. We elucidate four stages of aquatic plant restoration including basic ecological restoration-vegetation succession-system improvement and its operation and maintenance and their logical relationships.

Meanwhile we emphasize the advantages of functional plants at different times. In order to provide some theoretical basis and practical guidance for the of aquatic plants in the ecological restoration of shallow lake.

In recent decades, due to human disturbance of the eutrophication of sewage, Strength increase of fishery and water division, many aquatic vegetation degradation, lakes change gradually from the grass type lakes to Algae type lake, aquatic plant is an important part of aquatic ecosystem community, and plays an important role in the aspects of water pollution control, water conservation, water conservation, climate regulation and environment and so on.

The analysis of community configuration process of lake ecological restoration of aquatic plants Indicate that: when using aquatic plants to regulate the water ecological system structure, restore the structure and function of the lake ecosystem, enhance the buffering capacity of anti external interference, it demands full knowledge of aquatic plant performance, life habits and natural environment of lakes, and according to these conditions to formulate the corresponding configuration method of aquatic plant communities; in the configuration process, it demands comprehensive consideration of aquatic plants in ecological and economic benefits, so that the aquatic plants ecological restoration project can play a role in long-term.

Eutrophication is a serious problem in the ecological environ-

ment of shallow lakes currently. Ecological restoration by using aquatic macrophytes becomes a good method to solve this problem. This research takes Gonghu Bay in Wuxi as an example, mainly discusses the process of aquatic plant allocation in the process of ecological restoration of shallow lake. We elucidate four stages of aquatic plant restoration including basic ecological restoration-vegetation succession-system improvement and its operation and maintenance and their logical relationships.

Meanwhile we emphasize the advantages of functional plants at different times. In order to provide some theoretical basis and practical guidance for the of aquatic plants in the ecological restoration of shallow lake.

In recent decades, due to human disturbance of the eutrophication of sewage, Strength increase of fishery and water division, many aquatic vegetation degradation, lakes change gradually from the grass type lakes to Algae type lake, aquatic plant is an important part of aquatic ecosystem community, and plays an important role in the aspects of water pollution control, water conservation, water conservation, climate regulation and environment and so on.

The analysis of community configuration process of lake ecological restoration of aquatic plants Indicate that: when using aquatic plants to regulate the water ecological system structure, restore the structure and function of the lake ecosystem, enhance the buffering capacity of anti external interference, it demands full knowledge of aquatic plant performance, life habits and natural environment of lakes, and according to these conditions to formulate the corresponding configuration method of aquatic plant communities; in the configuration process, it demands comprehensive consideration of aquatic plants in ecological and economic benefits, so that the aquatic plants ecological restoration project can play a role in long-term.

Anthropogenic decline of the mudflat-specific fauna and flora in Japan: significance of the restoration of the estuary in Isahaya Bay in the Ariake Sea

Masanori Sato
Kagoshima University

Mudflats are mainly formed in the upper littoral zones in estuaries, especially in the innermost part of macro-tidal embayments (upper reaches of estuaries), providing a habitat for peculiar fauna and flora. The peculiar fauna and flora of estuarine mudflats appear to have been extirpated in many estuaries in Japan, along with the mudflats that have been damaged or destroyed by thoughtless and drastic coastal reclamation (Sato, 2010). At present, the Ariake Sea, which constitutes the largest area of mudflats remaining in Japan, also has the greatest variety of the mudflat-specific species. Lots of the mudflat-specific species are almost or completely restricted to Ariake Sea, e.g., the brachiopod, *Lingula adamsi* (Japanese name: Ooshamisen-gai, designated as a critically endangered species (CR) in the Japanese Red List of the Ministry of the Environment 2017), the nereidid polychaetes, *Hediste japonica* (Ariake-kawa-gokai, endangered species (EN)) and *Nectoneanthes uchiwa* (Uchiwa-gokai, near threatened species (NT)), the bivalve, *Tegillarca granosa* (Haigai, vulnerable species (VU)), and the salt marsh plant, *Suaeda japonica* (Shichimen-so, VU), while their populations of the same (or closely related) species are distributed along Asian continental coasts, which suggests they are continental relicts.

Some of the mudflat-specific species now restricted to Ariake Sea previously enjoyed a wide distribution in Japan. For example, our recent examinations of old polychaete specimens deposited in Japanese and European museums revealed that the distribution of *H. japonica* formerly extended to central Japan, including the Seto Inland Sea, Ise Bay, and Mikawa Bay at least until 1969 (Sato & Sattmann, 2009; Sato, unpublished data). However, all populations of *H. japonica* seem to have been extirpated throughout Japan, except for in the inner part of the Ariake Sea, which is the last habitat of this species remaining in Japan. Even worse, a recent reclamation project in Isahaya Bay in the inner part of the Ariake Sea (enclosure of the

inner Isahaya Bay by the construction of a 7-km dike in 1997) caused the loss of an estuarine muddy shallow area of 36km², including mudflats (29km²) of the most important habitat for *H. japonica* and the other endangered mudflats-specific species (Sato, 2010). Reduction of the original wide distribution of estuarine mudflat fauna in Japan into the present narrow one in the inner part of the Ariake Sea has been documented also for some bivalves and a salt marsh plant (Sato, 2010).

The high productivity of macrobenthic organisms in Japanese mudflats seems to greatly benefit carnivores such as migratory shorebirds and bottom-dwelling fishes. The highest number of migratory shorebirds (13,500 individuals) was recorded in the former mudflats in the Isahaya Bay in spring in 1988, before the enclosure of the mudflats (Hanawa and Takeishi, 2000).

Our recent study demonstrated that estuarine mudflats supply important foraging places for the natural populations of the Japanese eel, *Anguilla japonica* (Nihon-unagi, EN, one of the most important fishery resources in Japan), which fed on various macrobenthic invertebrates inhabiting estuarine mudflats (Kan et al., 2016).

Traditional fishing for eel in mudflats with a Japanese eel fork "Unagi-kaki" has been maintained by the local people in the inner part of Ariake Sea.

Conservation and restoration of Japanese mudflats are needed to conserve many endangered species and to maintain traditional human fisheries and culture. From this aspect, restoration of the estuarine mudflats in Isahaya Bay in the Ariake Sea is highly desirable. If the tidal currents are recovered within the regulating reservoir, which was changed from the original estuarine mudflats to a freshwater pond by the enclosure of the mudflats, the estuarine habitats for many endangered species seem to be restored rapidly in the regulating reservoir.

Re-establishment of the Eurasian otter in South Korea

Sungwon Hong, Young Min Kim, Jieun Choi, Eun Song Jeong, Yuno Do, Gea-Jae Joo
Pusan National University

Urbanisation and associated anthropogenic impacts have reduced the distribution of many native mammals globally. In South Korea, where urbanisation and industrial development have been exceptionally rapid, the distribution of native Eurasian otters (*Lutra lutra*) was severely reduced between the 1950s and the early 1980s. However, we focused on the otter re-establishment based on improved environment and public awareness. The government implemented a policy in the 1980s to promote the coexistence of nature conservation and development. To mitigate the effects of river and stream pollution, the government has invested \$1.5 billion (U.S.) to date, and since the 1960s, forest density has increased dramatically from 27.5 to 125.6 trees/ha. Firstly, we hypothesised that these two distinct improvements in the environment could enable the distribution of otters to increase. Secondly, scientific research and public awareness have both facilitated conservation efforts to restore otter populations in South Korea, but how changing public attitudes to conservation have contributed to otter recovery is unknown. Finally, we applied both diffusion kernel method and self-organizing map to analyse the otter diffusion way between 2014 and 2017, more precisely. We collated data from five otter distribution studies from 1987 to 2010 and examined the relationship between changes in otter distribution and environmental variables (biological oxygen demand, forested area and density, and percentile of national park area) across 111 river basins. The otter distribution has increased from 29.7% to 87.4% of river basins. In the early 1980s, otters occurred only on islands, in remote farmlands, and mountainous areas, in addition to a remnant population near the capital city. After the average biological oxygen demand remarkably improved in the 1990s and establishing strict law, water quality was an important factor affecting the otter population. Later, afforestation became a more important factor influencing the otter population. However, the most important reasons for the otter recovery

were the implementation of effective conservation laws and their enforcement in the late 1990s. Because historic newspaper articles can reveal such changes, we categorized the 5168 newspaper articles about otters from 1962 to 2010 into five topics (occurrence, ecotourism, conflict, research, and restoration) and geo-tagged any otter locations mentioned to a 15 x 15 km grid to compare with the otter distribution established by five scientific surveys. Since 2000, the number of newspaper articles about conflicts between otters and urban development, and the roles of otters in encouraging eco-tourism have increased significantly. Using the diffusion kernel estimation, population dispersals were separately identified according to geographic conditions in northern and southern areas. Both populations were observed to disperse eastward although the survey period was relatively short. Whereas the northern population in the upper basin of the Nakdong river decreased in densities and dispersal area during the survey period, the southern population in the downstream area dispersed widely as the time progressed. The Geo-SOM was applied to reveal associations between spraint densities and environmental factors. The northern populations were negatively associated with anthropogenic factors (e.g., distance to residence area) initially in 2014, but associations changed later to show high relations to biotic factors (FAI, BMI, and canopy development) in 2016. The results indicated a possibility of transition in niche preference, reflecting human intervention in the early period during the course of otter population dispersal. In the southern populations, however, spraints were consistently associated with favourable landscape conditions and biotic factors through the survey period. The study suggested that niche preference could be diversely addressed depending upon biological and environmental factors constrained by geographic conditions where the populations reside for dispersal.

Securing management measures of wild deer in Kushiro Marsh, the first Ramsar Site in Japan

Satoshi Kobayashi Kushiro Public University / T. Yoshida, H. Uehara, H. Takafumi, M. Sarashina Rakuno Gakuen University
H. Uno, Y. Inatomi, T. Shimamura, Y. Osa, M. Ueno Hokkaido Research Organization

Kushiro Marsh was designated as the first Ramsar Site (7,863 ha today) in Japan in 1980 when Japan became a signatory to the Ramsar Convention on Wetlands. It is located in the eastern part of Hokkaido, the northernmost major island in Japan. Then the Kushiro Marsh National Park was designated in 1987, including the Ramsar Site area as a core and covering 28,788 ha today. The Wetland Restoration Project has been, however, carried out in some areas within Kushiro Marsh since 2005. In addition, wild sika/deer (Hokkaido subspecies *Cervus nippon yezoensis*), whose population was thought to have been increasing in Kushiro Marsh, has caused yet a new problem for the conservation of its rich biodiversity.

Researchers from Rakuno Gakuen University and the Hokkaido Research Organization, both have experiences in dealing with deer issues in several parts of Hokkaido, in collaboration with Kushiro Public University, located just adjacent to Kushiro Marsh, have carried out a research project from 2014 to 2016 to understand and analyze the situation. Main objectives are to estimate the number of wintering deer population within Kushiro Marsh; to capture some deer for satellite-tracking to understand their daily and seasonal movements; and to collect opinions over wild deer management from various local stakeholders in order to help future management planning.

Our findings are as follows:

- 1) Some wild deer use the central area of Kushiro Marsh and its surroundings thus considered to be residential, but others move onto rather far away areas - migratory;
- 2) The unprecedented concentration of wintering deer has been recognized in some parts of Kushiro Marsh; and
- 3) Introducing management measures of wild deer within the

National Park area is expected to contribute to controlling crop damages caused by wild deer in surrounding farmlands.

Possible target areas for deer management have been identified, but it requires further examination to recognize when and how management measures are to be carried out. On the other hand, consideration for some endangered species such as red-crowned cranes *Grus japonensis* is necessary in the national park area. Dialogues and exchanging information with local conservation NGOs with special focus on cranes and other endangered bird species have been therefore initiated.

A representative from the Royal Society for the Protection of Birds (RSPB), U.K., was invited to Hokkaido in 2015 to share his experiences in Ramsar Sites in U.K. From the viewpoint of conserving wetland-dependent bird species, the management of red deer (*Cervus elephus*) has been initiated by the Society in two Ramsar Sites successfully.

The fact that a bird conservation organization has been engaged in culling programmes of wild deer so as to protect bird habitats is an eye-opener for many conservationists in Hokkaido.

More intensified management measures of deer population in Kushiro Marsh will be introduced in due course based upon the results of the research project, and such measures will be certainly useful and provide further information for similar problems in other Ramsar Sites and wetland protected areas.

With grant fund made available for the research from 2014 to 2016 by the Japanese Ministry of the Environment: Project number 4-1405.

Linking wetland bird ecology with human activities in multiple-use wetlands in India

Shivona Bhojwani National Centre for Biological Sciences, Wildlife Conservation Society-India, Ashoka Trust for Research in Ecology and the Environment
K.S Gopi Sundar International Crane Foundation, Nature Conservation Foundation
Jagdish Krishnaswamy Ashoka Trust for Research in Ecology and the Environment

A one-third decline in the coverage of natural wetlands in South Asia has led to the loss of habitat for many wetland bird species. As natural wetlands declines, the potential use of human made or modified wetlands by wetland birds, needs assessment. A number of such wetlands in India are irrigation tanks embedded within agricultural landscapes, being primarily built for irrigation. They are also used heavily for domestic uses, freshwater aquaculture, and recreational purposes. In spite of this, many wetland bird species, especially waterfowl use these wetlands, especially in the wintering season. A few studies in South Asia have investigated responses of wetland birds to management regimes in coastal wetlands or agricultural landscapes. However, the conditions under which these "multiple-use" wetlands support water bird populations is not well studied. For this purpose, we used aquatic vegetation as a predictor of bird abundances at wetlands as it performs a dual role: a) plant communities are good indicators of eco-hydrological conditions at wetlands b) birds associate closely with vegetation for foraging, roosting or nesting purposes. We also chose to focus on the influence of aquaculture practices on birds as there could be different mechanisms by which they influence bird communities. First, a direct one, where we expected negative influences of human activities on bird abundance. Second, an indirect one, by which we expected management for exotic carp production to influence negatively aquatic vegetation thereby influencing bird abundances. Conversely, we also gained insights on mechanisms by which the ecology of the wetland influences carp production. The study was carried out in 19 agricultural wetlands of Gondia district, Maharashtra, India. Using GIS software and field surveys, we selected wetlands of similar sizes (7 to 12 ha) located in paddy fields, on a gradient of overall wetland vegetation, estimated coarsely before sampling. Birds

were counted in each wetland through the wintering season by two observers. We quantified submerged, surface and shore vegetation separately, using a combination of methods. To understand the influence of fishing practices, key informant interviews, group discussions and frequent visits to the sites were made. Bird species were parsed into a few guilds based on their foraging habitat, feeding strategies, diet and size. These guild abundances were used as responses in N-mixture models with fishing and vegetation variables as predictors. We found that the herbivorous guild comprising dabbling and diving ducks, Eurasian Coots, and carnivorous bird guilds that included Egrets, Herons and Little Cormorants, were positively associated with the biomass of submerged vegetation, percent cover of sedges and *Nymphaea* sp. at these sites. Importantly, these vegetation types were negatively influenced by occurrence desilting in the past ten years, a tank management practice, seasonality and prevalence of exotic carp culture. Vegetation that positively influenced skulking birds like rallids, negatively influenced small shoreline waders like sandpipers and stints. The data collected from interviews did not support the hypothesis that disturbance negatively influences bird guild abundance. We also found that aquaculture production was higher in sites that had greater values for submerged vegetation and bird guild abundance, as compared to the other sites. Insights gained through perceptions of fishermen, based on interview surveys, corroborated with the overall findings of the study. This study not only explores links between agricultural wetlands and bird conservation, but also the link between their ecology and potential to provide ecosystem services. Thus, this study has the potential to provide insights for future bird-friendly management of agricultural wetlands.

Adaptive Actions by the community to resolve various issues of Climate Change in the Wetlands along the coast of Bay of Bengal, Odisha, India

Jitendriya Naik
NET-COAST

It was for the last 20 years, PALLISHREE has been performing the role of an implementing NGO in the field of environment through education and awareness building spheres. The local problems due to Climate Change issues have been addressed by PALLISHREE. It has mobilized financial support to undertake activities from the Japan based support agencies such as JFGE, KNCF, NALAPO, TOYOTA, AEON and JWF in which Ramsar Center Japan has played important role in extending technical support in conceptualization as well as implementation of programmes. The programmes were implemented in more than 180 coastal villages along Bay of Bengal in Odisha. The core principle of the intervention was to build critical awareness of the community and also mobilization of participation in the intervention. The villages were facing Climate Change issues like Sea Erosion, increased salinity over land and water, repeated occurrence of natural disasters and erratic rainfall. As a result, the local communities were facing severe impacts in terms of increased risk over life and livelihood. This has been further resulted in the migration of poor families.

PALLISHREE has been facilitating community adaptation to the issue of climate change and its impact.

- a) Land degradation: Construction of Cross and Counterbond, Gully plugging, check dams, grass planting and Mangrove Plantation. Plantation in School, temple and community land.
- b) Indiscriminate use of chemicals in agriculture: Preparation of vermin-compost, use of cow dung, biological interventions, changing pattern in crop diversity and other serial cultivation to increase nitrogen in the soil.
- c) Adaptation to hazard by stress tolerant seed varieties: Conservation and use of indigenous seeds and other flood, drought and saline tolerant varieties.
- d) Erosion and accretion: Grass and Mangrove Plantation and palli-shed have been initiated.
- e) Flash flood/water logging: Awareness building to create es-

capas to allow flood water into the low land. Clearing of outlets and inlets of drainage system.

f) Hazards like:

- Flood: Individual survivability and community readiness, adaptation of flood resilient rice variety, pond renovation & rejuvenation preparation of high raised platform, tube well, toilet & house.
- Cyclone: Mangrove plantation, reopening of sea mouth blockage, adaptation of saline resilient crop, facilitating the hydrological connectivity, sand dune vegetation.
- Drought: Rain water harvesting and Adaptation of drought stress tolerant rice variety.
- As a result the organization strive to check the increasing trend of migration. For this the organization promotes measures such as alternative livelihood like Agriculture, Fishery, Eco-Tourism, Fruit Plantation, Rice-fish culture, Silvo-culture, Poultry farming & Mushroom Cultivation, Sustainable life forest, sand dune vegetation.
- Besides the organization also work in the following spheres so as to make the adaptation process sustainable.
- Reducing the anthropogenic pressures over the wetland by demolishing all detrimental practices.
- Awareness building to create ecosystem restoration by local community.
- prohibition to use small mesh size net and poaching of fish juvenile.
- Adoption of responsible fishery practices.
- Use of alternative source of green energy such as use of solar devices and promotion.
- Training on energy saving lifestyle to the community and manage solid wastes. For this PALLISHREE used to organize awareness building activities through street play, wall painting, poster, newsletter, booklet & leaflet. It also promotes similar awareness generation activities in the schools targeting the students and teachers including local youth group and women.

Numerical Simulation on Algae Bloom in Chaohu Lake,

China Xin Qian, Mei Li, Huiming Li
School of the Environment, Nanjing University, China

The Chaohu Lake Basin is located in the middle of the Anhui Province between the Yangtze River and the Huaihe River. It is among the five well-known freshwater lakes in China and with 78 km long from east to west and 44 km wide from south to north. The lakeshore is 188 km long and the average depth is 2.5m. The water area is approximately 760 km², whereas the basin area is roughly 13,350 km². The Chaohu Lake is the main water source of local industrial, agricultural, and living activities. It is also the main water body that integrates industrial and agricultural drainage with the domestic wastewater along Chaohu Lake.

The water quality of several of the main inflowing rivers deteriorates continuously as a result of the excessive economic and population growth in the Chaohu Lake Basin, which in turn deteriorates the water quality of Chaohu Lake. The water environment in the Chaohu Lake Basin has undergone significant ecological stress in the past three decades. Since the 1970s, frequent "algal blooms" have been detected in Chaohu Lake, and this phenomenon is accompanied by water deterioration. As a result, the water quality is poorer than the national Class V standards and significantly affects drinking-water safety, fishery, and tourism. Moreover, this water pollution hinders local economic development and affects the health of residents considerably.

The water quality has not improved despite recent efforts in pollution control and lake management. The high levels of non-point source pollution in the basin are difficult to control in the long term although the loads of main point-source pollution in cities and towns are managed effectively in recent years. The water quality is difficult to improve because of the insufficient knowledge regarding the formation, transfer, accumulation,

and outbreak of the algae bloom in Chaohu Lake.

This research aims to forecast and provide early warning against algae bloom in Chaohu Lake and try to identify the hydrodynamics factors that influence the migration of nutrients and algae bloom in Chaohu Lake. In order to study the process of the algae bloom in the lake, a three dimensional numerical model was introduced to simulate the distribution of the water quality parameters and the area of algae bloom.

The field works were carried out to gather the sufficient data for calibration the coefficients and verification for the simulation results. The initial nutrients distribution data were collected from field data and distribution of algae were from MODIS data, the wind data are from the weather forecasting in the next days from the web page. In order to make reasonable early warning of distribution of algae bloom, the simulation scenarios are focus on mainly the weather conditions in the summer. The results show that the wind speed and the direction are the key factors for the algae bloom. The detailed wind forecasting is the most important factors for the early warning of the concentrations and areas of the algae bloom in the lake. The process for the early warning against algae bloom in Chaohu Lake has been recommended to the management bureau.

Impact of Changes in Environment and Climate on the Ecology of a Tropical Coastal Wetland of India

Shadananan Nair

Nansen Environmental Research Centre, India

Coastal wetlands, providers of many valuable ecosystem services face challenges associated with anthropogenic impact and global environmental changes. Impact of the changing climate exacerbates the impacts of human interference on the ecology of the Vembanad-Kol coastal wetland (declared as Globally Important Agricultural Heritage Systems by the Food and Agriculture Organization for the below sea level farming system) in the south-western part of India, making the region inhospitable to living organisms and affecting the livelihood of thousands of wetland dependent communities. This largest designated Ramsar site in India, once an excellent natural water purifier and life-supporting system, preferred nesting ground for many migratory birds, rich in many fish species and other aquatic organisms is now under increased stress from the impact of expanding population, globalisation and industrial growth, agricultural development and rapid urbanization and after all the changing climate. The ponds, wells and canals on which majority of the population depended for all domestic purposes are now highly contaminated. It is a unique wetland rich in rice cultivation, with most of the area lying nearly one metre below sea level. Cultivation was made possible by constructing dikes and pumping out water. The project to multiply rice production by controlling salinity intrusion and evacuating floodwater in the area became a total failure because of the drawbacks in design and method of operation.

Obstruction to natural flushing deteriorated the water quality and the rice production became half. Water-borne diseases spread, vectors multiplied fast and many species fish and birds disappeared. Diseases like Chikungunya, Japan Encephalitis, Dengue Fever, Diarrhea and Jaundice became common. People still abstract the same water for non-cooking purpose, as there

are no other alternatives. Skin diseases affect those who directly use the water for bathing. Illegal sand mining, water diversion and river linking, new roads for flourishing real estate business, tourism development and the new scheme for inland navigation worsen the environmental conditions. Changing climate now adds to this. Increasing seasonality and intensity of rainfall lead to fall in groundwater level and large-scale sedimentation in the wetland. Encroachment and sedimentation has already reduced the area of this wetland by 30% in the last century. Increasing frequency of floods spoils rice farming in large area. Fall in summer runoff permits salinity intrusion far inside. Change in sea level poses a serious threat to the wetlands environment, as the height of land separating the wetland and the sea is less than one metre. Sustainable management of the wetland and strategies for adaptation under a changing climate and rising sea level is essential to meet such challenges.

Implementation of policies, rules and regulations often fail because of poor and corrupt administration and vested political interference. Research project on water quality and water availability in the inland canals connected to the wetland shows that conditions can be improved by implementing inexpensive local technologies. Present study is an assessment of the impact of changes in environment and climate on the ecology of the wetland. Current policies and strategies have been critically reviewed. Suggestions for an appropriate and comprehensive policy for the wetland and a strategy for climate change adaptation have been provided.

Effect of policy change and human activity on vegetation pattern and biodiversity conservation in coastal wetlands: A case study in Yancheng, China

Zheng Zang, Xinqing Zo

School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing, Key Laboratory of Coastal and Island Development, Ministry of Education, Nanjing

Qiaochu Song, Yulong Yao, Dongju Zhang

School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing

Using the Yancheng National Nature Reserve of China as an example, this study investigated the influence of vegetation pattern in coastal wetlands vegetation responses to land-ocean interactions. Remote sensing images were used to reproduce the changes in wetland vegetation cover over the relevant years since 1987. We explored the potential impact of policy changes and human activities on vegetation restoration and biodiversity conservation in coastal wetland. The results showed that during the study period, the vegetation displayed a zonal distribution pattern in parallel with the line of latitude, whereas the wetland type changed from sea to land as bare mud flat, hosting *Spartina alterniflora*, *Suaeda glauca*, *Phragmites australis*, and constructed wetlands dominated by rice. At the landscape level, the number of patches, patch density, and mean nearest-neighbor distance gradually increased during the investigation period, while the mean patch size gradually decreased in the study area. Human activity such as changes in land use patterns resulted in the progressive development of vegetation patterns toward fragmentation, and the non-zonality (intrazonality) distribution of vegetation became more obvious in coastal wetlands. To mitigate interference from human activity on coastal wetlands, an adequate buffer zone should be reserved in coastal wetlands on the basis of the zonal distribution of the vegetation. This buffer zone will guarantee the connectivity of the landscape and the sustainability of policy, further allowing coastal

wetlands to play a positive role in global biodiversity conservation work.

The Seabirds of Tubbataha Amidst Change

Maria Retchie Pagliawan*, Angelique Songco*, Arne Jensen**, Segundo Conales Jr*, Noel Bundal*, Rowell Alarcon* and Cresencio Caranay Jr.*

*Tubbataha Management Office, **Wild Bird Club of the Philippines

The Tubbataha Reefs Natural Park (TRNP), located in the middle of Sulu Sea in the Philippines, is the last intact seabird habitat in the country. Over a hundred species of birds have been recorded, of which six are regular breeders. These are the Red-footed booby *Sula sula*, Brown booby *Sula leucogaster*, Sooty tern *Onychoprion fuscatus*, Great crested tern *Thalasseus bergii*, Brown noddy *Anous stolidus* and the Philippine endemic subspecies of Black noddy *Anous minutus worcesteri*. Since 2004, the population of these species was monitored on a regular basis. This paper presents the results of the 2017 seabird census, the changes in their population in the last 13 years, and the management interventions planned in order to conserve their population.

A total of 33,650 breeding seabirds were recorded in the park during the census in May 2017. Bird Islet hosted the majority of the population (28,280 adults), while South islet had to 5,370 adults. *T. bergii* constituted more than half of the total count (17,126 adults), the highest record for this species in the Park. The population of *A. stolidus* reached 2,670 adults, the highest record for this species since the baseline counts in 1981. *S. leucogaster* colony continued to occupy the middle of the Bird Islet, with 2,917 adults this year. The population of *O. fuscatus* decreased to 5,098 adults from 8,555 last year. One interesting occurrence this year was the early onset of egg-laying for the

O. fuscatus, which may have started in February, two months earlier compared to previous years. These four species are ground-breeders, constituting 82% of the population. This huge percentage of ground-breeders compared to the tree-nesters was likely influenced by the continuous decline in the vegetation in the two islets. The combined count for this year's tree-nesters (*S. sula* and *A. minutus worcesteri*) dropped to

5,797 adults compared to the 10,857 last year. This number is 50% less than the 5-year average count of 11,500 individuals of tree-nesters in the Park. This decline may be attributed mainly to the huge drop in the population of the Philippine endemic *A. minutus worcesteri*, which reached its lowest count (3,710 adults) since 2005 and is 54% less than its 10-year average of 8,000 adults. *S. sula* population is roughly 2,000 individuals, almost the same as last year's. Another highlight was the re-sighting of one Masked booby *Sula dactylatra*, which was first observed last year after a 21-year absence from the Park.

TRNP is being managed under a no-take policy. Despite management efforts to protect the Park and conserve its resources, the effects of both anthropogenic and natural impacts seem inevitable. Bird mortality due to entanglement in fishing lines were frequently observed. Changes in climate and local weather patterns also seem to affect the seabirds and their breeding phenology. In years when extreme El Niño occurred, *T. bergii*, *O. fuscatus* and *A. stolidus* did not return to Tubbataha to breed.

The loss of vegetation and the conflict in habitat use between the *S. Sula* and *A. minutus worcesteri* may have led to the decrease in the population of the latter. All these, coupled with the decrease in land area of both islets due to erosion, may have significantly influenced the seabird population in the Park. Management interventions to minimize the effects of these threats include regular clean-up and propagation of native plant species. Soft-engineering techniques are currently being explored to minimize erosion in the islets.

JICA Technical Cooperation Project for Biodiversity Conservation through Implementation of the Papua New Guinea Policy on Protected Area

Yukio Nagahama INTEM Consulting, Inc.,
Koji Asano NIPPON KOEI Co., Ltd.

Japan International Cooperation Agency (JICA) is currently implementing in partnership a biodiversity project with Conservation and Environment Protection Authority (CEPA), Papua New Guinea (PNG) to build institutional capacity for protected area management in PNG. CEPA-JICA Project duration is from June 2016 to June 2020. One of the outcomes of this project is to develop a model for establishing a new Marine Protected Area (MPA). Bootless Bay has been selected as the site for establishing a new MPA because of its rich biodiversity, cultural significance for the local communities and its importance for the general public.

CEPA-JICA Project is focusing on protecting the major marine habitats, including mangrove forests, seagrass beds and coral reefs, because these habitats support the rich biodiversity in Bootless Bay. Detailed GIS maps of the mangroves including the other critical habitats in Bootless Bay were developed by CEPA-JICA Project. Rapid Marine Biodiversity Survey in Bootless Bay was done in late October to November of 2016 to determine habitat distribution in Bootless Bay. Three key threats were identified from this survey; 1.) decline of fish resources, 2.) mangrove degradation, and 3.) marine debris. The results were shared with stakeholders of Bootless Bay. A roadmap to establish MPA in PNG was elaborated in December 2016, and shared with stakeholders of Bootless Bay. In the roadmap, CEPA-JICA Project did situation analysis, stakeholder analysis, problem and objective analysis. The roadmap concluded four targeted MPAs include the following: 1.) Central Papua Conference Bautama Tahira Mangrove Conservation MPA. This MPA allows for zonation include bird watching, boardwalks, mangrove conservation areas and education and research mangrove areas, 2.) University of PNG (UPNG) Tahira Mangrove Conservation MPA. This project allows

for joint collaboration with UPNG for mangrove conservation, education and research, 3.) Motupore Island MPA. This MPA allows for coral reef, sea grass and mangrove conservation for research and education purposes, and 4.) Airop (Horse Shoe) Reef MPA. This project allows for coral reef conservation and sustainable management to allow for reef fish species sustainability and coral reef conservation.

Bootless Bay Marine Conservation Initiative (BBMCI) was formulated to establish MPA and to share information regarding activities within Bootless Bay. National government, local government, NGO, local communities and private sectors have participated to BBMCI. By-law of BBMCI was approved by the members and chairperson and vice chairperson were selected in April 2017.

From field observation and from reports by local NGO, marine debris in Bootless Bay are increasing. Marine debris can cause problems to marine habitats and animals, discourage tourists, and also hazardous to hygienic safety of local communities.

Coastal clean-up event under BBMCI was carried out at Tubuseria Village water front in April 2017. More than one hundred peoples participated to the event and collected 200 plastic bags (50L) of debris in over an hour. Tubuseria community is more aware of solid waste and take up responsibilities to manage waste.

From here on, CEPA-JICA Project will prepare MPA application form based on PNG PPA, consult with stakeholders, draft MPA proposals, submit the proposal and prepare management plan of MPAs.

Recent environmental changes and benthic community response in Lake Nakaumi and the Honjo area, Japan

Kengo Kurata, Koji Seto, Estuary Research Center, Shimane University
Keiko Yamaguchi Faculty of Life and Environmental Science, Shimane University
Ryusuke Shinohara Graduate School of Life and Environmental Science, Shimane University
Takeshi Sonoda Faculty of Bioindustry, Tokyo University of Agriculture

Recent environmental changes in Lake Nakaumi and the Honjo area have been studied after the cancellation of a land reclamation and freshening project. Although there is a long-term monitoring project ongoing to study the environmental changes occurring in Lake Nakaumi and the Honjo area, this paper presents its current status and summarizes the results obtained so far.

Lake Nakaumi, which flows out to the Japan Sea through the Sakai Strait, is the fifth largest coastal brackish lake in Japan, with an area of 86 km². The halocline in the lake causes the lower layer to be hypoxic during warmer months, restricting the distribution of benthic invertebrates. The reclamation design for the Honjo area used surrounding dikes to separate the water column from Lake Nakaumi since 1981. In 2002, the local government decided that Lake Nakaumi, including the Honjo area, should remain a brackish water area; several nature restoration projects were started. In 2006, researchers started long-term monitoring projects to study the environmental changes and the benthic community response in order to examine how the nature restoration projects proceeded.

Periodic monthly samplings revealed that the biomass of several bivalve species in the Honjo area increased after the removal of the western dike, whereas those in Lake Nakaumi remained at similar levels during the same periods. Data analysis performed from May 2006 to October 2010 indicated that some of the restoration projects had indeed affected water circulation between the Honjo area and Lake Nakaumi, and that the benthic community responded to these environmental changes. The abundance of the polychaete *Pectinaria okudai* increased after the partial removal of the eastern dike, indicat-

ing that the other restoration measure had influenced the recruitment of benthic species at the stations near the dike opening. Monthly samples taken in the field from November 2010 to December 2011 should be included in further discussions. Another surveys conducted in the predetermined years (2006, 2010, 2014, 2016) investigated the spatial distribution of environmental parameters and benthic invertebrates. Several studies had suggested that the Honjo area with surrounding dikes showed weak or no halocline and provided suitable habitats for bivalves such as *Arcuatula senhousia*. However, the distribution of this species in the Honjo area was restricted to the shallower zones in the summer 2006 samples.

After the partial removal of the eastern dike, surveys conducted in 2010 and 2014 indicated either that relatively higher concentrations of dissolved oxygen could be detected in the of lower layer water samples, or that several bivalve species could be found in stations near the dike opening. Seawater flowing into the Honjo area through the opening improved the bottom sediment habitats, but the range of this effect was apparently limited to adjacent areas. The results of the 2016 survey indicated that the spatial distribution of benthic invertebrates in the summer showed restricted habitats both in Lake Nakaumi and the Honjo area. Most of the habitats in Lake Nakaumi and the Honjo area were below the halocline, resulting in severe hypoxic conditions as evidenced by the dissolved oxygen concentrations. These summer conditions had also been reported in the lower layer in Lake Nakaumi before the reclamation project, as well as in periods before the nature restoration projects.

Our approaches on the monitoring of wetlands' biodiversity for environmental conservation

Misuzu Aoki, Syou Kato, Taiki Ito, Tomomi Yamashita and Kenich Yokoi
Wetlands International Japan

The rapid environmental deterioration of wetlands such as lakes, mires, marshes, and tidal flats is a critical threat to the plants and animals that inhabit them. This problem is also affecting our lives because the activities of plants and animals in wetlands bring us various benefits: for example ecosystem services. Therefore, it is very important to conserve the environments of wetlands and to use them in a sustainable way ("wise use"). In order to receive the wetlands' benefits continuously in the future, gathering and accumulation of data on their biodiversity is a strong pre-requisite. Understanding the current condition of the wetlands is important for us, but it is difficult to say if we have the necessary amount of relevant information.

Wetlands International Japan (WIJ) is conducting a wide range of activities and projects aimed at promoting the conservation of wetlands and wise use of them. In particular, we are working to gather and organize basic information on the biodiversity of wetlands and objectively comprehend the current state of wetlands. In this presentation, we will introduce an in-progress monitoring project that is aimed at obtaining basic information on the biodiversity of wetlands.

In 2003, The Ministry of the Environment of Japan launched a long-term ecosystem monitoring project called "Monitoring Sites 1000 Project," based on the Second National Biodiversity Strategy of Japan. This ongoing project aims to detect qualitative or quantitative changes in various ecosystems, such as alpine zones, forests, "satoyama," inland waters, and coastal regions, in the Japanese archipelago. This project is established at over 1000 investigation sites, and we will continue to conduct the survey for a period of 100 years.

As a part of this project, we are involved in ecosystem surveys that cover the coastal regions (rocky shores, tidal flats, seagrass

beds, and algal beds) and the inland waters (lakes, mires, and marshes), with the objective of biodiversity monitoring in these wetlands. The surveys in coastal regions and inland waters have been conducted for about 10 years, using both qualitative and quantitative methods for assessing biodiversity. The data obtained in the project are published on the webpage of the Ministry of the Environment Japan. It is expected to be used for analyzing long-term fluctuations of biota or flora in each of the studied regions, and the elucidation of the factors behind such fluctuations, as data accumulate in the future. In addition, novel information on the invasion of alien species and on the occurrence of endangered species can be obtained. It is expected that this data will be utilized for planning the conservation measures undertaken by administrative organizations, such as preventive measures for alien species, the protection of endangered species, and assignment of red-list species. Furthermore, the part of data obtained from the surveys in the coastal regions will be shared through two global-scale database systems, the Ocean Biogeographic Information System (OBIS) and the Global Biodiversity Information Facility (GBIF), to help elucidate the long-term fluctuations of biota and flora on a global scale. On the regional scale, the data on biota and flora are also used to meet the criteria for registration with the Ramsar Convention, thus directly contributing to the conservation of wetlands.

Recent environmental changes and benthic community response in Lake Nakaumi and the Honjo area, Japan

Kengo Kurata, Koji Seto, Estuary Research Center, Shimane University

Keiko Yamaguchi Faculty of Life and Environmental Science, Shimane University

Ryusuke Shinohara Graduate School of Life and Environmental Science, Shimane University

Takeshi Sonoda Faculty of Bioindustry, Tokyo University of Agriculture

Recent environmental changes in Lake Nakaumi and the Honjo area have been studied after the cancellation of a land reclamation and freshening project. Although there is a long-term monitoring project ongoing to study the environmental changes occurring in Lake Nakaumi and the Honjo area, this paper presents its current status and summarizes the results obtained so far.

Lake Nakaumi, which flows out to the Japan Sea through the Sakai Strait, is the fifth largest coastal brackish lake in Japan, with an area of 86 km². The halocline in the lake causes the lower layer to be hypoxic during warmer months, restricting the distribution of benthic invertebrates. The reclamation design for the Honjo area used surrounding dikes to separate the water column from Lake Nakaumi since 1981. In 2002, the local government decided that Lake Nakaumi, including the Honjo area, should remain a brackish water area; several nature restoration projects were started. In 2006, researchers started long-term monitoring projects to study the environmental changes and the benthic community response in order to examine how the nature restoration projects proceeded.

Periodic monthly samplings revealed that the biomass of several bivalve species in the Honjo area increased after the removal of the western dike, whereas those in Lake Nakaumi remained at similar levels during the same periods. Data analysis performed from May 2006 to October 2010 indicated that some of the restoration projects had indeed affected water circulation between the Honjo area and Lake Nakaumi, and that the benthic community responded to these environmental changes. The abundance of the polychaete *Pectinaria okudai* increased after the partial removal of the eastern dike, indicat-

ing that the other restoration measure had influenced the recruitment of benthic species at the stations near the dike opening. Monthly samples taken in the field from November 2010 to December 2011 should be included in further discussions. Another surveys conducted in the predetermined years (2006, 2010, 2014, 2016) investigated the spatial distribution of environmental parameters and benthic invertebrates. Several studies had suggested that the Honjo area with surrounding dikes showed weak or no halocline and provided suitable habitats for bivalves such as *Arcuatula senhousia*. However, the distribution of this species in the Honjo area was restricted to the shallower zones in the summer 2006 samples.

After the partial removal of the eastern dike, surveys conducted in 2010 and 2014 indicated either that relatively higher concentrations of dissolved oxygen could be detected in the of lower layer water samples, or that several bivalve species could be found in stations near the dike opening. Seawater flowing into the Honjo area through the opening improved the bottom sediment habitats, but the range of this effect was apparently limited to adjacent areas. The results of the 2016 survey indicated that the spatial distribution of benthic invertebrates in the summer showed restricted habitats both in Lake Nakaumi and the Honjo area. Most of the habitats in Lake Nakaumi and the Honjo area were below the halocline, resulting in severe hypoxic conditions as evidenced by the dissolved oxygen concentrations. These summer conditions had also been reported in the lower layer in Lake Nakaumi before the reclamation project, as well as in periods before the nature restoration projects.

Envisaging the Wetlands Degradation due to poor management practices in Bentota Area Sri Lanka

Ranjana UK Piyadasa Department of Geography, University of Colombo

Gayani Ranasinghe Department of Town and Country Planning, University of Moratuwa

This study was conducted to identify paddy lands convert into saline wetlands in Bentota, Sri Lanka considering climate change impacts and salt water intrusion scenarios. This area involved a very high risk for paddy cultivation due to saline water intrusion during dry periods and heavy floods occurred. Therefore, the land use patterns in coastal areas cannot be continued for a long time due to the fluctuation of salinity levels and environmental changes. Land degradation due to salinization refers to reduction in the ability of the soil to perform a range of productive, environmental and habitat functions. Paddy lands are severely vulnerable to saline deposition and fail of paddy production which will lead to land degradation at the end. This study was conducted to envisage the amount of paddy land degradation in Bentota Divisional Secretariat Division considering climate change impacts and salt water intrusion scenarios. This area involved a very high risk for paddy cultivation due to saline water intrusion during dry periods and heavy floods occurred. Land use and land cover change of this area during the period from year 1983 to 2013 was explored considering the available land use data. Time series analyses on temperature and rainfall data were performed to identify climate change trends in the area. Temporal and Spatial variation of six physicochemical parameters such as pH, electrical conductivity EC, total dissolve solids TDS, Cl⁻, SO₄²⁻ and NO₃⁻ of selected dug wells, all surface water bodies and soil parameters such as EC, pH, moisture content and color were measured to detect the magnitude of the salinity due to seawater intrusion during July to December 2016. Systematic sampling method was used to select the ground water and soil sampling locations following the 23 midpoints of 2x2km grids. Arc GIS tool was applied to show the spatial distribution of parameters. The

study revealed that 245 hectares of paddy lands out of the 2524 hectares of cultivated paddy lands were in 1983 has been cultivated in year 2013 while 1385 hectares of paddy lands currently degraded. Tea and Cinnamon lands have been emerged while reducing Rubber and Coconut lands in the area. Extents of Marshes, Scrubs and Grass lands have been gradually increased during last 30 years. Time series analyses indicate that monthly mean temperature and maximum daily rainfall had a general increasing trend whereas, total monthly rainfall and total annual rainfall showed a general decreasing trend in Bentota area. It was indicated relatively high rainfall situations during May and October while low rainfall situations during January, February and July, August. Highest value range of all parameters that indicates high salinity level in ground water, surface water and soil were found near to the estuary of Bentota River, Dedduwa Lake and Coastal belt while the wells located in inland part of the region, 4-5km from coastal belt and River indicating lowest value range in all parameters that indicates no salinity conditions.

This situation was severe during July and August and will be more severe during January and February in every year since area is having lowest or no rainfall during that period. Decreasing trend of total monthly rainfall and total annual rainfall and sea level rise effects will be further upraised this issue even in future too. Decision makers and agriculture industry should find ways for enhancing land productivity of those abundant paddy lands to uplift the livelihood of the community and farmers who live in this area and upgrade the contribution for the National economy of Sri Lanka.

Wetland Conservation Action by Government and NGOs in Bangladesh and Future Course of Action

Tapas Ranjan Chakraborty Department of Environmental Sciences-Jahangirnagar University
Sanowar Hossain Bangladesh POUISH

Around 50% of the area of Bangladesh is wetlands; 13 types of natural wetlands are found in the country. The socio-economic and cultural state of the country are wetland based, it is believed that all most all traditional livelihoods of the country is wetland dependent. Natural resources of the wetlands were harvested by the community as common property resources. As there was over harvesting and rapid degradation of the wetland and its natural resources from 80s government and development actors started initiating the resource management intervention. For different wetlands some attempts were taken, which can be classified in to two major types, (1) Disaster management action and (2) Biodiversity conservation action. In most cases the planning process was participatory and the implementation was done as project intervention. Stakeholder diversity, local power structure and geo-limitations were the main challenges of participatory resource management of the wetland. The conservation interventions by government and development organizations have created model of community based management. In some projects the population growth of species was around double. The tools of Participatory Action Plan Development, Participatory Capacity and Vulnerability Assessment and Community Risk Assessment were participatory process of conversation planning and action. Beside the national Laws, the country is signatory of CBD, Ramsar, CITES, CMS, etc. Tanguar haor is one of two Ramsar sites in Bangladesh. Every winter about 60 species of migratory birds visit Tanguar Haor. Climate change is a threat to wetland and its natural resources, climate change vulnerabilities are contributing to additional challenges of natural resource management of the wetlands. Action to cope with climate change was mostly on livelihood adaptation; for wetlands Ecosystem based Adaptation was recommended. Rapid urbanization and habitat

fragmentation are being causing risk to resource management. In Bangladesh many wetlands are subject to trans-boundary management. Fifty four rivers of the country are trans-boundary. Fish migration path is intercepted by embankment and other barriers in catchment and in up-stream. There are a few interventions for the trans-boundary wetlands but major challenge is political commitment. In order to address the human needs in the changing climate and rapid urbanization community-based adaptation and climate smart development are essential for every wetland. Therefore, Bangladesh now needs a comprehensive strategy combining political, economic, social, and technological approaches considering environmental and climate change adaptation challenges to manage the natural resources in the wetlands. Climate change adaptation in wetland ecosystem should be incorporated into a system of integrated land and water use and, indeed, into the socioeconomic system of the country. Policies, strategies, and management plans for sustainable use and conservation of wetlands of Bangladesh must be based on solid knowledge and understanding of their ecological and socioeconomic functions and processes and the newly added crisis. The outcome of the conservation actions by Government and NGOs on wetland and resource management has been studied in Medir Haor, Hakaluki Haor and Tanguar Haor from July 2014 to June 2016. The present paper aims to identify the management challenges of conservation action and the sustainability requirements in the wetlands and also try to draw a comparative analysis if legislative status of a wetland helps in community based participatory management.

Sungei Buloh Wetland Reserve

Choon Beng How
National Parks Board

Sungei Buloh was first opened as a Nature Park in 1993 and by 2002, 130 hectares were officially gazetted as a Nature Reserve and renamed Sungei Buloh Wetland Reserve. In the same year, it was recognised as a site of international importance for migratory birds and awarded a certificate by Wetlands International, marking the reserve's formal entry into the East Asian Australasian Shorebird Site Network. In 2003, Sungei Buloh Wetland Reserve became Singapore's first ASEAN Heritage Park.

Singapore's National Parks Board (NParks) manages SBWR with a multi-pronged approach - conservation, education, research and nature-based recreation. While wetlands provide a plethora of ecosystem services, it is increasingly critical to focus on socio-ecological aspect, with developmental pressures and the rise of the green sustainability movement. People, remains the foci of conservation success. NParks recognises the importance of effectively engaging different stakeholders which are key to the long term conservation of the wetland reserve. It does so through a variety of programmes tailored specifically to each group, including schools, non-governmental organisations and corporate organisations.

Tucked away in the northwest corner of a highly-urbanised island, SBWR has been fitted sensitively with boardwalks, trails and bird-watching hides to bring city-dwellers closer to nature sensitively without disturbing wildlife. Information boards with species identification guides and explanatory diagrams complement trails for self-guided walks. Visitors may also choose to participate in guided walks by volunteers, prawn harvesting demonstrations, photography and birdwatching workshops and nature camps for children. The activities organised for the general public are designed to be highly interactive, and are aimed at further increasing awareness of the wetlands, the ecosystems within and how the community can do their part to conserve

them. Those who prefer to have to have a first-hand encounter with the wetlands and do not mind getting their hands and feet dirty can volunteer in mangrove salvaging, habitat restoration, coastal clean-ups and biodiversity surveys. Through engaging activities like these, participants feel closer to nature and better appreciate, thus grows a need to protect it. The team at SBWR is supported strongly by a network of committed volunteers. Some of the volunteer activities include leading guided walks, conducting workshops and contributing to wildlife surveys. The NParks website and mailing list updates act as our portal for communicating and publicizing outreach activities and events to public and volunteers.

In 2008 the draft Sungei Buloh Master Plan was unveiled, demarcating fringe areas around the Reserve that would help to reduce the pressure on it due to increased visitorship. This is in alignment with the Master Plan's three strategic thrusts of ensuring a living wetland, encouraging bio-learning and enhancing the reserve as a destination with a difference. This new Sungei Buloh extension with its nature trails and visitor centre is the result of phase 2 of the Master Plan, and will allow visitors to continue enjoying the wetlands while also allowing the existing parts of Sungei Buloh to be a more tranquil sanctuary for wildlife. The new 31-hectare extension opened in 2015, harbouring rich mangrove and coastal forests, which are home to diverse species of fauna such as crabs and mudskippers and complements the habitats in the wetland reserve. With the opening of the new visitor centre, new programmes and guided walks are offered, increasing the suite of new outdoor recreational and educational options to our visitors. It also hosts a new gallery, classrooms and laboratories, augmenting the programmes and interpreters throughout the reserve.

The observations of the landscape of Yaoundé political capital of Cameroon, highlight the presence of numerous wetlands of variable surfaces that concentrate a rich and unique diversity but also fragile and play multiple roles for the daily life of the populations including the contribution to the maintenance of the local equilibrium Climate control, urban water regulation, wastewater treatment, and flood reduction regularly caused by abrupt rains associated with the current climate change. They also serve as garbage dumps for households located in the vicinity and weaned from the collection of refuse by the public services. It is still the dormitory of the children of the street and the space of withdrawal of the gangsters after any package.

Only today, through the opposing codes, these circles are modeled by two groups of actors in particular the poor households and the public authorities represented by the urban community or the boroughs of the boroughs The first actors who have occasionally come from the countryside do not have permanent employment, regular remuneration or work in the informal sector, which includes auctioning, driving "taxi motorcycles", holding call boxes defined as The sale on the pavement of retail telephone credits on behalf of mobile phone companies, the manufacture of cinder blocks, the holding of makeshift restaurants etc. The practice of these low-level activities exposes them to complex precariousness. Thus, they show a large deficit of access to food resources. They struggle to get drinking water. They have a limited capacity to acquire viable, reliable and secure land for the construction of decent housing among others. Their quality of life can only be improved by exploiting the useless wet spaces. They build housing in unstable and unsustainable materials and carry out activities such as agriculture, pig, poultry and ruminant farming, the products of which are often consumed and sold to wealthy households. The money collected is reinvested in

the acquisition of goods and services and to deal with other economic and social consequences.

The second actors, in particular the administrative departments, whose urban communities, borough councils and the Ministry of Urban Development and Habitat are investing wetlands through other codes. Thus, their interest in wetlands is to rehabilitate them. At the end of this period, these places become viable, secured and constituted in ecotourism area which welcomes the national and foreign tourists passing through the political city of Cameroon.

The introduction of eco-tourism areas has considerable advantages, such as those resulting from the agropastoral practices of the poor. One can at the end obtain a new landscape of wet spaces materialized by uniform types of crops, the eucalyptus plants that create a pleasant micro-climate for the stroll of the city dwellers especially during heatwaves. Artificial water jets where children and the elderly cool off or play games. They also become places where friends and intimate friends meet to celebrate birthdays, picnic, take photo shoots.

Study on flood control effect of rainwater tank with small hole and creation of wetland habitat in urban area

Teruki Hamada, Yukihiko Shimatani, Ryoichi Watanabe, Jun Teramura, Tomoki Takebayashi, Fumiko Taura
Japan society of civil engineers

Generally in Japan, the traditional management of stormwater quickly into the sewer and discharging it to the river is done, but in this urbanized area where the sewer has developed, the peak flow rate of the river is increased and urban flood damage causing. The method we propose temporarily shuts off from the sewer network and expects that peak flow of river and sewage will decrease by shifting the time to release. Also, the water discharged from the rain water tank will be caught and held in the rain garden and stormwater wetland located downstream. These are expected to suppress the heat island phenomenon, improve the landscape, create a wetland habitats. The experimental facilities consists of rainwater tank, rain garden, stormwater wetland.

Installation of the rainwater tank completed in November of 2016, water level in the tank and rainfall are observed. Rain garden, stormwater wetland are under construction at present. 1) rainwater tank with small hole The noteworthy point of the rainwater tank with a hole is that it can automatically separate the flood control capacity and water use capacity by making a hole in the side wall of the tank. The hole in the side wall is located 24 cm from the bottom of the tank and the valve is attached. The opening degree is adjusted so that the outflow amount becomes a maximum of 59mm/h according to the water level. 59mm/h is the capacity of the existing public sewer system, which means the allowable discharge amount. The size of the tank is 11.1 m² in area and the height of the tank is 60cm. The flood capacity is 3.8m³. The inflowing roof area is 41.2m². 2) rain garden The area of the rain garden is 20m² and the condition before construction is a pond covered with concrete. Also, because the soil conditions are extremely low in infiltration rate, concrete is not removed and roofgarden is assumed. Similarly to the rainwater tank, it was assumed that the outflow of 59mm/h was permitted, the inflow

and the rain falling on the spot were temporarily stored as an area of 20m² and a artificial soil thickness of 40cm (assuming a effective porosity value of 40%). 3) stormwater wetland The bottom of the stormwater wetland is the lowest, so the groundwater level is higher than the bottom of the pond. In this pond, in order to maintain the condition that the rainwater is flooded all the time, consider the drying cycle of the soil, the frequency of rain, etc, and have a structure that can adjust the height of the hole. Since the rainwater tank has been installed and has not experienced a full rainy season and there is not yet rain enough to cause flooding, the effect will be verified in the future. In the case of small rain, the water level in the tank rose with 5.8mm rain in 10 minutes, and a storage effect such as gentle drop was observed. Creating a habitat is expected by catching rain temporarily in the garden of the house without sending rain directly to the sewer. Both the rain garden and stormwater wetland are currently in the design stage, but we plan to carry out construction and conduct hydrological investigation such as flood period and frequency. At the same time, we will select vegetation and accumulate knowledge on the creation and maintenance of urban wetland habitat.

A Case Study of Rainwater Society Initiative Projects that Promotes De-Centralized Water Management Systems

Fumiko Taura, Yukihiro Shimatani, Sampei Yamashita, Ryoichi Watanabe, Mayumi Fukunaga, Toshiyuki Moriyama, Tomoko Minagawa, Tomoyasu Yoshitomi

Kyushu University Faculty of Engineering, Kyushu University Faculty of Engineering, Kyushu Sangyo University Faculty of Engineering, Fukuoka University Faculty of Engineering, The University of Tokyo Graduate School of Frontier Sciences, Fukuoka Institute of Technology Faculty of Social and Environmental Studies, Kumamoto University Faculty of Advanced Science and Technology, Tokyo Gakugei University Field Studies Institute for Environmental Education

Introduction:

Changes of land uses by rapid urbanization also change the way of rainwater discharge management system and cause an urban stormwater disaster. Meanwhile, a situation of water shortage by a natural disaster such as the drought climate and the earthquake frequently occurs. It is also social problems that for dealing with urban stormwater disaster, one solution is to construct huge-size water management infrastructure, however its operation and maintenance cost is significant and municipal financial resource is going to be shrink due to population decrease.

Due to feature of the current rainwater management system that bury rainwater pipes into the ground, people cannot recognize how rainwater discharge through their living environment, therefore it makes difficult to evoke people's interest and understanding about the better rainwater management system. In the meantime, de-centralized, self-sustained, and resilient water management sub-system that focuses on rainwater harvesting, storage and infiltration, is visible and possible to be maintained by various community members.

The challenge here is how to promote this sub-system by reliable element technologies of stormwater management and by involving various stakeholders including local municipals, active community groups as well as other citizens.

Research objectives and processes:

The objective of this research is to report multi-faceted and multi-layered projects that promote de-centralized water management system done by author's group in Hiikawa watershed region. Not only for Hiikawa watershed, but other regions should face the challenge of establishing sustainable water management system.

The authors group established a research group named "LRwS - Labs for Rainwater Society" in 2015 and focused on Hiikawa watershed region as a research field. LRwS defines "Rainwater Society" as a society that under the de-centralized water management system, multi-gen-

erational people cooperate to store, infiltrate, and harvest rainwater and increase green spaces at everywhere in a watershed region.

Focusing on water which feature is multi-faceted, LRwS envisions Rainwater Society as a model of modern social problem-solution method. Rainwater Society should be continually transformed and improved by multi-generational co-creation. For promoting Rainwater Society, LRwS conducts multi-faceted and multi-layered projects based on three goals; (1) to practice multi-generational co-creation, (2) to design sustainable region with the development of element technology of stormwater management, (3) to establish a community network that connects various stakeholders relate to Rainwater Society.

- (1) To practice multi-generational co-creation includes to find region's social problems, to work on problems, and to educate and spread the concept of Rainwater Society among people.
- (2) The development of element technology of stormwater management includes to invent rainwater tank that combines flood control function, and to invent handy tool to measure soil infiltration capability. Case studies of implementing technology of rainwater runoff reduction and harvesting based on building-types.
- (3) To establish a community network includes an event named "Kam-pa by a river" and rainwater design workshops.

Conclusions:

The author concluded that multi-faceted and multi-layered projects triggered that affected people in other watershed region started their own activities of stormwater management as well as a foundation of new citizen group in Hiikawa region. These outcomes were unexpected-important results. Following subjects are needed to be continued; (1) develops of element technologies of stormwater management with additional facility installment by try-and-error method, (2) establishes a community network that cover Hiikawa watershed region, (3) organizes a core member's group to promote more projects towards establishing rainwater society.

Preparation of Lake Conservation Management Plan for Sustainable Tourism in Gaidahawa Lake, Lowland Nepal

Lanka Bahadur Shahi, Prava Pandey

National Lake Conservation Development Committee, Ministry of Culture, Tourism and Civil Aviation, Government of Nepal

Gaidahawa Lake (GL) is a freshwater perennial water body of 28.5 ha with greater than 34560 ha basin area in Bishnupura, Rudrapur and Suryapura VDCs of Rupandehi district, Nepal which is very close to the Lumbini World Heritage Site, the birth place of the Lord Buddha.

The land inhabits a human population of 20,951 populations in 3,120 households. Yet, lake area has been subjected to the natural succession and encroachment by hill migrants of 80 households within 100 m perimeter of lake with 4.7 as an average household's size. Senior citizens claim that water body of GL used to be greater than 80 ha in the past.

Lake Basin represents subtropical climate with 3 distinct noticeable seasons such as hot/dry, monsoon and cool/dry. Lake water is non-arsenic, slightly alkaline and coliform contaminated. All physical & chemical parameters are within reference of the National Drinking Water Quality Standard and comply with prevailing national guidelines for irrigation, aquaculture, livestock watering and recreation.

The lake is rich in biodiversity with 134 species of plant including 6 species of plants and endemic Indian-eyed Turtle *Morenia petersi*, vulnerable in IUCN Red List, more than 26 species of herpetofauna, 17 species of mammals, 95 species of birds and 7 species of exotic fishes.

Since many years political leaders and communities preferred for a huge potential of GL area for tourism as well as contribute to the bio-physical surrounding of the Lumbini. The area deserves as next immediate destination choice for those visiting to the Lumbini. However, assessment study indicates that Lake Basin environment is under tremendous human pressure that results to narrow lake area, degraded water quality and high uncertainty of Lake Environment. Therefore, National Lake Conservation Development Committee endeavored to assess and prepare a broader intervention plan of Gaidahawa Lake in the framework of International Lake Basin Man-

agement (ILBM) approach with keen interest of communities that indeed boost up to tourism, biodiversity and livelihoods.

This plan has explored activities in 4 components such as 1) Lake Basin Governance, 2) Lake Basin Environment, 3) Lake Tourism & Livelihoods, and 4) Lake Basin Management Capacity. 1st component delivers semi-governmental institution to execute plan to restore 2nd component 'Lake Basin Environment' and 3rd component 'Lake Tourism & Livelihoods'. For all these, 4th component 'Lake Basin Management Capacity' builds technical, managerial and financial strength of institution and communities to integrate basin environment to tourism, biodiversity and livelihoods.

The plan consists of 71 major activities and sub-activities mostly within 5 years, and delivers 5 outcomes. 1st outcome keeps Lake Basin governance in place. 2nd outcome delivers appropriate basin environment for biodiversity, tourism and livelihoods. 3rd outcome delivers for tourism infrastructure facilities. 4th outcome provides NR based climate resilient income opportunities to disadvantages groups and other households, and places 4 micro enterprises all following conservation codes including benefit sharing mechanism. 5th outcome brings different stakeholders for lake conservation and participatory performance monitoring including 1 model school evolved in demonstrating lake awareness.

A total of NRs. 659, 129 thousands is required to implement the plan in which about 1.4% for lake basin governance, about 50% for restoring basin environment, about 4% is used for administrative cost and about 43% for creating tourism infrastructure which mutually enhances climate resilient livelihoods and contribute to employment opportunity that ultimately meet the poverty reduction strategy of Government of Nepal.

Lake Danao of San Francisco, Cebu, Philippines as titlist of clean and green lake: its development, problems and prospects

Serapion N. Tanduyan, Berenice T. Andriano and Ricardo B. Gonzaga
Cebu Technological University, San Francisco, Cebu Campus

Lake Danao is a 649 ha lake located at the municipality San Francisco, Cebu. Lake Danao of San Francisco, Cebu was judged as one of the cleanest and greenest lakes of the Philippines under the Gawad ng Pangulo sa Kapaligiran Lake Category because Lake Danao as nature's gifts to the inhabitants of San Francisco was cared by the people as a sign of people's love of nature. That is why its development, problems encountered and the plans of the Local Government were considered.

Interview guide and actual field visit of the lake were used to gather data from the different agencies of the government in Pacijan Island, LGU officials and the fisher folks.

Results show that the Lake Danao really meets the criteria of the national lake contest for its clean water and its environment has luxurious growth of plants around it. It is free from garbage waste and pollutants. Its award include Plaque of Distinction - Cleanest lake (Cebu Province); Award of Recognition- Cleanest Lake of Region VII; Presidential Award of Excellence as National Finalist- Search for the Cleanest Inland Bodies of Water Provincial Winner; Cleanest Inland Bodies of Water Presidential Award of Excellence; 1st runner up Search for the Cleanest Inland Bodies of Water throughout the Philippines and Presidential Award of Excellence- 2nd runner up Search for the Cleanest Inland Bodies of Water still on the entire country level.

The lake supplies water to the rice fields in Sitio Danao and Patabog. Its shoreline ranges from rocky to soft mud. The type of soil is coarse, silty and sandy. The depth of the water ranges from 27-290C. Water has a pH of 8.5-9.0. Salinity ranges from 0-0.5 ppt. The lake water is free from pollutants, except for some allochthonous materials (Station Profile of Carmen Lake Danao

Fishery Complex/Research Station for Freshwater Fisheries Development Zone, Union, San Francisco, Cebu. 1995). It has no definite inlet and outlet, but it is presumed that a subterranean spring supplies water to the lake. Assorted vegetation such as hydrilla, water lily, water hyacinth, and kangkong "Ipomaea aquatica are found in the lake. "Suli-suli" palawan nipa and coconuts grow along the periphery of the lake

Washing and bathing are now prohibited in the lake and no motorboats allowed but only the paddle boats. Two parks are established in the lake namely: the Green Lake Park and the Lake Danao Park and an eco trail was constructed around the lake for additional attraction.

Results further shows that aside from the local tourists visiting Lake Danao foreigners from Canada, Germany West, Hong-kong, Indonesia, Italy, South Korea, Malaysia, Saudi Arabia, Switzerland, Taiwan, United Kingdom, USA and balikbayan also visited the lake.

Problems encountered were lack of personnel's training to manage the lake, people's negative reactions to the different lake regulations and ordinances and lack of funds. The LGU, the BFAR, DA and DENR and the Cebu Technological University and other agencies collaborated to make and implement plans for the preservation of the Lake Danao.

The impact of wetland conservation around tourism protected areas.

A case of kashaasha wetland around bwindi impenetrable national park in south western Uganda

Nathan Justice Gahungu Makuregye
Wetlands international

Kashaasha wetland is located in the southern sector of Bwindi Impenetrable National Park (BINP). The wetland is located in the southern Sector of Bwindi Impenetrable national park in Rubuguri Parish, Kirundo Sub County, Bufumbira North County, Kisoro district. The wetland which is approximately 12 Km long and 1 Km width. It is adjacent to Bwindi Impenetrable National Park (BINP), has got high conservation values. Bwindi Impenetrable National park is number one tourism foreign exchange earner for Uganda as result of Gorilla Tourism. BINP is a UNESCO World Heritage Site due to its ecological importance. Unlike other parts of BINP, where adjacent communities are allowed resource access, communities in the southern sector of BINP have been denied access due to the presence of seven Gorilla groups that has made this area a high tourism area. Degrading and encroachment on Kashaasha wetland increases the risk of encroachment and poaching of BINP. The wetland supports 2,700 Batwa indigenous people with raw materials for crafts making. Batwa were evicted from BINP and the Mgahinga Gorilla National Park in 1991, with the main aim of protecting mountain Gorillas. Cutting this forest will further impoverish the Batwa and other communities hence exacerbating Human Wildlife conflict

Conservation of 12 Kilometer long Kashaasha wetland by the community was identified as one of the main key contributions to collaborative management of BINP and addressing human wildlife conflict. Kashaasha is a great water catchment area providing the local communities, Batwa indigenous peoples, tourism lodges and Rubuguri town council with clean water. Kashaasha acts as water shed to water streams that provide water to community members. These streams also drain into lake Mutanda which provides water and fish to the district

The wetland further inevitably influences ecosystem services and livelihoods for local communities and Batwa indigenous peoples that were previously dependent on BINP before it was gazette in 1991. The studies aimed at finding out the impact Kashaasha Wetland conservation on the conservation of Bwindi national park and ascertain the wetland conservation mechanisms being put in place by communities as a means of promoting sustainable tourism.

The findings indicated that due to climate change and anthropogenic activities the swamp had started experiencing degradation leading to further encroachment on BINP. The study noted that in 1990, the swamp had reduced in size by 30% due to climate change and agriculture. This threatened the wellbeing of people who originally depended on it for ecological governance purposes and as well as threatening its role as an alternative livelihood source of products to Bwindi Impenetrable National Park.

Communities have since conserved the wetland. The agriculture in the wetland has been abandoned in favour of using the wetland as per the Uganda's National Policy for the Conservation and Management of Wetland Resources that seeks to promote the protection of Uganda's wetlands in order to sustain their ecological and socioeconomic functions. The study however noted that the wetland size continues to reduce due to climate change. Although people's livelihood on swamp has been affected, there is still good will for people to support conservation of Kashaasha wetland by enhancing formulation of bi-laws in conservation of wetlands hence promoting sustainable tourism around Bwindi Impenetrable National Park in Uganda.

Kashaasha wetland is located in the southern sector of Bwindi Impenetrable National Park (BINP). The wetland is located in the southern Sector of Bwindi Impenetrable national park in Rubuguri Parish, Kirundo Sub County, Bufumbira North County, Kisoro district. The wetland which is approximately 12Km long and 1Km width. It is adjacent to Bwindi Impenetrable National Park (BINP), has got high conservation values. Bwindi Impenetrable National park is number one tourism foreign exchange earner for Uganda as result of Gorilla Tourism. BINP is a UNESCO World Heritage Site due to its ecological importance. Unlike other parts of BINP, where adjacent communities are allowed resource access, communities in the southern sector of BINP have been denied access due to the presence of seven Gorilla groups that has made this area a high tourism area. Degrading and encroachment on Kashaasha wetland increases the risk of encroachment and poaching of BINP. The wetland supports 2,700 Batwa indigenous people with raw materials for crafts making. Batwa were evicted from BINP and the Mgahinga Gorilla National Park in 1991, with the main aim of protecting mountain Gorillas. Cutting this forest will further impoverish the Batwa and other communities hence exacerbating Human Wildlife conflict

Conservation of 12 Kilometer long Kashaasha wetland by the community was identified as one of the main key contributions to collaborative management of BINP and addressing human wildlife conflict. Kashaasha is a great water catchment area providing the local communities, Batwa indigenous peoples, tourism lodges and Rubuguri town council with clean water. Kashaasha acts as water shed to water streams that provide water to community members. These streams also drain into lake Mutanda which provides water and fish to the district

The wetland further inevitably influences ecosystem services

and livelihoods for local communities and Batwa indigenous peoples that were previously dependent on BINP before it was gazetted in 1991. The studies aimed at finding out the impact Kashaasha Wetland conservation on the conservation of Bwindi national park and ascertain the wetland conservation mechanisms being put in place by communities as a means of promoting sustainable tourism.

The findings indicated that due to climate change and anthropogenic activities the swamp had started experiencing degradation leading to further encroachment on BINP. The study noted that in 1990, the swamp had reduced in size by 30% due to climate change and agriculture. This threatened the wellbeing of people who originally depended on it for ecological governance purposes and as well as threatening its role as an alternative livelihood source of products to Bwindi Impenetrable National Park.

Communities have since conserved the wetland. The agriculture in the wetland has been abandoned in favour of using the wetland as per the Uganda's National Policy for the Conservation and Management of Wetland Resources that seeks to promote the protection of Uganda's wetlands in order to sustain their ecological and socioeconomic functions. The study however noted that the wetland size continues to reduce due to climate change. Although people's livelihood on swamp has been affected, there is still good will for people to support conservation of Kashaasha wetland by enhancing formulation of bi-laws in conservation of wetlands hence promoting sustainable tourism around Bwindi Impenetrable National Park in Uganda.

Study of evaluation of traditional dry-stone revetment

Eriko Takeuchi, Hironori Hayashi, Yukihiro Shimatani
Faculty of Engineering, Kyushu University

This study aims to investigate the strength of the traditional stone masonry revetment without concrete in river.

The dry-stone revetment, which is a traditional works' method without using concrete, had been used for a long time as a river bank protection in Japan until the concrete river bank protection method and the mortar stone masonry revetment have been popularized. The dry-stone revetment is a combined structure of complex materials filled with small stones behind large stones on the surface. Therefore, it does not block the groundwater from the ground behind the river bank protection, so it is known that plants grow abundantly between stones and functions as a landscape or as a habitat for living things.

However, it is not used as a river bank protection in recent years, or it cannot use even if we want to use it, because skill is necessary and there is no knowledge on strength, although the dry-stone revetment has considerable strength. And furthermore, in recent years, examples of restoration of rivers consolidated by concrete and examples of river improvement considering the environment are increasing, so it is a problem to clarify the strength of the traditional dry-stone revetment.

Therefore, in order to investigate the strength of the dry-stone revetment in the river, this study conducted the following research.

We reviewed the design guidelines and studies of stability of revetment in road and river field. There are no detailed design standards for dry-stone revetment of rivers.

Understanding the structure of the traditional dry-stone revetment in the river, the field surveys are conducted. In the field survey, we grasp some important elements of dry-stone revetment, slope gradient, height, size of stones and ways of stacking stones. Based on the results of the field survey, we set up the hydraulic model experiment.

It is important for the structure of the dry-stone revetment to engage the built stones each other.

The hydraulic model tests are conducted to clarify dry-stone revetment strength against the flow. Variables of these experiments were flow rate, size of the stone, method of stacking stones and thickness of the backfill. The method of stacking stones, which is one of the variables, was used three types. Three types of them, the stacking-flat, the form of a valley, the similar way of Ano Zumi. The flow rate is incremented until the dry-stone revetment was destroyed. The result of the hydraulic model experiment is to obtain the strength of the dry-stone revetment against the flow due to the difference in the method of stacking stones, the optimum size of the stone against for the external force, and the optimum thickness of the backfill material. In this presentation, we will present two variables of the strength of the flow and the method of stacking.

It is thought that these results are considered to be the basic data for design guidelines for dry-stone revetment. We would like to continue our research to clarify the function of the traditional dry-stone revetment and aim to disseminate the dry-stone revetment as modern technology of river revetment.

Xinglongtai No.1 Primary School of Liaohu Oilfield is located in Panjin, Liaoning Province where the Liaohu Estuary National Nature Reserve of China is seated. From the beginning of the 1980s, we have always been focusing on green or environmental protection education. Within the span of over three decades, the concept of environmental and wetland protection education has constantly shaped our education philosophy. Making full use of the valuable wetland resources, we have been actively involved in wetland education and environmental protection activities with a focus on the annually held "Protect Mother River", "Understand Wetland Birds" and "Protect Wetland Birds". Our school was named as "Wetland Experimental School" in 2011 by Wetlands International-China and updated to "Wetland School" in 2016. Untiring efforts have been spared to popularize wetland knowledge and education, such as the research and development of wetland school-based teaching material, launch of wetland education courses and establishment of wetland museum. Moreover, we've carried out environmental protection education and wetland practice and experience in collaboration with international and domestic related units and groups.

We also held such theme paintings, photography and essay contests class meetings and forums as "Protect Wetland Birds and Build a Harmonious Homeland", "Harmonious Coexistence of Man and Nature", "Wetland Birds in My Eyes", "Happy Old Times", "Beautiful China: Artist Garden", "Environmentally Friendly Liao River", "Panjin: Give the World Big Surprise", "The Days Without Water", "Water of Life" and

"Love Wild Birds and Share a Common Bluesky" to impart students with the knowledge of wetland and environment, forming the atmosphere of wetland protection.

There are the most beautiful and internationally renowned wetlands in Panjin where environmental protection experts,

scholars and volunteers are solicited to conduct exploration and investigation. Xinglongtai No.1 Primary School of Liaohu Oilfield is among the frequently-visited place to share the experience and vision in environmental and wetland protection education. We have seized these great opportunities to invite these experts to impart the knowledge on environment, ecology and wetlands.

A list of representative exchange and communication activities is listed as follows: Ms. Liying Su, Director General of International Crane Foundation convened to launch the migratory birds habitat protection activity titled "Spring: Migration with Migratory Birds"; Dr. Da, Australian Bird Expert, was invited to carry out the science activity under the theme of "One Blue sky, One Home"; Volunteers from All-China Environment Federation were mobilized to participate in the "Return to Habitat"; Environmental protection experts and volunteers from Korea, U.S.A. and Japan were called upon to hold the "International Nature Classroom Activity on the Migration Path of Cranes"; Teenagers from China, Japan, Korea, Mongolia and Russia jointly organized "Northeast Asian Teenagers Hand-in-hand Activities" and so on.

The successful implementation of these environmental protection activities has not only allowed the students to learn more about natural ecology and environmental protection skills, but enabled them to experience, appreciate and enjoy the beauty and harmony of nature. As such, they have demonstrated remarkable capabilities in showing gratitude, awe and respect; maintaining intimate relationship with nature; treasuring and protecting the environment and wetlands. We are always on the way to wetland and environmental protection education.

Management Effectiveness Assessment of Jagadishpur Reservoir Ramsar Site

Nepal Kamal Thapa

Ministry of Forest and Soil Conservation, Adaptation of Smallholders in Hilly Areas (ASHA) Project, Jagadishpur Ramsar Site Conservation Project

Nepal has the protected area network of national parks, wild-life reserve, hunting reserve, conservation area, buffer zone and Ramsar Site covering 23.39% of country's total area. However, Ramsar Site is not legally considered as protected area (unless it is situated within the legally established protected area) thus threatening its existence and limiting to paper parks. Nepal has ten Ramsar sites and 4 Ramsar sites lies out of the protected area systems. Jagadishpur reservoir Ramsar site, designated in 2003, is only the Ramsar site in Nepal which is human made reservoir and purposely built for irrigation purpose. The site covers an area of 225 hectares with its inner water surface area of 157 hectares. Earthen dike surrounds the reservoir with 20 KM long main canal with subsidiary branch canal and sub canal for irrigation supply.

Protected areas legally established under National Park and Wildlife Conservation Act (1973) has been assessed in 2003 and 2004 however protected areas under international category such as Ramsar Sites are ignored in Nepal. Management effectiveness assessment was carried out in Jagadishpur Reservoir Ramsar Site using Ramsar Site Management Effectiveness Tracking Tool (R-METT) methodology. Assessment was carried out in the workshop setting and facilitated by the author. Participants belonged to district forest office, Jagadishpur Reservoir Management Multi-stakeholder Forum, local community, local government representatives and related stakeholders of the Ramsar site.

High threats to the site were identified as spread of invasive species, isolation from natural habitats and siltation/sedimentation. Livestock grazing, illegal hunting and poaching of aquatic life and birds, vandalism, water management issue (use for irrigation), loss of species, drought conditions are observed to be of medium threats. Jurisdiction overlap between District Forest

Office (conservation priority) and Division Irrigation office (use priority) has further aggravated the management challenges. Although the district forest office sometimes makes random visit/patrol to the site, there is no dedicated team/department to look after. Irrigation office's priority comes only to enhance the irrigation system of the reservoir. Management effectiveness score of 32.43 percent (36 score out of 111 possible score) was achieved for the site. Score for the indicator is very poor and none of the indicator achieved 3 (highest score). Eight indicators scored 0, fifteen indicator scored 1 and six indicator scored 2 for the assessment questions. The highest score was in Process element (15 score) and the lowest was that of Context (legal background of the site) which resembles score of (0) zero. The strength of the current management of the Site includes positive impact on local communities, resource inventory and educational awareness. Major constraints to effectively manage the Site include lack of management plan, budget deficit, no legal status, and weak enforcement of law.

It is recommended that the site has to be legally recognized and adequate financial resources have to be allocated for the sustainable management. Special focus need to be given for the Communication, Education, Participation and Awareness (CEPA) along with deriving economic benefits from the Ramsar Site to increase the welfare of people living in the vicinity of the site which encourages ownership feeling among locals. Management effectiveness of Jagadishpur Reservoir Ramsar Site is in fair condition, applying the rating criteria of management effectiveness of other protected areas in the Himalayas (Oli, et. al., 2013).

Wetlands in Central Asia: raising awareness about their values in local communities in Kazakhstan, Kyrgyzstan and Turkmenistan

Zhanel Karina, Eldar Rustamov

Ramsar Regional Initiative for Central Asia, Regional Environmental Centre for Central Asia

Central Asia is a vast region with a diversity of wetland types such as lakes, rivers, reservoirs and marshes that are unique in their nature and provide important ecosystem services for both humans and the environment, in particular, in the arid zones. Many of these ecosystems are under increasing pressure due to the anthropogenic impacts, poor nature management and climate change. As there is no comprehensive research on the current status of the wetlands in Central Asia, application of the monitoring mechanisms is not always ensured and the countries lack effective management system for wetlands conservation and wise use, it is crucial to raise awareness about wetlands in the region.

Enhancing awareness about wetland values at all levels as well as conducting a regional inventory of wetlands and improving the management effectiveness are among priority activity areas of the Ramsar Regional Initiative for Central Asia (RRI-CA). The new Ramsar regional initiative started its activity in 2016 and currently has Kazakhstan, Kyrgyzstan and Turkmenistan as members. The Initiative aims to promote stronger cooperation and synergies within the Central Asian region to effectively implement the Ramsar Convention and its Strategic Plan at the national and regional levels.

Currently the project on the update on the status of wetlands in Kazakhstan, Kyrgyzstan, and Turkmenistan by collection and dissemination of good practices for the conservation and sustainable use of wetlands by local communities is under realization within the RRI-CA activities. The specific objectives of the project include a) raising awareness about the importance of

wetlands, and vital ecosystem services and other benefits they provide; b) update of the information on the current status of the selected wetlands in Kazakhstan, Kyrgyzstan and Turkmenistan; c) collection of the examples of good practices by local communities for the conservation and sustainable use of their wetlands; d) organization of the site based World Wetlands Day celebrations with the involvement of local communities. The main output of the project will be a manual in local languages, containing the updated information on the status of the selected wetlands in each of the three target countries and the good practices for the conservation and sustainable use of wetlands conducted by local communities. We believe that the implementation of this project will contribute to the realization of the Ramsar plan on communication, capacity building, education, participation and awareness on the regional level.

Since the representatives of the local communities play a key role in the management of local resources, they have direct impact on wetland conservation and use. The work with local communities is important in order to understand the benefits that the local communities receive from the wetlands. Using this bottom-up approach by working with local communities who utilize wetlands services, is crucial for raising awareness about the value of wetlands and for ensuring involvement of local communities into the decision-making process and dissemination of knowledge.

The Ramsar Regional Initiative for Central Asia would like to express its gratitude to the Government of Japan for their financial support of the project.

Roles of Resident Researchers to Promote Adaptive Fisheries: Lessons Learned from Lake Saroma, Japan

Kimihiko Maekawa INTEM Consulting, Inc.,

Shimpei Iwasaki Department of Environmental Science, International College of Arts and Sciences, Fukuoka Women's University

Many scholars increasingly put high emphasis on a significance of adaptive management. Adaptive management as an approach takes uncertainty into account and assumes that management knowledge is inadequate, thus requiring experimentation and learning in an iterative process. Many traditional fishery systems faced with difficulties in adapting to changes in the environment. The emerging challenges require not only a given form of social control among resource users but also promoting adaption of scientific technology

In general, academic researchers, who usually come from universities or research institutes, mainly aim to report their findings in scholarly journals, rather to directly find workable solutions to problems of interest to fishers in a local context. On the other hands, this presentation aims to shed light on "resident researchers" as the key actor to catalyze adaptive fisheries. The term resident researchers refer to persons the trans-disciplinary solution-oriented research by committing themselves as stakeholder in the local community (ILEK 2013).

In the case of Lake Saroma, the fishers have started to employed full-time researchers since 1987. In those days, the fishers got anxious about uncertainties of changing lake ecosystem and regional variability inherent in climate change, though they made great efforts on fishing regulations such as setting allowance limit for scallops in 1970's. To promote stable fishery production, they sought to find workable solutions with active use of scientific expertise by employing resident researchers as their own staffs. Accordingly, the resident researchers living with the fishers have been committed to implement two activities.

First is research and development related to conditions of fishery resources and the lake water ecosystem. The former includes measurements of growth of scallops or such a living things. The latter includes water monitoring such as temperature, salinity, and so on. Compared to academic researchers, it is important to note that resident researchers are not only

engaged in the research activities but also sharing the timely knowledge with the fishers by meetings, or face to face communication. In an urgent case that the fishers experienced difficulties in tackling with various environmental challenges, they give the reports to the researchers immediately so that the unique system makes it easier to respond to the issues by taking full advantage of scientific technology and knowledge.

Second is to create a platform for boosting collaborative partnerships among the stakeholders especially outside researchers. Scallop culture, which is one of the most important fishery production in Lake Saroma, imposes heavy burdens on the lake environment. To evaluate the conditions of environment, the resident researchers organized the Environment Monitoring Commission composed from several institutes and executed a holistic approach for the fishery management. Each researcher investigated their own fields, and sharing/discussing the results/knowledge once a year, in order to provide scientific information for decision making in the lake management. The resident researchers can lead to better collaboration between fishers and outside researchers as a catalyst by working for the interest of fishers. The information gathered by resident researchers could be used for fishers and academic researchers. The presence of resident researchers is expected to develop a win-win situation for both of them.

Long-term commitments with the fishers can lead resident researchers to choose samples, methods, questions, observations, and research designs that are required in resource management, enabling to respond to changes in the lake environment with a process of trial and error. Long-term residency can allow the resident researchers to interpret concerns of the fishers and act in a leading role in the coordination of adaptive fisheries development in strong collaboration with outside stakeholders. Their roles will be more appreciate in the resource management debate toward wise use of wetlands.

KODOMO Ramsar in Tsurui Village

Kunihito Otonari, Nobumichi Kurosawa, Yuko Kurosawa
KODOMO Ramsar in Tsurui Village Executive Committee

Tsurui is a village with a population of approximately 2,600, located in the northwest of Kushiro Wetland National Park in eastern Hokkaido, Japan. The name "Tsurui" means "cranes (Red-crowned Crane) are there" and as its name suggests, Red-crowned Cranes live in the village all the year round. Tsurui occupies a large part and core area of Kushiro Wetland National Park, as well as a part of the Ramsar site in it. Numbers of species live in Tsurui's diverse environments including wetlands, hilly area that forms the catchment area of the wetland, and pastures for dairy farming, the main industry of this village.

2017 is a year of milestone for this village because it is the 80th anniversary of the establishment of the village and the 30th anniversary of the designation of Kushiro Wetland as a National Park. Celebrating these anniversaries, an event named "KODOMO Ramsar in Tsurui Village" was held from 4 to 6 August 2017.

KODOMO Ramsar is a series of programs for environmental education and exchange between children, organized since 2006, targeting the children engaged in activities in Ramsar sites mainly in Japan. It has been held in and around Ramsar sites and organized by the Ramsar Center Japan (in Tokyo) in partnership with other bodies such as Wetlands International Japan and the municipalities and organizations at the venue. For the KODOMO Ramsar in Tsurui Village, an executive committee was established to prepare and operate it, consisting mainly of local volunteers as well as Ramsar Center Japan, Wetlands International Japan and Mr. Daisuke Nakamura who would facilitate the children's meeting.

The program was participated by 36 children from 13 sites in Japan, ranging from 4 to 6 grade of primary school. They took part in nature experience activities including walking in Kushiro wetland and fishing Cherry Trout. They also observed a water

source for central Tsurui, forestry work, dairy farming and cheese making. The participants were encouraged to find attractive profiles of Tsurui Village through those experiences and, based on their findings, they nominate "treasures" they wish to preserve for the future. After deliberate discussions, they chose 6 treasures; "a will to live together with plants and animals" "a source of life, spring water" "Red-crowned Cranes saved by the villagers" "Kushiro wetland" "balanced relationship between people and nature" "people protecting the nature and environment". They also composed a message that expresses the beauty of Tsurui village; "Tsurui Village living with Red-crowned Cranes — the tradition of Tsurui protected by all of us, the future of Tsurui created by all of us —". They integrated the message and the treasures into a poster, which was presented to the mayor of the Village.

It could be said that this program contributed to enhance the child participants' curiosity and interest in nature through various experiences as well as to promote their willingness toward their engagements in each site. On the other hand, local people were inspired by the perspectives of the children. They started to see the advantages of the village in a new light and obtained some hints for community vitalization. It is considered to be a task for local people to think about the wise use of local nature with Kushiro wetland in the center, and establish a community in harmony with local characteristics of Tsurui village.

Science communication about the Hizen-Kashima Coast

Naoki Fujii Institute of Lowland and Marine Research, Saga University
Yasuhiro Nakamura Hizen-Kashima Tideland Observatory

Mamoru Nagaike Kashima Lifelong Learning and Cultural Promoting Foundation /
Kenji Yoshino, Yuichi Hayami Institute of Lowland and Marine Research, Saga University

The Ariake Sea is a typical shallow water area with the largest tidal area in Japan. In the past, it was a bountiful sea with many shellfish and creatures such as mudskippers, the Green eel goby, and the Grenadier anchovy. Recently, however, problems such as dysoxic waters and red tide have occurred, reducing the catch significantly. Therefore, other than the nori-seaweed industry, the fishing industry has been stagnating in the Ariake Sea area. According to a report from The Commission for the Assessment of Comprehensive Research on the Ariake Sea and the Yatsushiro Sea, the environmental degradation in the Ariake Sea has been caused by several complicated factors such as the Isahaya Bay reclamation project and laver acid treatment. As a result, conflicts have arisen around the coastal areas of the Ariake Sea. To overcome these conflicts, it is important to focus on ways to revitalize the Ariake Sea and its surrounding areas. Therefore, marine scientific research is needed to provide the information needed to form consensus on the Ariake Sea regeneration. However, as the scientific explanations may be too complex for the local citizens, it is necessary to develop a science based platform whereby these scientific results could be explained to the local Ariake Sea public in simple terms

In 2012, a citizen's science lecture course, held five to seven times a year, was opened to train interpreters and increase the number of people (for example, eco tour coordinators) involved in imparting scientific findings to the general public. The course content covers Ariake Sea regional culture, tideland creatures, a fishery tour, and food culture.

Originally, the course was organized by Saga University alone; however, as cooperation in the region has deepened, the course is now being held in collaboration with local organiza-

tions. Because the course was aimed at training scientific interpreters, in 2011 and 2012, the lectures were similar to university lessons, with the main content being ocean investigation methods and tideland biological collection and identification. However, as this content was academic and difficult to understand, there were few participants, with many courses having less than 10 people. Therefore, the lifelong learning concept was adopted and the content changed to focus on areas that were more familiar to local citizens, such as the fishing industry and the observation of coastal organisms. Further, rather than only having classroom based lecture, experiential learning was also included which included excursions and coastal explorations.

Even though this course has been conducted for five years from 2011 (it was canceled in 2014), there has been little growth in the number of scientific interpreters. It is necessary, therefore, to organize an open science lecture to discuss the problems.

Nonetheless, the interest of citizens has expanded due to the registration of the east Yakata Flats and Hizen Kajima Tideland as a Ramsar wetland site. In addition, Kashima City Hall has started to set up a course to train tour guides for the Hizen-Kashima tidal flat. As expectations for scientific interpreters in this area are expected to increase, we would like to continue the science course.

Development of an environmental education program on tidal flat

Miho Hiruma, Misuzu Aoki
Wetlands International Japan

Tidal flats have many functions. These include water purification, helping the spawning and growth of fish, and supplying us with food. In addition, we use tidal flats as a place for activities such as fishing, nature observation and education. In other words, we gain various benefits from tidal flats.

However, many people cannot sufficiently recognize the benefits as being those obtained from tidal flats. One of reason that cannot recognize of the benefits from tidal flats may be that they are becoming places that are mentally remote in our daily lives. In other words, the ties between tidal flats and people are weakening in modern times. In such circumstances, in order to have people gain a greater recognition of the value of tidal flats, the most important them is for there go to the tidal flats and experiencing them using the five senses.

Wetlands International Japan works to educate the general public concerning the value of tidal flats. As a first step, we think that it is important for people living near tidal flats to learn about them by enjoying and discovering there charm and value.

Especially, In order to ensure that tidal flats are conserved for the future, we think that it is important to have the children who are responsible for the next generation recognize the benefits received from tidal flats. Thus, we started a project to create an environmental education program that utilizes tidal flats in 2016. We chose Arao-higata located in the eastern side of the central part of the Ariake Sea as the place of our activity. This project is being conducted with the cooperation of people in various positions such as staff of the local municipality (Arao City), fishermen, elementary school staff, NGOs and researchers.

In this project, we provide opportunities for children living near the Arao-higata to go to the tidal flat, and also we offer experiences of touching living things inhabiting tidal flats. Our aim is to make an education program so that children will gain

an interest in tidal flats and recognize the importance of conservation of tidal flats through these experiences. In 2016, in order to accurately grasp the biota in the Arao-higata, we conducted a survey of biota in the tidal flat with researchers. We were able to record 141 species of benthic animals. Based on the result of this survey, we made the survey list named "List of Benthic Animals of Arao-higata" which selected 50 major species of benthic animals. Additionally we attempted an education program "Treasure hunt game of the benthic animals" using the survey list. This program involved three steps. At first, the children spent time learning about tidal flats and the benthic animals living there.

Second, in the field, we had the children search for the benthic animals and capture them. Finally, we instructed the children to check the names of the captured benthic animals by themselves. Specifically, to make it possible for children to search for the benthic animals by themselves, we taught the following three techniques.

1. Take a lower visual line than normal
2. Search for them under stones and seaweed
3. Dig some holes

By searching for benthic animals using these three techniques, we attempted to provide some successful experiences for children. Also, in order to maintain children's interest in searching for benthic animals, we attached scores to benthic animals and created a sense of it being a game competing for points.

In the future, in order to continue the program, we plan to develop teaching materials and to grow leaders who can explain the differences and features of benthic animals.

The Progress of Environmental Education in Kashima city

Yuji Morimoto, Sayaka Nakamura
Ramsar Convention Promotion Office, Kashima City

Ariake Sea has a vast mudflat that accounts for about 40% of the total tidal flat area in Japan. The bounties from the mudflats has sustained the life of local people for a long time. In the mid 1950s, children went out on the mudflat during low tide and caught many Chinese razor calms. As Ariake Sea is so familiar to the local people, it is called the "Maeumi" that means the sea in front of the local community. However, the people gradually lost interacts to Ariake Sea due to the changes in the food culture and the degradation of marine environment. Now, most of the citizens have almost no opportunity to find the importance of the life in the mudflats and no children play there.

In Kashima City, In order to make the children aware of the importance of the conservation of the mudflat, we are developing educational programs such as hands- on activities that based on the ESD environmental education program created by the Ministry of the Environment Japan. This program is made for the study in the elementary school class. In the "Roadside Station Kashima"; the "Kashima Gatarinpic" event which had international interests has been hold every year. Everybody can also enjoy the "Mudflat experiences" program here beside the time of that event. In this program, children enter the mudflat and aware the bounties from the mudflat during playing. In addition, we can learn about the role of mudflat and the efforts to protect wetlands globally from the observation of migratory birds visiting at the Ramsar site "Hizen Kashima-higata" mainly in winter. Kashima is rich in natural environment including mountains, rivers, and ocean in one city. Therefore, the aim of our Environmental Education Program is to understand the importance of nature and inform it by themselves through the experience learning in the connection of water flow from the mountain to the sea

In order to continue the environmental education program,

the cooperation of elementary school teachers is essential. As to deepen the teachers' understanding of Ariake Sea would lead to children's learning, we thought that it would also be necessary to create a system to make it easier for teachers to prepare the classes.

Therefore, we made a prototype workbook for the environmental education program which is helpful for teaching in the classes. We started a trial of an environmental education program based on the cooperation of all the elementary schools in the city using this workbook in this year. We will continue this activity tentatively for two years. We will collect the comments and opinions from the teachers during it, then we will complete the workbook. Finally, we hope that the elementary schools will become able to implement programs by themselves. Moreover, we hope that the children will share the knowledge and the experience with their parents and the parents will also be aware of the importance of the mudflat and attend the activity to conserve it.

Physico-chemical parameters of water and its impact on biodiversity of Hakaluki Haor at Sylhet, Bangladesh

M. Tajul Islam

Design Development Consultants Lts.(DDC), Dhaka

Bangladesh is unique in the nature of relationship between its people and wetlands. Majority of the population directly depends on wetlands on products and services for livelihoods with many communities densely settled in and around the wetlands. Unfortunately, wetlands in Bangladesh have been degraded because of population pressure and natural calamities like flash flood, demand for wetland products and non-judicious infrastructure and obstructs or prevents wetlands from maintaining their ecological functions. A haor is a wetland ecosystem in the north-eastern part of Bangladesh which physically is a bowl or saucer shaped shallow depression. The haor basin is a remote and difficult area that is flooded every year during monsoon. Some of the most extensive seasonally flooded areas in South Asia are situated in bowl-shaped depressions known as haors located between the natural levees of rivers subject to overflow during the monsoon. Due to continuous submergence, wetland habitat is characterized by anaerobic conditions which inhibits normal plant growth apart from a group of plants known as hydrophytes are adapted to withstand these conditions. The Haor Basin is the only region in Bangladesh where remnant patches of freshwater swamps and reed lands still exists.

Hakaluki Haor is located in the North-East of Bangladesh it belongs to two districts Moulvibazar and Sylhet under Sylhet division. Hakaluki Haor is one of the Ecologically Critical Area (ECA), which was once with plenty of aquatic resources including swamp forest. Macrophyte is the integral components of wetlands which are amongst the most productive ecosystems.

Physico-chemical water parameters are among the factors, which determine the status of wetland ecosystem. It is important to gather baseline data of water quality, which will allow

understanding the seasonal variations. Study on physical and chemical water parameters which focuses on to assess the water quality in Hakaluki Haor and impacts on for a and fauna, to assess and compare to the physico-chemical attributes of water of study area, to assess the level of pollution of the habitats and impacts of water quality study on biodiversity. For water quality study research carried out during the period from May, 2013 to February, 2014 in 5 spots (Lamba beel spot-1, Haorkhal beel spot-2, Nadanjuri beel spot-3, Chatla beel spot 4 and Chokia beel spot-5) under 5 administrative upazilas of Hakaluki Haor at seasonal intervals. Water samples were collected from 5 spots as during 4 seasons and a total 15 physico-chemical parameters were studied.

Significant seasonal variation was observed in all seasons among physico-chemical parameters. Physical parameters were measured at field condition and chemical parameters were analyzed in the Lab of the Department of Environment, GoB, Sylhet. pH values varied from 5.9 - 7.1, water temperature varied from 23.7 - 26.7 °C, transference varied from 23-53 cm, TSS varied from 18.1-192 mg/l, TDS varied 25-193.5 mg/l, EC varied from 30-680 $\mu\text{s}/\text{cm}$, DO content of water varied from 4.6- 5.6mg/l, BOD varied from 0.2-2.614 mg/l, COD varied from 38-312 mg/l, NO₃-N varied from 0.1-30.4 mg/l, NH₃ varied from 0.9-2.18 mg/l, Alkalinity varied from 12-42 mg/l and PO₄ varied from 0.9 -13.4 (mg/l). Agricultural and organic pollutants have been observed as the main source for the Haor water quality, Agrochemical used in the paddy field, poisons used for fishing after dewatering the beel and chemical used surrounding tea garden of Hakaluki Haor which have been continuously polluting the water of Hakaluki Haor.

Where is the future of our wetland? It lies in the hand of our youth

Liangzhong Chen

Operation Earthz

As the future of wetland worldwide is filled with uncertainties due to excessive water extraction, land conversion to agriculture and urban development, shoreline and waterfront development for industrial and other economic activities resulted by growing pressure of human population.

One of the reasons of such situation, is our decision makers for economic development may not fully aware the critical ecological functions and roles to our future life and destiny of wildlife played by wetland. Thus to increase the awareness of wetland conservation among general public, especially among our teenage, is of great importance.

The best way to publicize and educate general public and our young generation is to organize them to join the monitoring and field research activities of conservation of wetland ecosystem.

On the other hands, to sustain current field research and monitoring activities for wetland conservation, need human resources and additional funding.

Operation Earth in past few years, mobilized teenage field research volunteer expedition teams, to support monitoring and conservation of wetland ecosystem program by direct participation in following research programs:

1. Amazon flooded rainforest in Peru;
2. Tonle Sap Lake of Cambodia;
3. Taihu Lake in Jiangsu Province, China,
4. Waterbirds Monitoring in the Yellow River Delta Area, Shandong, China; and
5. Ertix River Headwater area of Altay Mt., Xinjiang, China, etc.,

The field research activities for volunteers, must be in conjunction with local field researchers of various wetland conservation research project site, so as to really help the research program be sustained.

The methods of field research volunteers are not experts, they have to be trained before participate in monitoring activities, thus the classroom training is provided at the first day of the

survey to gain knowledge of the participants on waterbird identification and counting techniques.

Survey team of field research volunteers are divided into small groups to count individual waterbird, nests and chicks at breeding colonies and feeding sites.

Our field research monitoring activities are include:

Waterbirds monitoring, to increase knowledge on waterbird identification and counting techniques, to understand population trend of the key species of large waterbirds;

Fish survey, to assess the conservation project and participation of the fisheries, Ecotourism and relevant authorities. Fishery monitoring has been conducted to define fish population and density in the core area, to determine threats to fish by illegal fishing and records location of illegal fishing, number of fishers, gears and seasonal camping and boats.

Caiman Survey, to understand population, behavior and threat of caiman; Macaw survey;

Amazon Pink Dolphin Survey; Terrestrial transect survey of wildlife;

Survey on local community participatory monitoring and conservation, to inform local community members that fishing in the core area is prohibited. Interview with local residents and local authority to define potential threats, problems and suggestions to solve the problems.

These field research monitoring program supported by Operation Earth field research volunteers, have achieved excellent result: field research and monitoring program of wetland is sustained, awareness of wetland conservation scientifically among general public, especially among the young people, is greatly increased and environmental stewardship is fostered among the teenage field research volunteers and their parent, which will certainly help the restoration and conserve ecological health of wetland in the future once these teenage field research volunteers grown up and become decision makers.

Status and Habitat Preference of Three Threatened Waders with Regeneration and Floristic Composition of Inter-tidal Mudflat Vegetation in Sonadia Island, Bangladesh

Md Golam Rabbi
Nature Conservation Society

Sonadia Island in southeast coast of Bangladesh is well-known for harboring diverse species of despite its small size. The important habitats and communities at the site include mangrove, mudflats, beaches and sand dunes, canals and lagoons and marine habitat. The site lies on the East Asian Australasian and Central Asian Flyways and the mangrove and shallow shoals surrounding the island provide an excellent wintering area for migratory waterfowl and shorebirds, including three globally threatened species; Critically Endangered Spoon-billed Sandpiper (*Calidris pygmaea*),

Endangered Nordmann's Greenshank (*Tringa guttifer*) and Vulnerable Great Knot (*Calidris tenuirostris*). Other important species include marine turtles, Irrawaddy dolphin and crustacean species, a wild grass relative of rice, fishes and mollusks. The research was carried out in this site from October 2014 to March 2017 to gather information about migratory birds, habitat preference and for the very first time, aiming to document baseline information about floristic composition and the status of natural regeneration essential for the sustainable biodiversity management planning. Boat-based surveys were carried out in four segregated islands, namely, Taziakata (21029'44.5" N, 91055'41.9"E), Moghchar (21029'18.2" N, 91055'41.9"E), Balakerdia (21032'39.4" N, 91050'32.2"E) and Kaladia (21033'55.0" N, 91051'03.5"E). Surveys were conducted during high tides in two roosting grounds and during low tides in two feeding grounds. In 2014-2015 presence of Spoon-billed Sandpiper was 19, Nordmann's Greenshank was 31 and Great Knot was 27. In 2015-2016 the number was 21, 29, and 36 and for 2016-2017 it was 17, 35, and 31 respectively. A total of 24 samples of sediments were analyzed in field and the lab from all four different sites. The first dominant phylum is Mollusca with 390 individuals at Taziakata-2 where total weight was 60.72 gm compare to 16.75 gm living and 43.97 gm non-living organism. The second dominant phylum is Echinodermata, 226 individuals at Taziakata-2 where

total weight was 60.72 gm compare to 16.75 gm living and 43.97 gm non-living organism. The third dominant phylum is Annelida, 216 individuals at Kaladia-1 where total weight was 17.5gm compare to 3.19gm living and 14.31gm non-living organism. Habitat analysis data and the presence of migratory bird species at Taziakata and Kaladia demonstrated as the prime feeding grounds, while the nearby Moghchar and Balakerdia are the roosting grounds respectively. Random sampling quadrat method was used to conduct the vegetation survey in the all sites. All the sites are mainly monoculture mangrove plantation sites, except Taziakata. 09 vegetation species belonging to mangroves, herbs and grass species were recorded. All the sites, except Taziakata, contained a combination of tree stands of *Avicennia marina*, *Avicennia alba*, and *Aegialitis rotundifolia*. The high Importance Value Index (IVI) recorded for *A. marina* in Kaladia (157) indicates that this species dominates over *A. alba* and *Aegialitis rotundifolia*. While Magchar and Belekerdia were dominated by *A. alba* with the highest IVI value of 202 and 192 respectively. *Aegialitis rotundifolia* had the least stands density among all the species. Almost similar compositional pattern and species dominance like tree stands for mangrove saplings were observed in all sites. Notably, saplings of *Avicennia officinalis* were found, although this species had no tree stands in the studied sites. Taziakata contained no tree stands; however, the saplings of mangrove species were recorded. According to analysis of variance (ANOVA), no significant differences in species composition were observed in all sites suggesting homogeneity of species composition. Finally, research findings suggest that presence of non-planted tree stands and saplings of mangrove species into plantation sites indicates their dispersal ability across local environment and thereby, might able to occupy non-vegetated mudflat areas.

Community based Management of Marine Biodiversity in Bay of Bengal

Asaduzzaman Miah
Bangladesh POUH

The Bay of Bengal is the largest bay in the world and a northern extension of the Indian Ocean, positioned between India and Sri Lanka in the west, Teknaf Peninsula of Bangladesh to the north, and Myanmar (Burma) and the northern part of the Malay Peninsula to the east. Numerous large river systems including the Ganges and Irrawaddy drain into it. Teknaf Peninsula is one of the longest sandy beach ecosystems (80 km) in the world. It represents a transitional ground for the fauna of the Indo-Himalayan and Indo-Malayan ecological sub-regions. Important habitats at the site include mangrove, mudflats, beaches and sand dunes, canals and lagoons and marine habitat. Mangrove forest occurs in Teknaf peninsula both as natural forest with planted stands and mostly distributed in the inter tidal zones. The Teknaf peninsula mangroves supports the habitat of 161 different fisheries species. The beach of Shahporir Dwip in Teknaf peninsula is a suitable breeding ground for marine turtles. Globally threatened Olive ridley and green sea turtles (*Cheloniemydas*) are dominant in mangrove vegetated areas of Shahporir Dwip, Hawksbill and Leather back turtle nests are rarely found.

Main threats to biodiversity at the site include the degradation of sand dunes due to grazing, cutting of sand dune vegetation for fuel-wood and industry; the conversion of dune, beach and mangrove habitat to agriculture, aquaculture, tourism and small scale industry; the harvesting of turtles and turtle eggs; post larvae collection of shrimp and colossal loss of biodiversity, destructive fishing methods; hunting of shorebirds; large scale shell collection; coastal erosion due to shell removal; beach compaction by vehicles; pollution and land degradation from boat discharges and ship breaking, agro-chemicals, impact

of coastal aquaculture on environment, natural disasters, sea level rise, tourism and small industry etc.

Bangladesh POUH has been implementing a project with the financial support of JFGE in association Ramsar Center Japan (RCJ) to reduce the loss of juvenile and non-commercial species from the sea to ensure the ecosystem well being for the sustainability of the Bay of Bengal resources. The project has been implementing in the shore and the sea of the Teknaf peninsula. The fishers, fishing in the sea, is the main stakeholder of the project along with the administrative authority, local community, and tourist. The participatory protection of the juvenile of the commercially important species and non-commercial by the fisher in marine fishing resulting ecological balance of the sea ecosystem and the sea resource sustainability.

The project has been conserving the biodiversity of the marine ecosystem by reducing the volume of harvesting, minimizing the accidental harvest, and releasing the juveniles back in the habitat. The local community specifically the fisher who harvest aquatic resources and the farmer along with tourist who collect terrestrial resources of marine ecosystem have been making aware about the value of the biodiversity and the practices of sustainable harvesting and conservation. The project has also been sensitizing, motivating and building up knowledge and capacity of different stakeholders and community on practicing biodiversity conservation in harvesting and diversification of the livelihood option. Along with other conservation activities marine turtle hatchery development, protection of different habitats and introduction of safe fishing nets are initiated and the activities have been creating an encouraging impact.

Bio-diversity conservation has got essential for maintaining a secured and safe life and livelihood of the community in a given geographical area. The Govt. agencies have clear cut mandates towards these spheres. None of the developmental measures/policies could be passed, if it has any contradiction towards the survival of the natural capital like wetlands or mangrove forests of the area. The joint initiatives taken by the NGO namely PALLISHREE and CBO namely KISSAN could able to make such mobilisation in 12 villages of Ganjam district of Odisha in conserving biodiversity.

Rushikulya River meets Bay of Bengal at Ganja in Ganjam District of Odisha. Olive Ridley Sea Turtle are arriving in millions every year. Previously, there were no conservation activities taken although this is the second largest mass nesting beach in World. The eggs were destroyed by predators. Although the Forest department has taken initiation now a days, but PALLISHREE, formed a CBO namely KISSAN "Kruma Iswaram Sangham" (Turtle-God Association) during 2006. There are mythological stories in Hindu that once God became a Turtle and saved the Earth. So in order to bring emotion among the stakeholders, the local community had kept the name of the CBO as "KISSAN". It was a part of the project supported by KNCV, Japan and technical support of RCJ, Japan. PALLISHREE enhanced the capacity of the local community in Sea Turtle conservation and build partnership with Forest Department. The local community is now taking all the responsibility till from meting of the turtle to release of hatchlings to Bay of Bengal. So they have been engaged from November to the next year June, almost 8 months in a year. Generally, they used to stop fishing in the sea from November to the next year April (6 months), to safe guard the turtles from casualty. The catch of the fisherman is very high during the rest of the 4 months.

Because the jelly fish in the coastal sea is eaten by the turtle and make the netting favourable in fishing. Jellyfish always create problem in fishing for the fishermen. Thus, the turtles are the friend of the local fishermen.

Secondly, KISSAN has taken care of the mangroves plants which have been planted by PALLISHREE. After the completion of project in the year 2008-09, the community as such KISSAN has taken all responsibility of the mangroves forest. The management has got on an average of 60,000 INR by selling the mangrove seeds annually. KISSAN is also raised mangroves nursery and provided plants to others. This mangrove forest played important role during the last cyclones "Phailin & Hud Hud" broke 2013 & 2014. The fish resources have been increased in this area. So the community has shown interest to conserve and replicate it in other places.

KISSAN has promoted women SHG in different hamlets of 12 coastal villages. The members of the SHG are organised to take lead roles in conservation of mangrove plants and turtles eggs. They could understand the importance of bio-diversity conservation in reduction of risk on their lives and livelihoods. Besides, the participation effort has resulted in the promotion of special youth Task Force in the area. KISSAN in support of PALLISHREE to build the capacity of these youth volunteers in the 'watch and monitoring' spheres. The process has attained sustainability since it is now led and managed by the community. The NGO is supporting these community groups in the spheres of coordination with other stakeholders like the Forest Department, Fishery department and other private associations.

Species and functional diversities of zooplankton in shallow water bodies and its application as ecological indicator

Hye-Ji Oh Kyung Hee University / Geung-Hwan La, Eun-Jin Han Suncheon National University, Korea
Kwang-Hyeon Chang Kyung Hee University / Hyun-Woo Kim Suncheon National University, Korea

Bio-diversity conservation has got essential for maintaining a secured and safe life and livelihood of the community in a given geographical area. The Govt. agencies have clear cut mandates towards these spheres. None of the developmental measures/policies could be passed, if it has any contradiction towards the survival of the natural capital like wetlands or mangrove forests of the area. The joint initiatives taken by the NGO namely PALLISHREE and CBO namely KISSAN could able to make such mobilisation in 12 villages of Ganjam district of Odisha in conserving biodiversity.

Rushikulya River meets Bay of Bengal at Ganja in Ganjam District of Odisha. Olive Ridley Sea Turtle are arriving in millions every year. Previously, there were no conservation activities taken although this is the second largest mass nesting beach in World. The eggs were destroyed by predators. Although the Forest department has taken initiation now a days, but PALLISHREE, formed a CBO namely KISSAN "Kruma Iswaram Sangham" (Turtle-God Association) during 2006. There are mythological stories in Hindu that once God became a Turtle and saved the Earth. So in order to bring emotion among the stakeholders, the local community had kept the name of the CBO as "KISSAN". It was a part of the project supported by KNCV, Japan and technical support of RCJ, Japan. PALLISHREE enhanced the capacity of the local community in Sea Turtle conservation and build partnership with Forest Department. The local community is now taking all the responsibility till from meting of the turtle to release of hatchlings to Bay of Bengal. So they have been engaged from November to the next year June, almost 8 months in a year. Generally, they used to stop fishing in the sea from November to the next year April (6 months), to safe guard the turtles from casualty. The catch of the fisherman

is very high during the rest of the 4 months.

Because the jelly fish in the coastal sea is eaten by the turtle and make the netting favourable in fishing. Jellyfish always create problem in fishing for the fishermen. Thus, the turtles are the friend of the local fishermen.

Secondly, KISSAN has taken care of the mangroves plants which have been planted by PALLISHREE. After the completion of project in the year 2008-09, the community as such KISSAN has taken all responsibility of the mangroves forest. The management has got on an average of 60,000 INR by selling the mangrove seeds annually. KISSAN is also raised mangroves nursery and provided plants to others. This mangrove forest played important role during the last cyclones "Phailin & Hud Hud" broke 2013 & 2014. The fish resources have been increased in this area. So the community has shown interest to conserve and replicate it in other places.

KISSAN has promoted women SHG in different hamlets of 12 coastal villages. The members of the SHG are organised to take lead roles in conservation of mangrove plants and turtles eggs. They could understand the importance of bio-diversity conservation in reduction of risk on their lives and livelihoods. Besides, the participation effort has resulted in the promotion of special youth Task Force in the area. KISSAN in support of PALLISHREE to build the capacity of these youth volunteers in the 'watch and monitoring' spheres. The process has attained sustainability since it is now led and managed by the community. The NGO is supporting these community groups in the spheres of coordination with other stakeholders like the Forest Department, Fishery department and other private associations.

Large-scale private-public peat swamp forest restoration in Riau, Sumatra, Indonesia

Tony Whitten Fauna & Flora International
Bradford Sanders Restorasi Ekosistem Riau (RER)

Almost all the peat swamp forest in eastern Sumatra has been drained, cleared, logged or burned, and without a well-managed, community-sensitive initiative backed by sound science - and considerable resources - the future for the forests on the Kampar Peninsula and Padang Island would be bleak. These logged-over and cleared forests need to be protected and actively restored in the long-term with the understanding and support of the surrounding communities. This talk will describe the landscape, social setting and civil society dynamic within which the restoring forests lie, and describe the steps being taken to ensure sustained management together with a description of the major monitoring programme.

Indonesia has designated 1.7 million hectares for 'ecosystem restoration concession' (ERC) licenses to restore and protect the country's forests. Since these licenses can only be held by business entities, the private sector can play a key role in forest restoration. An ERC aims to promote restoration efforts on former (poorly managed) Production Forest to protect flora and fauna together with soil, hydrology, nutrition cycles and other natural process. The overall objective is to prevent conversion of natural forest to plantation monoculture and to re-establish a biological balance.

Strengths of the concept include securing land rights and entrusting concession management to a legitimate management authority; collaborating with local communities and forest-dependent people in monitoring and safeguarding the forest from illegal exploitation and allow for utilization of non-timber forest products; and the potential for obtaining sustainable financing through carbon credit (REDD) projects.

Asia Pacific Resources International Limited (APRIL) has made a US\$100 million commitment to support conservation through

forest restoration licences. To achieve this, APRIL established Restorasi Ekosistem Riau (RER), a collaborative project bringing together groups from private and public sectors to restore and conserve 150,000 hectares of degraded peat swamp forest on Indonesia's Kampar Peninsula and Padang Island, in Riau, Sumatra.

The Peninsula holds one of Sumatra's largest remaining peat swamp forests. It is home to a near complete peat swamp fauna including at least 44 globally threatened species, stores huge quantities of carbon, and its resources support the livelihoods of over 17,000 people who live in surrounding areas. Historically the forest has been damaged by logging and is part of an area that had been allocated for selective logging concessions.

Supported by resources and expertise from partners Fauna & Flora International, Bidara, The Nature Conservancy and the APRIL Group, RER is working with local communities to restore the forest and provide sustainable livelihoods for communities in surrounding areas. Three years of operation have already resulted in a decrease in threats to the forest, with no illegal logging, encroachment or fires in forests under RER management in 2015-16. Six villages in adjoining areas have received training in sustainable farming techniques, while the establishment of a 21-strong Fishing Group has already resulted in a decrease in destructive fishing practices. RER partners are also working with regional government to coordinate peat swamp forest landscape restoration across the Kampar Peninsula. Through public-private sector partnerships, RER aims to create a replicable model for private sector engagement in forest protection and restoration in production landscapes.

Reasonability of cyclic floodplain rejuvenation for biodiversity and flood management in Japanese lowland rivers

Shigeya NAGAYAMA

Aqua Restoration Research Center, Public Works Research Institute, Civil Engineering and Eco-technology Consultants Co., Ltd., River Basin Research Center, Gifu University

Morihiro HARADA River Basin Research Center, Gifu University

Shiro SAGAWA Graduate School of Regional Resource Management, University of Hyogo

Yuichi KAYABA River Restoration Team, Public Works Research Institute

The riverscape has intensively changed in Japan since the Meiji era (1868-1912), when modern civil engineering technology was introduced from European countries. The floodplain, which was a broad wetland on the coastal alluvial plain, has been disconnected from the main river channel due to intensive levee construction from the Meiji to the Showa periods. Since the 1980s, inter-levee floodplains in many Japanese lowland rivers have been terrestrialized, and riparian forests were established in the context of riverbed degradation.

Terrestrialization and riparian forest establishment have led to further deterioration of floodplain ecosystems and decrease in the flow discharge capacity. Therefore, river managers have implemented tree removal and excavation of terrestrialized floodplain surfaces to increase the flow discharge capacity. These measures may recover floodplain ecosystems due to increases in inundation area and flood frequency. We examined this hypothesis from a viewpoint of recovery of freshwater unionid mussels, which are potential indicator species of floodplain ecosystems, after tree removal and excavation. We also examined how the initial ground elevation and elapsed time (max. 16 years) after the excavation affect mussel recovery.

This study was conducted in the lowland Ibi River (32-39 km from the river mouth), central Japan. The riverbed slope is approximately 1/3,300. The excavation work was implemented in the study segment from 2000 to 2007 to increase the flow discharge capacity. River managers also had another purpose, i.e., to determine how the initial excavation height affects the suppression of tree establishment, although this aspect was not examined in this study. We selected fourteen excavation sites

with different initial ground heights and at different years since excavation. The river managers did not expect the recovery of any floodplain-dependent aquatic organisms. Freshwater mussels eventually colonized ponds (i.e., floodplain ponds), which were naturally created in the excavation sites through flooding. Mussels were captured in nine of the fourteen excavation sites in December 2011 and 2016. In eleven excavation sites, including the nine sites for mussel survey, cumulative sediment depth and the number and area of floodplain ponds were investigated based on cross-sectional profiles (2001, 2002, 2005, 2008, and 2013) and aerial photographs (2002, 2006, 2007, 2009, and 2012), respectively.

In the sites with lower excavation heights (but higher than drought water level), mussel abundance was higher in both 2011 and 2016 surveys, and sediment depths and deposition rates were lower. Mussel abundance and the number and area of ponds first increased and then decreased, with peaks between 5 and 6-9 years after excavation, in the context of continuing sedimentation. These results suggest that excavations should be strategically implemented so that low excavation sites at 5-9 years after excavation always occur in a target river segment. This strategy can be performed based on the concept of cyclic floodplain rejuvenation that re-terrestrialized sites with continuing sedimentation are planned to be excavated. Cyclic floodplain excavation can contribute to floodplain biodiversity and flood management by increasing in the capacity of flow discharge and can be a reasonable method in many Japanese lowland rivers where sediments progressively accumulate on the excavation sites.

Comparison of the photosynthetic responses to temperature and irradiance of two edible brown algae, *Cladosiphon okamuranus* from Amami Islands and *Cladosiphon umezakii* from Takeno, Honshu Island, Japan

Rika Fukumoto Faculty of Fisheries, Kagoshima University, Japan

Iris Ann G. Borlongan United Graduate School of Agricultural Sciences, Kagoshima University, Japan

Gregory N. Nishihara Institute for East China Sea Research, Organization for Marine Science and Technology, Nagasaki University, Japan

Hikaru Endo Faculty of Fisheries, Kagoshima University, Japan

Ryuta Terada United Graduate School of Agricultural Sciences, Kagoshima University, Japan

Species of the brown macroalga *Cladosiphon* (Chordariaceae; *Mozuku* in Japanese) are found along the temperate and subtropical coasts of Japan, and are regarded as important edible resources. In fact, the mariculture of *Cladosiphon okamuranus* has been widely practiced in the subtropic Ryukyu archipelago including Amami Islands, and has been one of the major industries that contribute to the islands' economy. Meanwhile, *Cladosiphon umezakii* has recently been reported as new species from the temperate region of Honshu Island, with a potential as new food resource. Although phylogenetically-related in the genus *Cladosiphon*, distribution of the two species in Japan is completely different; hence their temperature and irradiance optima or tolerances for photosynthesis may be distinct. Knowledge on this aspect still remains insufficient. In the present study, effects of temperature and irradiance on the photosynthesis of two species of *Cladosiphon*, *C. okamuranus* (CO) from Yoron Island in Amami Islands, Kagoshima Prefecture and *C. umezakii* (CU) from Takeno, Hyogo Prefecture, Honshu Island were determined. Measurements of photosynthesis and dark respiration rates, and photochemical efficiencies on the sporophyte stage of these two species were carried out by using optical dissolved oxygen sensors and the pulse-amplitude modulated (PAM) fluorometer. Results of the oxygenic gross photosynthesis and dark respiration experiments over a temperature range of 8–40 °C revealed the rise in gross photosynthesis rates with increasing temperature, and a sharp decline after reaching their peaks ($GP_{max} = 10.59 \mu\text{g O}_2 \text{ g}_{\text{fw}}^{-1} \text{ min}^{-1}$ for CO; $10.41 \mu\text{g O}_2 \text{ g}_{\text{fw}}^{-1} \text{ min}^{-1}$ for CU) at 29.5 and 25.7 °C, respectively. Maximum quantum yields (Fv/Fm)

of *C. okamuranus* and *C. umezakii* after 48 h of exposure over a similar temperature range were relatively stable at low temperatures, but dropped to 0 at 36 °C and 32 °C, respectively. Although temperature optima for photosynthesis of the two species partly overlap each other; *C. okamuranus* can tolerate relatively higher temperatures than *C. umezakii*. The two species likewise showed similar responses to light at 28 °C, with comparable photosynthesis-irradiance ($P-E$) curve parameter estimates, and no reduction in photosynthetic activity and quantum yield of oxygenic evolution up to $1,000 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$. Photoinhibition-recovery experiments at 8, 16 and 28 °C were also carried out on both species. Their effective quantum yields (Φ_{PSII}) after 6h of continuous PAR exposures at $1,000 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$ under all temperature treatments significantly decreased, and did not recover after 6h of dark acclimation. Such irradiance level was high enough for the seaweeds to suffer from photodamage, regardless of temperature.

Whereas complete recovery in post-dark acclimation Fv/Fm occurred for *C. okamuranus* exposed to $200 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$ at 28 °C, and for *C. umezakii* at 16 °C. Low temperature limitation may account for the decreased photosynthetic activity of *C. okamuranus*, while temperatures beyond the tolerable limits in *C. umezakii* may cause its greater tendency for photodamage. Overall, this study clearly showed the distinct temperature adaptations of the two species, in relation to the temperatures in their respective habitats, which further explains their distribution in coastal waters of Japan.

The effect of irradiance and temperature on the photosynthesis of a temperate seagrass, *Zostera marina* (Zosteraceae) from Kagoshima, Japan, as the southern end of its distribution in the western Pacific

Natsumi Shimada Faculty of Fisheries, Kagoshima University, Japan

Gregory N. Nishihara Institute for East China Sea Research, Organization for Marine Science and Technology, Nagasaki University, Japan

Hikaru Endo Faculty of Fisheries, Kagoshima University, Japan

Ryuta Terada United Graduate School of Agricultural Sciences, Kagoshima University

Seagrasses (marine flowering plants / angiosperm) often form dense assemblages and provide a number of functions within the coastal ecosystem. Kagoshima Prefecture is located in the southern part of Kyushu and northern part of Ryukyu Islands, and lies at the boundary between temperate and subtropical climates. Hence, more than 10 species of temperate and subtropical seagrasses including *Zostera marina* L. (Zosteraceae) are found in the region. Although annual in habit and cosmopolitan in distribution, temperate species of *Z. marina* in Kagoshima Bay seem to have an annual habit. They disappear by the end of early summer; while newly germinated seedlings re-appear in autumn, and dominate seagrass beds in winter and early spring. Seawater temperature rise, brought about by global climate change has been a serious concern; its effect may influence the continued survival of biological organisms, particularly of such temperate species at the southern end of its distribution. In the present study, we determined the effects of irradiance and temperature on the photosynthesis of *Z. marina* from Kagoshima Bay by field and laboratory measurements. Measurements of photosynthesis and dark respiration rates, as well as maximum (Fv/Fm) and effective quantum yields (Φ_{PSII}) were carried out using optical dissolved oxygen sensors and the pulse-amplitude modulated (PAM) fluorometer. In situ measurements of *Z. marina* population revealed a decline in Φ_{PSII} with increasing incident PAR, with minimum values occurring during noon to early afternoon. Φ_{PSII} recovered by evening, indicating dynamic photoinhibition. Results of in vitro

photosynthesis-irradiance ($P-E$) experiments showed that *Z. marina* did not undergo photoinhibition at 24°C, as net photosynthetic (NP) rates were saturated at E_k (i.e., at $154 \text{ mmol photons m}^{-2} \text{ s}^{-1}$), and remained stable up to the highest irradiance level of $1000 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$. However, an occurrence of such was observed at 8°C, given the decline in NP rates above E_k ($134 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$). The response of oxygenic gross photosynthesis (GP) rates over a temperature range of 8–40 °C showed a gradual increase up to 32 °C, and a decrease thereafter. Fv/Fm of *Z. marina* exposed to a similar temperature range for 72 hours were likewise evaluated. Values were relatively stable between 8 °C and 28 °C after 24 hours, and eventually declined to almost 0 above 32 °C after 48 and 72 hours. Results of the photoinhibition-recovery experiments (i.e., 12-hour PAR exposures at 200 and $1,000 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$, and at 8 and 20 °C) revealed larger depressions in Φ_{PSII} of samples exposed to $1,000 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$ under both temperature treatments. Fv/Fm of samples after 12 hours of dark acclimation were restored to initial values at 20 °C, but not at 8 °C. Indeed, low temperature, in addition to high PAR stress, has enhanced photoinhibition with greater risk of photodamage. This species is considered to be well-adapted to the current seawater temperatures in Kagoshima (15 – 28 °C); however, summertime seawater temperature at the study site is close to their tolerable limit, which could also influence its distribution at lower latitudes.

Field Observation Study on the effect of Fe-Fulvic acid silica complex material aiming at the NAGASU Tidal Flat restoration

Ryoichi Watanabe, Teruki Hamada, Koreyoshi Yamasaki Fukuoka University
Masahiro Koga, Yoshiaki Koga Koyou Co.Ltd.

The NAGASU tidal flat that carried out this field experiment study is located at the middle site of Kyushu Island. The Ariake Sea is a heavily closed sea water area, therefore tidal exchange with the outside of the bay is not effective, and eutrophication progresses by pollution load from land.

For these past several years, fish catches of the Manila Clam *Ruditapes hilippinarum* decrease sharply in various places throughout the all over Japan. The reasons for the decrease of fish catches of the Manila Clam *Ruditapes hilippinarum* has not yet become clear.

It is being explained what humic substance and Fe-Fulvic acid are important for tidal flat ecosystem. Since the dam reservoir temporarily stores river waters, those humic substance like Fe-Fulvic acid trap in the lake of the dam bottom. And also, after the 1960s, supply of the sand material from main rivers had decreased sharply in the Ariake Sea coastal area.

The consequent decrease in the Fe-Fulvic acid and sand supply to the sea is not advantageous to diatoms (siliceous and mostly benign) in tidal flat ecosystems. Therefore, a lot of fine organic rich suspended sediment such as silt and clay deposits on the tidal flats surface. In the Ariake bay, annual catch yields of the Manila Clam *Ruditapes hilippinarum* has been decreasing from the 1990s especially in Kumamoto and Fukuoka prefectures.

In this research, we observed the effect of Fe-Fulvic acid silica complex material at NAGASU tidal flat.

We installed the Fe-Fulvic acid silica complex material in the Nagasu tidal flat from July, 2014 and began observation. This observation research has carried out once a month at the NAGASU tidal flat from July, 2014. The observation contents are the observation of the tidal flat surface altitude by the RTK surveying, the collection of the bivalve in the quadrat (50cm×50cm),

collection by the sampling core of the tidal flat surface layer. The area that the Fe-Fulvic acid silica complex material into the tidal flat, approximately 2,000 square meters. The Fe-Fulvic acid silica complex material is enclosed in a biodegradable bag with sand. The material is located into a a cross-woven lattice form within 2,000 square meters, and distance between the material is approximately 5m. In addition, the contrast section that did not spend the Fe-Fulvic acid silica complex material in the place approximately 100 meters away from the construction section that spent the Fe-Fulvic acid silica complex material.

Observation Results from the monitoring survey showed improvement in habitation of the Manila Clam *Ruditapes hilippinarum* and sediment quality, the restoration of the tidal flat was confirmed. For example, the Manila Clam *Ruditapes hilippinarum* have sharply increased in the NAGASU tidal flat experimental area. Also diversity of bivalves and other benthic organisms have increased in the tidal flat area, suggesting an improvement of the habitat environment. Furthermore, analysis of the Fe-Fulvic acid silica complex material in the tidal flat suggested that suspension feeders such as bivalves have an important role in the water purification process of tidal flats. Therefore increase in bivalve abundance will likely result in the improvement of water purification ability of the tidal flat area.

Protection and utilization of great salamander in Toyosaka district, Higashi-Hiroshima city

Toshihisa Asano, Norio Shimizu
Hiroshima University

Great salamanders are the biggest amphibians in Japan, 150 cm at the maximum. They are designated as a Japanese special natural monument. They distributed from Gifu to Oita Prefecture. The many inhabit the rural area in the Chugoku region.

We focus on the great salamander in the Mukunashi river, Toyosaka, Higashi-Hiroshima city. We will report the critical situation of the great salamanders in this river, and discuss the challenge for extending social support for the solution.

Mukunashi river is a small river flowing through rural area in the center of Hiroshima prefecture. In this basin, the population is decreasing and the aging of the population is proceeding.

Shimizu and others have investigated the great salamander of this river. They found the natural nest for breeding. This is an only natural nest finding in Hiroshima prefecture now. However, the survey showed clearly that there is no salamander of a specific generation. Only big old salamander or small newborn one lives in this river, middle size salamander has not been found here. In this river, there are many small dams for agriculture. These prevent the salamanders from moving freely in the river. And young salamanders are carried away to the paddy field together with water for agricultural use. It is thought that many young salamanders are dead in the irrigation canal or the paddy field. In order to regain the sustainable habitat of the salamanders, the repair of the river and land use management of the drainage basin are required.

Some residents in this district have conserved the salamander from the 1960s.

However, they grow older and some of them have died. So it becomes difficult to continue the conservation activity. In addition, many of the other residents are not so interested in the environment of river or the salamanders. The residents who have conserved salamanders in the Toyosaka district met by

chance the members of the nature conservation group who lives in the urban area. Then the conservation activities spread, adding the researchers of Asa Zoo and Hiroshima University to the members. The basic survey for the salamander conservation was restarted in 2011.

This survey clarified the ecological feature of the salamanders in this district and the crisis of their habitat. However, it is actually difficult to solve the problem. This problem is not known by many people and the problem solving is not considered to be necessity. So the request to the river improvement for coexisting with the salamanders does not arise.

Although the concern of the residents to salamanders is increasing by the energetic report of local mass media or eager study activities at the elementary school, it is not enough in order to require the river improvement. It is necessary to show intelligibly that conservation of the salamanders makes benefits of the district. Some activities are actually beginning to try. The Kamo plateau eco-museum proposed by Hiroshima University Museum is one of them. The problem is developing the concrete activities which contribute to both the salamander conservation and the regional vitalization, and which stimulate many residents' participation.

Analysing social perceptions on the risks and benefits of tidal flat restorations: Cases from Japan and Malaysia

Hiromi Yamashita Ritsumikan Asia Pacific University (APU)
Naoyuki Mikami Hokkaido University

This presentation analyses what kinds of discourses have been identified regarding perceptions of tidal flat restoration projects in past studies in different parts of the world, what kinds of conclusions have been drawn so far, and what kinds of contributions environmental sociological approaches could make in future studies in this field. Various tidal flat restoration projects have been conducted in recent years in an attempt to revitalize fish stocks, prepare for sea level rise or for mitigation purposes.

Coastal wetland restoration projects, such as coastal realignment or re-flooding farmland, still represent a new concept. Due to the need for long-term social support and investment in such schemes, as well as avoiding potential conflict, it is becoming increasingly important to take into account the various perceptions that exist in the community. When looking at the existing study results, although they clearly list what kinds of opinions have been expressed by citizens, they lack investigation into aspects of environmental justice, and risk communication. Citizens are sometimes branded as self-interested, hoping to receive short-term and tangible benefits but not caring for tidal flat environments or future generations. This short paper explores the patterns of social perceptions of the risks and benefits of tidal flat restoration projects in the existing research findings and discusses the potential contributions environmental sociological approaches could provide in making future analyses of perception studies more meaningful. This paper is part of a Japanese government-funded (grant-in-aid) research project looking at how the 'risks' and 'benefits' of tidal flat restoration projects are communicated and perceived by different stakeholders in case studies from Japan, the UK, the Netherlands and Malaysia (2015-2018). This short paper looks into what kinds of discourse have been identified regarding perceptions of tidal flat restoration

projects in the past studies in different parts of the world, what kinds of conclusions have been drawn so far, and what kinds of contributions environmental sociological approaches could make in future studies in this area. Tidal flat is a shallow, often muddy, part of seashore, which is covered and uncovered by the rise and fall of the tide. It supports not only an immense variety of wildlife, but also has an economic value, including providing a source of food, water purification, erosion control, and reducing damage from tsunamis. Among conservationists, tidal flats are regarded as one of the most important areas to conserve for the health of the wider coastal and oceanic environments. International convention documents, such as those produced by Ramsar, emphasize this (e.g. Ramsar Convention Secretariat 2008). In recent years, various tidal flat restoration projects have been conducted in the world in an attempt to prepare for sea level rise or revitalize fish stocks. A wetland scientist, Mitsch (2010) notes that ecological restoration is becoming common practice to improve ecological quality of many degraded ecosystems. Coastal wetland restoration projects, such as coastal realignments or re-flooding farmlands still represent a new concept. However, it is believed to become one of the important environmental conservation activities in the future. Due to the need for long-term social support and investment in such schemes, as well as avoiding potential conflict, it is becoming increasingly important to take into account the various perceptions that exist in the community.

Red-crowned Cranes in Japan; Is it Possible for Them to be Independent?

Nobumichi Kurosawa
Kushiro Sarun Trust

The Red-crowned Crane (*Grus japonensis*) is a species that represent the wetlands in East Asia as an apex species in the food chain in wetland. There are two separate populations in China and Japan. The population in China is migratory and has approximately 1,300 individuals, while the population in Japan is non-migratory and has approximately 1,750 individuals that live only in Hokkaido, especially in eastern Hokkaido including Kushiro Wetland.

Red-crowned Cranes in Japan had been regarded to be extinct in early 20th century due to hunting and habitat degradation, until a few dozen birds were found again in 1925 in Kushiro Wetland. Thanks to the effective winter feeding by local people since 1952, the population increased steadily. The conservation efforts are evaluated highly to be worthy of praise.

However, as most of the wetland and natural water system in eastern Hokkaido freezes during winter, it is difficult for the cranes to find enough natural food to maintain their current population. The feeding by local people and NGO is indispensable for crane's survival. Currently the feeding is subsidized by local and national government.

As a large population of cranes, sometimes as much as 200 to 300, gathers at each of the 3 main feeding sites in winter, there is concern over the outbreak of infectious diseases such as bird flu among them. Moreover, due to the decreasing wetland area including the Kushiro Wetland, the population density is still high in the limited habitat even in summer. It makes many of them obliged to live near people's living range. As a result, accidents to cranes, such as collision into cars, trains and power lines, and damages by cranes to agriculture are both increasing. There are numbers of reports regarding the damages to agriculture, which include eating seeds and seedlings of maize for livestock feed during sowing season, spoiling silage (stored fodder)

by pecking its plastic wrapping, and intruding into cattle shed to eat cattle feed or foul it with their feces.

There are several movements in other areas in Hokkaido to promote cranes' natural dispersion by preparing good habitats and/or restoring old habitats. It has worked for a certain degree but is not enough to alleviate the concentration in eastern Hokkaido.

There is no reintroduction scheme for them so far, but the Ministry of the Environment aims to encourage them to disperse autonomously by reducing the period and amount of feeding.

The main habitats of cranes in eastern Hokkaido are wetlands and the surrounding dairy farm areas. There is a high possibility for them to disperse into farming regions producing rice, vegetable and other crops. It wouldn't be a problem while the number is small, but when the number increases, new problems to agriculture might arise before long. It will be necessary to ensure not only the wetland environments for cranes but also the consensus of local people around wetlands.

Since Red-crowned Crane is appreciated as an auspicious bird in Japan, it is highly possible that the dispersed population is welcomed in each area. In order to live along with cranes, it should be an essential step to raise awareness of local people as well as to promote wetland conservation and restoration.

Integrated evaluation of biodiversity in tidal flat in Tokyo Bay

Masayuki Takada Hosei University

Yoshio Mishima National Institute for Environmental Studies

Takahiro Ota Nagasaki University

Hiroyuki Oguma National Institute for Environmental Studies

By using the data of biological survey (2006, 2007, 2010) conducted by Chiba prefecture for Sanbanze tidal flat (1800 ha) in Tokyo Bay, we tried to create maps on biodiversity of tidal flat by combining these data. The following seven data were used.

- Benthos: "number of species" and "wet weight"
- Fishes: "Number of species" and "Number of individuals"
- Phytoplankton: "Number of species" "Total cell number"
- Algae: "Number of species"

The map was prepared from the point data of the survey point by the following two methods.

- 1) Spatial interpolation by IDW method using geographic information system
- 2) Estimate by multiple regression analysis from Pixel value of satellite image (Landsat)

We mapped each of the above four classification groups, seven parameters individually. Next, standardized so that the maximum value became 1, and totaled in consideration of dispersion, and created two integrated maps, which are showing the number of species and the quantity of biomass.

As a result, the spatial interpolation method has a geometric shape, and in the method using the satellite image, a noise-like pattern was appeared due to delicate reflection difference such as sea surface influence, but the following common tendency it has been clarified.

- 1) The number of species and biomass in Fish tended to be higher as they were closer to the land.
- 2) The number of species in Benthos tended to be higher in the direction closer to land, and the biomass showed an opposite tendency.
- 3) Plankton tended to be higher in both the number of species and biomass, closer to the offshore area.
- 4) The number of species of algae tended to be higher in the coast closer to the land.

- 5) The integrated maps roughly show the number of species and biomass tended to be higher near the land area.

It is presumed that the difference in properties of individual tidal flats (such as mud type and sand type) is difficult to find due to the location of the survey point, but the biodiversity was shown to be both rich. It is also suggested that plankton is low on the land side due to water purification effect of tidal flat.

We provided these maps to conservation activity members conducting on-site surveys of tidal flat, and interviewed the following items.

- 1) Difference between maps and actual feeling
- 2) Relationship between people's use and rich areas of biodiversity
- 3) Effect of maps on conservation and understanding the tidal flat, and dissemination of more effective map information As a result, the following was clarified as the effect of the map information.

- 1) It can lead to conviction that the area is rich in biodiversity seeing his experience of conservation activities.
- 2) It can be used for checking information or correcting misunderstanding by his experience.

The former is a great motivation for the continuation of conservation activities and it also works effectively for disseminating information to others. The latter is an indispensable viewpoint for adaptive conservation management.

On the other hand, the trade-off between index integration and information accuracy is a future task in terms of information disclosure and communication. Especially, according to the purpose, it may be unnecessary to provide the details of the information and uncertainty, and it is difficult for the public to understand it. It is necessary to further consider a more desirable expression method of map information through balancing these two factors.



Sago Eco-Techno Village: Towards Alleviating Disaster and Vulnerability of Agriculture and Communities through Nature Conservation and Enhancement in the Agusan River Basin in Mindanao, Philippines

Rowena P. Varela, Glenn Arthur Garcia, Roger T. Sarmiento
College of Agricultural Sciences and Natural Resources, Caraga State University

With Climate Change affecting the Philippines, the 10-year forecast reveals that periods of high rainfall (La Nina) will increase in northeastern Mindanao. This phenomenon will trigger more frequent and dangerous typhoons and flooding that will impact on people and their sources of livelihood. Thus communities need to prepare for disasters and risks associated with these typhoons and flooding episodes. Natural vegetation along rivers serves as buffers against flash flooding. Reforestation that assumes the natural vertical and horizontal tree community structure constitutes the natural protection system against flooding. Hence, education through seminars, training and workshops was conducted to heighten the communities' awareness on the value of the riparian vegetation of Agusan River in preventing flash floods. The communities were involved in conserving natural stands of sago palm (*Metroxylon sagu Roett.*) and/or enhancement through replanting in disturbed areas in the wetlands of Agusan River Basin. Sago palm, also known as starch palm, is a plant species that produces 250-kg starch per palm. It thrives well in wetlands and water-logged areas in Southeast Asia and Papua New Guinea. This palm is ubiquitous in the Agusan River Basin and utilized as a traditional source of food among the indigenous people.

However, conversion of sago areas into ricefields and housing has been becoming fast in recent years with the increasing population. To prevent further conversion of natural sago areas in wetlands along the Lower Agusan River into housing areas and ricefields, communities along the river are organized to participate in establishing the 'Sago Eco-Village'. The eco-village is designed to be the pilot site for a wider sago replanting program that will eventually spread into the upper Agusan River Basin.

The 'Sago Eco-Village' aims to provide livelihood to the local communities through starch production while maintaining the sago-based plantation to serve as buffer during flooding and as habitat for biodiversity. The 'Sago Eco-Village' has 4 major project components: a) organized local communities; b) a sago-based nursery; c) sago-based plantation; and d) postharvest processing centers. To preserve the cultural value of sago as a traditional crop and its cultural connection to the indigenous people in the Agusan River Basin, sago starch processing adopting the traditional methods is highlighted in the eco-village. However, a modern mechanized sago starch processing is also a major component of the sago eco-village to cater to the demands for bigger volumes of starch for industrial purposes. Community participation is encouraged to let them take ownership of the sago eco-village, thereby sustaining the sago-based revegetation in the Agusan River Basin. The sustainability of the sago eco-village is viewed to increase the income of people in the communities that will reduce their vulnerability to disasters. Moreover, the demand for raw materials in sago starch production will encourage wider replanting of sago palms in the river basin resulting to sago conservation. The expansion of sago-based green belts through the community-based development of the sago eco-villages is viewed to assuage disaster and vulnerability of agriculture and communities through nature conservation and enhancement. The enhanced sago-based green belts are expected to help improve the waterways while protecting the agricultural fields and human settlements in the riverine villages from the rushing water during flooding episodes.

Practice of rebirth of the Tora area in a special emergency project to cope with severe disasters

Kiyofumi Kobayashi Kyushu University Graduate School of Engineering/Daishin Co.,Ltd
Hironori Hayashi Kyushu University Graduate School of Engineering
Yukihiro Shimatani Kyushu University Graduate School of Engineering

In the Sendai River basin which flows in Kagoshima prefecture, there was recordable heavy rain mainly in the northern part of the Satsuma region from July 19th to July 23th 2006. Total rainfall for 5 days exceeded 1000 mm at rainfall observatory. In particular, the damage of Satsuma Town was enormous. There were one person dead and three minor injuries, 214 completely destroyed buildings, 367 semi-collapsed buildings and 232 inundated buildings. This flood damage was mainly caused by unprecedented heavy rain. In the downstream part of the Satsuma Town Torai area, there was a narrowed section where the river channel was curved large. It was pointed out that rising of the water level of this greatly curved river channel part is one of the factors which caused the damage to be expanded.

On the other hand, similar floods had occurred in the area in 1972. As a result, the residents had a strong distrust against river administrators (MLIT: Ministry of Land, Infrastructure, transportation and Tourism). This project was accompanied by a remarkably large scale renovation that cuts waterways of about 250m in extension, 65m in average channel width and 700 thousand m³ of excavated sediment. In addition, the project site is adjacent to shopping districts and residential area in the Satsuma town. For this reason, we had to fully consider the impact of river improvement project extending to an extension of 2.0km on the lives of the local residents. For that reason, it was necessary to inherit the history and culture of the area, to mitigate the impact on natural landscapes and ecosystems, and to fully consider the utilization methods after the reconstruction in advance.

In this paper, we introduce the Sendai River river refurbishment project which was carried out by participating residents in

this Torai area. Specifically, the concept of planning design, the landscape hydraulic model experiment used to study the flood effect and the natural environment accompanying the division channel opening, the consensus formation process with the local residents, the maintenance management after the completion and the utilization I will introduce the situation in the local area. In the area, floods occurred two weeks after the completion, but the water level observation station supports the safety of the region, such as a water level drop of 0.8 m is confirmed. After that, six years have elapsed, flooding flows repeatedly from 3 to 5 times each year in the waterways, and now a new wetland space to be a habitat area is also created. In the 2.0 km river refurbishment section, a masonry protection stone utilizing construction-generating materials, a waterfront walking path incorporating universal design, a waterfront space that thoroughly preserves the sea, the foothills and the waterfront are also completed, and local residents and NPOs There are also many regional event by event. With this project as the opportunity, moves are also underway with the view of regional creation, such as expansion of neighboring prefectural parks, community development connecting creeks and towns, tourism projects to experience the nature of the Sendai River basin.

Study on river improvement technology in high gradient river using masonry groin for environmental conservation

Muneyuki Nakaji Department of Urban and Environmental Engineering, Kyushu University

Rei Itsukushima Department of Decision Science for sustainable Society, Kyushu University

Yukihiro Shimatani Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University

Nature friendly river improvement technology of midstream is generally established. However, the technology of high gradient river or mountainous stream is not established due to large velocity and attractive force during flood. We studied to design nature friendly river channel of the Oide River (located in Nagasaki city) which is steep high gradient river.

We tried to design a river channel that can flow flood occurred once in thirty years in safety and create habitat of aquatic biota. We used masonry groin as a riverbank defense method. However, groin design technology system is not established.

Accordingly, we conducted physical, movable-bed model. The physical model was scaled 1:50 applying the Froude's law. To investigate energy dissipating effect of groin structure and fluctuation of river bed after the flood, the experiments combination is conducted 24 experiment cases. We conducted experiments changing of left bank groin size (4.0m, 7.3m, not installed), groin distance (15m, 20m, 25m, 30m) and occurrence probability of flood (1/30 and 1/10). Regarding the right bank, a groin of sufficient size was necessary to protect the right bank river bed. Accordingly, the right groin size was unified at 8.8m in all cases. Measurement items are water level which are measured at intervals of 20m at three points on the left bank, the center and the right bank, flow velocity which are measured between groins at the three points similar to the water level and photogrammetry to evaluate fluctuation of river bed.

As a result, left bank groin size of 7.3m was unsuitable because inundation occurred in the upstream part of the right bank regardless of groin distance. The phenomenon is thought to be due to the fact that the river bed rose locally and the flow cross

section decreased compared to the groin size is 4.0m when left bank groin size is 7.3m. The right bank flow velocity of the case which left bank groin size are 4.0m and 7.3m were smaller than that of the case which left bank groin is not installed regardless of measurement point. This means that the flow velocity reduction effect by the left bank system also affected the flow velocity on the opposite bank. The case which left bank groin is not installed, excessive river bed scour was occurred at the left bank river bed. Therefore, we determine the left bank groin size of 4.0m as most appropriate. To decide optimal distance of groin, we evaluated the experiment in the case of left bank groin size as 4.0m.

As a result, in the case of 25m water route formed after flood was moderately meandered (sinuosity:1.06) and various habitats such as riffle-pool structure were expected to form after flood. Finally, from the viewpoint of flood control, river bed scour and environment, we decided that the left bank groin size of 4.0 m, the right bank groin size of 8.8 m and the groin distance of 25m are optimal as the structure of the groin system. As a result of this study, it is revealed that masonry groin is important element technology to design the environment consideration river channel in high gradient river.

Establishment of Monitoring Program in Iranian Wetland Ecosystems

Yosefali Ahmadi, Mehri Asna-Ashari, Abolfazl Abesht
Iran Department of Environment, United Nations Development Program (UNDP)

With the selection and application of the ecosystem approach for protection, management and wise use of Iranian wetland ecosystems, establishment of an integrated wetland management plan with the participation of all stakeholders has begun and, in cooperation with all the governmental organizations, NGOs and local communities, finalized in technical workshops and after numerous stakeholder meetings the integrated plan established.

Part of the integrated wetland management plan is dedicated to the monitoring protocol. In this section, required steps with details for monitoring of wetlands ecosystem are specified in three sections of the biodiversity, water-soil and socio-economic. These details include monitoring parameters, suggested locations for establishment of stations, monitoring and collecting data responsible, data storage locations and reporting times. The purpose of the preparing of the monitoring protocol is to raise awareness about the biological, physical and social conditions of the wetland and its catchment area, helping the beneficiaries to better manage these resources.

Conservation of Iranian Wetlands Project with the aim of helping to implement the integrated wetland management plan and collecting important ecosystem data from wetlands facing water quality problems has begun to design and set up monitoring stations for water quality in wetlands. In the first phase, two Choghakhor and Kanibarazan wetlands were selected. After field surveys and review of similar experiences, the location of the stations and parameters needed to be measured at different depths was selected and finalized. The Choghakhor wetland with an area of about 2000 hectares is one of the wetland ecosystems with high habitat values, with an average depth of about two meters. The station is located on the northeast of the wetland and in depth of about 2 meters, the sensors is installed

at three different depth on the floating platform. The parameters are water temperature, EC and DO in three depths (water level sensor in wetland bed) and a sensor also collect weather data such as temperature, air pressure, and relative humidity and a digital platform send data online to the server.

In the Kanibarazan wetland, with the aim of identifying of thermal stratification in the water column, installed the sensors of temperature, water level changes, EC and DO at two depths (water level sensor in wetland bed) and also air temperature, air pressure, and relative humidity parameters on a fixed platform. Also, with the purpose of collecting more data from other parts of the wetland, two satellite stations are located at two other points of the wetland, which collects temperature, water level changes and EC parameters.

In the second phase, based on the experiences of the first phase pilot, it was attempted to set up monitoring stations in Solduz and Nowrozlu wetlands, which are now the location of the stations, the target parameters and the required tools identified and finalized. And Planning for installing tools is underway.

Important points of the Iranian wetlands monitoring program include the participation of NGOs in data collection and the participation of universities and other research centers in analyzing data and helping to better management of these ecosystems.

Should we go alone, if we want to go fast? Should we go together, if we want to go far?

A discussion of sustainable cooperative efforts among registered and non-registered wetlands

Hiroshi Tomida Manko Waterbird and Wetland Center
Eiji Sawada Faculty of Economics, Kyushu Sangyo University

Old African proverb says "If you want to go fast, go alone. If you want to go far, go together." Could we apply this proverb to the wetland conservation cooperation? Ramsar sites registration increases concerns about the wetland and biodiversity conservation in the registered area, but is also expected to bring various regional financial profits ranging from increasing tourism revenue, community development to promotion of persons who have significantly contributed. In Japan, By some aspects, they might be competitors and by some aspects they might be cooperators. Then, how does each wetland develop a cooperative relationship? And in what case could they develop the sustainable cooperative relationship? We classify the stakeholder structures into four cases, and examine which case could explain the actual wetland conservation cooperation well and in which case could sustainable cooperation be developed. Classification of stakeholder structures is based on two different properties of the regional profit of Ramsar sites registration. One is the correlation between profit and order of registration. If the registration profit has the "first in time, first in right" structure, then earlier registered wetlands would earn more profit and registration would become less attractive for the non-registered wetlands. The other is the correlation between profit and the number of registered wetlands. If increasing number of the registered wetlands would make the Ramsar sites less distinctive, smaller number of the Ramsar sites would bring greater profits to the registered wetlands. From these two properties, we have four stakeholder structures; Case1: earlier registered wetlands earn greater profit and growing number of the registered wetlands increase the profit, Case2: earlier registered wetlands earn greater profit but growing number of the registered wetlands decrease the profit, Case3: earlier registered wetlands earn fewer profit and growing number of the registered wet-

lands increase the profit, Case4: earlier registered wetlands earn fewer profit and growing number of the registered wetlands decrease the profit. Within these four structures, both cooperation between registered wetlands and non-registered wetlands, and among non-registered wetlands are only expected in Case 3. Combining the field studies in Ariake sea and Okinawa islands, we apply every cooperation type in study area, international cooperation, national cooperation, local cooperation, to one of four stakeholder structures, respectively. As far as our studies, while many cooperation among registered wetlands and cooperation among geographically apart areas are observed, there are few regional cooperation. In geographically close areas, their profits are strongly linked and the both effect of the order of registration and the number of registered wetlands would become significant. Hence, regional cooperation has the Case1 or Case 2 stakeholder structures and that is the reason why only few cooperation are observed. Based on the above discussions, let us again consider the proverb noted in the beginning. By arranging in the context of wetland conservation cooperation, we can say "If you want to be registered earlier, then you would go alone without any cooperation among non-registered wetlands." And further can say "If you want to be registered together, then you would develop a cooperation between registered wetlands and non-registered wetlands." And finally, we have to add extra, "If you want to develop both cooperation between registered wetlands and non-registered wetlands, and cooperation among non-registered wetlands, then policy makers should redesign the stakeholder structures to make Ramsar site registration is profitable for later registered wetlands as well as the earlier registered wetlands."

Develop and startup ESD activities for rehabilitation of mangrove forests in Malaysia

Takuji Arai

Japan-Malaysia Association

Since year 1995, Japan-Malaysia Association (JMA) has been planting dipterocarpaceae tree species for reforestation purpose in Sarawak, Malaysia. Together with the Forest Department of Sarawak and local communities, we have been conducting not only tree planting but also maintenance, raising seedlings and also environmental education activities. Based on this experience, JMA is planning to develop and startup ESD activities for sustainable rehabilitation program of mangrove forests in cooperation with local universities and communities in Malaysia.

At this moment, Kuching Wetland National Park, Sarawak and Merbok Mangrove Forest Reserve, Kedah are proposed area for our project.

Kuching Wetlands National Park, located 30 km from Kuching city, was gazette as national park in 1992 and covers an area of 6,610ha. The park is composed of coastal, marine and freshwater ecosystems.

The park is home of at least three predominantly arboreal primates, the endangered proboscis monkey, the long-tailed macaques and the silvered langurs. White-bellied sea eagles, mudskippers and horseshoe crabs are also present. Otters and the Irrawaddy dolphins can also be sighted. On nearby Mount Santubong, hornbills can be seen.

Merbok Forest Reserve is located about 1 hour drive north from Penang. Merbok F.R., which is made up of 18 compartments with a total area of 4,176 ha, is under the jurisdiction of the Kedah Forestry Department.

Merbok F. R. consists of 32 species of trees exclusive to the mangrove ecosystem, and has been considered as one of the most floristically diverse mangrove sites in the world. The FR also harbors a diverse array of fauna, most prominent are its bird communities where about 80 species have been recorded including migratory species. Other inhabitants include several species of primates, reptiles and a high number of commercially-important aquatic species occupy the estuarine river ecosystem.

In the both area, the mangrove and river ecosystems play an

important role in providing livelihood for fishermen and the surrounding village communities. Some of the villagers and fishermen comprise of low income households. However some parts of mangrove forests have been degrading in effect of urbanization and development in the both area and it has been big concern on sustainability of ecosystem and biodiversity in the future.

We have had discussion with experts of Universiti Malaysia Sarawak (UNIMAS) and RCE Penang, Universiti Sains Malaysia (USM) several times for the future cooperation. At this moment, we are planning to start restoring forest in Kuching Wetland National Park with the Forestry Department, UNIMAS and local communities from next year.

Potential activities are as follows;

1. Reforestation activities at degraded sites with participation of local communities.
2. Establish mangrove seedling nursery as a stock for mangrove reforestation sites. The project's nursery can also be a supplier of mangrove seedlings for other mangrove reforestation projects in surrounding area.
3. The proposed reforestation project can be a platform to train local communities in silviculture, tree care, forest management, communication skills, and other relevant skills.
4. The proposed reforestation project can be an educational tool for local schools, visiting schools and universities to learn about mangrove ecosystem and conservation.
5. The proposed reforestation project can be used to conduct outreach and awareness programs to visitors, and the public at large.
6. The proposed reforestation project can be a platform for ecotourism and contribute to the growing ecotourism activities.
7. Establish a mangrove environmental/educational gallery and it will be the center of ESD program in the future.
8. Hold seminars at university to share experience with schools, NGOs and other related bodies and print leaflet for publication.

Wetland play important rule such as supporting biodiversity, hydrological buffer, and climatic buffer. Hydrology is the driving force behind wetlands and their important functions, while it is quite variable because input/output of water can be affected by both natural and anthropogenic factors in and around wetland. Therefore, hydrological monitoring is essential for wetland management.

Most important requirement for long term monitoring is continuities in terms of cost, measurement facilities, and technical easiness. If measurement facilities are fragile, continual data collecting is difficult and frequent maintenance should also rise running cost. Technical easiness is particularly important in case of monitoring by non- professional.

After data collecting, the data should be used for evaluating wetland hydrological condition. It is preferred that evaluating whole wetland hydrology based on data from limited observation point. To make it possible, water flow in whole wetland should be considered when determining location of observation point.

In this presentation, we introduce hydrological monitoring system which is developed for a small peatland, Nishibetsu mire, as an example. Water table measurement have been carried out in cooperation with local government officer and professional engineer in this mire.

Nishibetsu mire is located in cool temperate area in northern most island Hokkaido. The mire has an area of about 7.4 ha, lies at altitude 30-35 m, and receive avg. 1135 mm/yr of precipitation. The mire is designated as natural monument as a habitat of endangered tree species *Betula ovalifolia*. Therefore, local town should keep mire condition which allow the tree can maintain its population. The aim of hydrological monitoring is to capture the hydrological change in the mire, and to provide suggestion about factor of hydrological change for further detailed investigation.

To consider contents of monitoring and location of observa-

tion, following investigations were carried out: ground level survey, water depth measurement in many point, measurement of ground level fluctuation, reconnaissance to seek in/outflow path, seepage/spring of water, structure which affect water flow such as drainage ditches and sheet pile. Based on these investigation, we determined contents and location of monitoring as follows: groundwater level measurement at only two observation point. One observation point is located at area where hydrological head is highest (higher observation point, HOP), while the other point at area where hydrological head is lowest (lower observation point, LOP). Hydrological component at HOP must be simple because HOP receive water from only precipitation. Therefore, monitoring data at HOP is easier to interpret than other area where hydrological component is complex. Data at LOP coupled with HOP is expected to be used when considering whole wetland hydrology such as water retention regime.

To capture the hydrological change from monitoring data, we developed a coupled tank model which simulate water level fluctuation at both HOP and LOP. This tank model is calibrated by two series of observation data, making a small improvement in the fault of traditional tank model which use many physically uncertain parameters against only one series of calibration data. Using this model, we can interpret the monitoring data regardless of amount of precipitation.

To get suggestion about factors of hydrological change, we develop a three- dimensional ground water flow model which simulate not only water level at HOP and LOP but also water flow of whole wetland. And additional simulations are carried out under the possible situation. For example, if one of the surrounding ditch will be deeper, water level at HOP will be draw-down whereas that at LOP will not change.

Such scenario analyses greatly improve monitoring data availability.

Water Quality of Malaysian Tropical Reservoir Associated with Aquaculture Activities

Muzzalifah Abd Hamid, Harith Mokhlas, Siti Norasikin Ismail, Mashhor Mansor
School of Biological Sciences, Universiti Sains Malaysia

In October 2008, a large scale of aquaculture project was initiated at tropical Temengor Reservoir, Malaysia due to its vast area and favorable environmental conditions. The fish cage culture was operating within 100ha of the Aquaculture Industrial Zone (AIZ). The zone was identified by Perak Fisheries Department. The objective of the aquaculture industry at Temengor Reservoir is to produce a high quality of tilapia fish species that can be commercialized to local and international high-profit market. Although the positive economic impact of aquaculture is well acknowledged, however, the associated negative impacts on the environment cannot be overly emphasized. Without proper planning and management, the establishment of aquaculture could degrade the surrounding environment. Based on previous studies, aquaculture activities may contaminate the lakes and reservoirs due to the water discharge from the cage itself which contains a high concentration of nutrients and suspended solids. Therefore, the aquaculture sector must be well-managed and monitored to avoid any environmental degradation towards the Temengor Reservoir.

As there are limited documentations on the impact of aquaculture on this tropical reservoir, hence this limnological study was conducted on the water quality status and phytoplankton community at Temengor Reservoir as the elucidation of the current lake status could reflect the influence of tilapia cage cultures. A total of 15 sampling points were established and assessed along the aquaculture zone to examine the trend of water quality changes between the sites that were near to the fish cages versus those 5km away at a 1km interval. Evidently, among the physical parameters, transparency, dissolved oxygen and pH values were slightly lower in the stations with cages, while other parameters were relatively similar at all sampling points. From the water analysis, apparently, the nutrient concentrations are comparatively higher at aquaculture zone and decreased slightly at sampling points more distant from the

cages. The higher concentration of nutrients was attributed to the nutrient leaching from uneaten food pellet, fish excretion and decomposition of nitrogenous and phosphate compounds.

Besides, the chemicals substances such as vitamin and antibiotics that were used to increase the aquaculture production might as well contribute to loads of nutrients.

Evidently, the higher concentrations of nutrients and chlorophyll a have contributed to the higher abundance of phytoplankton especially at the aquaculture zone. There were 21 phytoplankton species recorded in this study. The dominant phytoplanktons were *Staurastrum* sp., *Cosmarium* sp., *Cyanodictyon* sp., *Peridinium gatumense*, *P. inconspicuum*, *Staurodesmus* sp., *Tabellaria* sp. and *Desmidiaceae* sp. Based on the trophic state index (TSI), the aquaculture zone is eutrophic. Perhaps it is estimated that an occurrence of an algal bloom will be resulted due to the high levels of eutrophication. Algal bloom could bring many negative impacts on the lake ecosystem and surrounding such as creating unpleasant scenery, foul-smelled blooms and altering water quality by increasing acidification, turbidity and decreasing oxygen availability which will induce the suffering of aquatic life especially the native fish communities. Fortunately, the trophic state at sampling points with no cage culture is still in mesotrophic state. However, the concentrations of nutrients and chlorophyll a at Temengor Reservoir were still within the acceptable limit of water pollution as the aquaculture waste could slowly sink to deeper depths. This resulted in low concentrations of nutrients as compared to other previous studies conducted in other areas. Hence, the localized water quality observed here has not led to any detectable environmental problem so far. Nevertheless, proper control and management need to be imposed in order to avoid total destruction the lake ecosystem.

Sustainable use of natural resources for community livelihoods in the Setiu Wetlands, Terengganu, Malaysia

Haramaini Arifin WWF-Malaysia (Setiu Wetlands Field Office)

Daria Mathew WWF-Malaysia (Peninsular Malaysia Office)

Muhammad Zaid Nasir, Nur Syahirah Wahab WWF-Malaysia (Setiu Wetlands Field Office)

The Setiu Wetlands in Terengganu is undeniably a jewel of Malaysia's natural world. Located within the administrative district of Setiu which is inhabited by 61,700 people, the Setiu Wetlands provide numerous ecosystem services that are beneficial to the local population's livelihood and wellbeing.

The reliance of local community has been examined via a number of studies and in a recently concluded high conservation value assessment (HCV) by WWF-Malaysia, whereby the findings confirmed the community's high dependency of natural resources from the wetlands especially on fisheries. The mangroves ecosystem serves as fish nurseries while the river and lagoon support freshwater and brackish water fisheries. The loss or degradation of the wetlands would cause serious implications by depriving the community of their basic necessities in terms of their main source of protein. The assessment also proved the existence of a strong link between economic income of the community with cultural resources derived from the wetlands that is tied to their traditional identify. *Lepironia apiculata* (Kercut) leaves and *Nypa fruticans* (nipah) fronds are the raw materials used to make traditional handicraft items (such as bags, floor mats, kitchen accessories, baskets, Malay wedding gift trays and lamp shades) which are sold and contribute supplementary income to the community. These traditional items are part of the culture of the local community and has existed for generations.

However, the Setiu district is one of the poorest districts in Terengganu thus there is great pressure and demand for economic growth to generate higher revenue. This factor also forms the catalyst for the government to implement social development and poverty alleviation programs to make available more job opportunities and income generating activities for the communities, often involving the allocation of natural and forested

areas for the poor to develop into agricultural smallholdings. The prospects of faster and huge economic returns from development are often perceived to outweigh the ecological and social benefits provided by wetlands ecosystems which are usually not directly measurable. It is a challenge to convince decision makers as well as the community themselves about the need to conserve the Setiu Wetlands in order to sustain the livelihood and well-being of the communities. One of WWF-Malaysia's strategies for Setiu Wetlands is to empower the local community to support and participate in conservation efforts through conservation partnership with community groups and Community-based Organisations (CBOs). The CBOs act as wetlands guardians and agents of change by promoting custodianship over wetlands and empowering the larger local communities to manage their wetlands resources in a responsible and sustainable manner. Since 2006, WWF-Malaysia has been working closely with the CBOs in Setiu in a variety of community participatory activities such as mangroves replanting, wetlands camp, community surveys and participation in planning processes for development and protected area planning, and patrolling nesting beaches to collect Painted terrapin eggs for transfer to and incubation at the hatchery. Capacity building of the local community to undertake and drive conservation activities that may also contribute supplemental livelihood benefits is emphasized as an integral aspect of the community engagement. It is envisaged that through community stewardship, there is greater possibility for ensuring the Setiu Wetlands remain healthy, ecologically functioning and biologically diverse.

The roles and actions of the wetland centre of Yatsu-higata Tidal Flat, a wetland in the city that experienced massive urban development in the inner area of Tokyo

Tatsuya Shibahara

Yatsu-higata Wise Use Partners

The areas in Tokyo Bay, where Yatsu-higata Tidal Flat is located in, are highly urbanised. Ninety percent of the coastline of the bay is covered with artificial embankments as the results of large-scaled reclamation of the tidal flats that started in 1960s. The areas along the rivers flow into the bay are densely inhabited, where 25% of Japan's total population reside.

Yatsu-higata is located inner part of Tokyo Bay. It is one of the precious remaining tidal flats that survived the massive reclamation. It is an important shorebirds habitat in the East Asian-Australasian Flyway (EAAF). The area became a national wildlife protection area in 1988, designated as a Ramsar site, and joined the EAAF Site Network in 1996.

Yatsu-higata has survived thanks to the conservation actions of local people that started in 1970s, and has been successfully conserved through the efforts by the Ministry of the Environment, Japan (MOE-J), and Narashino City. However, there are a few issues arising recently. First, a kind of seaweed species called 'Aosa (sea lettuce)' started to expand in a large scale which causes odor when it gets rotten in summer.

Second, the number of shorebirds flying in is reducing. Thirdly, non-native clam species proliferates recently, bringing about accumulated empty shells that may prevent the tidal flow near future.

To tackle such issues, many conservation activities have been carried out by the Yatsu-higata Nature Observation Center (YNOC), the basecamp of the CEPA activities for the conservation and wise use of Yatsu-higata. This presentation will share our best practices listed below. By doing so, we would like to consider the roles of the wetland centers in urban areas like Yatsu-higata, in order to contribute for wetland conservation in Asia, where more development and urbanisation will be going on in the coming future.

1) Deciding the anniversary day of Ramsar designation and cele-

brating it annually with events – More than 20 years has passed since the Ramsar site designation, but the conservation efforts are still continuously made by the local government and citizens, thanks to the designation of anniversary by Narashino City and the annual events to celebrate it. The events are planned and managed by the YNOC with local citizens.

Such anniversary and events provide opportunities to the citizens to participate and reminds them the most important conservation objectives; to promote conservation and wise use of Yatsu-higata. Such approach is effective for the wetlands located in urban areas and has straggle in showing direct benefits from wetlands.

- 2) Cooperative works for conservation and wise use of Yatsu-higata involving the MOE-J and citizens - In Yatsu-higata, the main body for the CEPA activities is the YNOC, and conservation is the MOE-J. The mains of wise use were the local fishermen till the reclamation of adjacent areas, but after they relinquished their fishery rights, there is no fishery going on. That makes it difficult to utilise Aosa seaweeds and non-native clams as resources. YNOC holds workshops to facilitate the cooperation among the stakeholders to share arising issues and discuss the possible solutions.
- 3) Networking and cooperative activities among the institutions and organisations that are related to Tokyo Bay – Around Tokyo Bay, there are small wetlands scattering. They survived from reclamation or were restored after the development. Local authorities manage such areas as parks. These wetlands have similar characteristics in terms of history and biodiversity. However, the management authorities vary, and the number of cooperative activities among the facilities is not high. In such highly urbanized inner bay, networking and cooperation among such facilities will be the key to effectively appeal the situation of the Bay and promote conservation.

Evaluation of infiltration characteristic of amended soil by long term observation under natural rainfall for establishing runoff reduction technology

Soichi Okayama Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University
Rei Itsukushima Department of Decision Science for sustainable Society, Kyushu University
Yohei Ogahara Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University
Yukihiro Shimatani Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University

Flood disaster has frequently occurred in urban areas. The cause is a decrease in the infiltration area due to urbanization and an increase in localized concentrated torrential rain due to climate change. As a solution to this problem, law maintenance, and introduction of rainwater storage facility have been carried out. However, existing method are not sufficiently popular due to problems such as cost, so urban flood damage is still occurring.

Therefore, it is indispensable to develop small, inexpensive, and easy technology for flood reduction, such as rainwater tanks, rain gardens, simple infiltration trenches, and so on. In addition, since it is difficult to increase the infiltration area in urban areas, it is effective to improve the penetration capacity of existing infiltration areas. In this research, we focus on compacted bare land such as ground and park. To enhance infiltration capacity of compacted soil at bare land, soil amendment materials such as humus and bamboo chips have been mixed.

On the other hand, infiltration capacity of soil at bare land decreases due to forming crusts at soil surface layer due to rain-drop impact. It is reported that underground vegetation and litter in artificial forests such as cypress are weakening the impact of rain drops and inhibit the formation of crusts. However, with regard to compacted bare ground in urban areas, no technology has been established for improving infiltration capacity by suppressing crust formation on the surface.

This study aims to evaluate the influence of soil surface structure (no surface structure, permeable soil paving material and gravel mulching) and soil amendment materials for compacted soil (humus and bamboo chips). We conducted infiltration

experiment under natural rainfall by observing surface runoff and measuring volumetric water content of soil.

As the results of this experiment, surface runoff frequently occurred in the case of soils with no surface structure, whereas surface runoff rarely occurred in the case of bamboo mixing soils covered with surface structure such as gravel mulching and permeable soil paving material. Coating surface structure is thought to be effective, because surface structure prevents surface disturbance by raindrop and avoided the decreasing of infiltration capacity. As for soil amendment materials in compacting condition, the amount of surface runoff of humus mixed soil is larger than that of bamboo chips mixing soil, because depression of void structure by compaction caused the decreasing of infiltration capacity of humus mixing soil.

In addition, the amount of permeated water exceeds the amount of water captured by the soil in the case of rainfall event more than 50mm. Permeation amount is more than 60% of total rainfall amount. Therefore, evaluation of infiltration capacity is more important than that of volumetric water content.

In this experiment, it was found that the compaction affects the infiltration capacity, and the influence differs depending on the soil amendment material. It is necessary to evaluate the influence quantitatively. In addition, there is a possibility that soil amendment materials such as mulch humus and bamboo chips deteriorate over time. We are going to continue this experiment and inspect the effect of aged deterioration on infiltration rate.

The Study of Grey Water Footprint of Organic-Rice Cultivation for The Lower Central Plain Management in Thailand: Case Study in Nakhonchaisi District, Nakhon pathom Province

Chotika Ya-anan, Werachat Chatpanyacharoen
Faculty of Environment and Resource studies, Mahidol University

The lower central plain in Thailand has usually been used for agriculture, especially rice cultivation because of the suitability of geography and the productivity of water body. The information from Rice Department, Ministry of Agriculture and Cooperatives in Thailand has been shown that the rice cultivation area of the lower central plain in 2016-2017 is approximately 381,856.8 hectares or the third rice cultivation area of Thailand.

To have good quality and quantity of rice cultivation, it depends on many factors. One of the essential factors is the plant's nutrition from fertilizer. It has been clearly seen that most Thailand's farmers have used the chemical fertilizers that contribute to the environmental problems whereas some farmers have used organic fertilizer instead. So, this study aims to research about organic fertilizer under the study's hypothesis 'Does organic fertilizer also has an effect on the environmental problems and Thailand's lower central plain management?' by using the calculation of grey water footprint as an indicator. The grey water footprint is one of water footprint types. It is defined as the volume of water required to dilute polluted water (A.Y. Hoekstra and A.K. Chapagain, 2011), in this case, is water polluted from natural organic fertilizer. The study area is located in Nakhonchaisi district, Nakhon Pathom province which is the part of Thailand's lower central plain.

Rudimentary field research was asking the information about organic-rice cultivation procedures from the organic-rice field's farmer. The farmer informed that the area has not been used any types of natural fertilizer but growing the Sunn-Hemp plant scattering all area and ploughing it into the soil as natural fertilizer before beginning the rice cultivation. Due to its rapid growth and nitrogen-fixing capability, Sunn-Hemp is gaining popularity as the cover crop (Audrey Alwell, 2015). Grown and

ploughed Sunn-Hemp 1 hectare can produce Nitrogen as much as Nitrogen from Urea (46-0-0) 93.75kg. (Land Development Department of Thailand).

Next step was collecting water samples in the organic-rice cultivation area. They were collected 3 times related to land preparation phase, the first vegetative phase (15-20 days of rice growth), and the second vegetative phase (50-60 days of rice growth), respectively. All of the water samples were analyzed the concentration of Nitrate-Nitrogen (NO_3^-) at the laboratory and its concentration was used for grey water footprint calculation. The result shows that the calculation of organic-rice's grey water footprint is 690 m^3/ton .

Even though the organic rice cultivation has no chemical fertilizer applied, ploughed up and over the Sunn-Hemp can increase Nitrogen in soil and released to water. The result of grey water footprint has been shown that organic-rice cultivation also has an effect on the volume of freshwater and widely effect on the lower central plain because almost all this area has been used for rice cultivation. It means that the volume of water used to assimilate pollutant is increasing.

In conclusion, the organic-rice cultivation can decrease the environmental problems from using the chemical fertilizers but it still has the amount of Nitrogen released to the natural water. It has been undeniable that the organic-rice cultivation also has the grey water footprint and there is much more Nitrogen drained into the natural water that may cause the problems such as, eutrophication. Therefore, grey water footprint is one of the effective indicators that can be used for managing many cases about polluted water and this research has shown that the grey water footprint will be able to use for agricultural management in the lower central plain of Thailand.

Diversity and distribution of Macroalgae in Chiang Mai, Thailand

Chindanai Jaitamart, Rungnapa Tagun and Tatporn Kunpradit
Department of Biology, Faculty of Science and Technology, Chiang Mai Rajabhat University

One of the most important producers in the aquatic ecosystem is algae. Due to they are important in the functional feeding group as a primary producer. More than that, algae has a great deal of usefulness to humans in area such as agricultural, environmental science, and medicinal applications. However, the applications of algae have not been fully developed because of a lack of basic knowledge, limited species level identification and basic ecological data. The ecology, morphology and pigment compounds in each species are different in even in the same genus and it is very complicated to identify. Hence, the study aims to survey the diversity and distribution of macroalgae and its relationships with the various habitats and environmental conditions in Chiang Mai province, northern Thailand. The samples were collected from 26 running and standing reservoir sites from seven districts throughout the Chiang Mai Province. The study was carried out from February to November 2016. The attached macroalgae that can be seen with the naked eye were scraped as filaments, thalli, brown or green film on hard substratum, rock, cobbles, gravel, sand, branches of trees or other substrates. Some may be found as a free floating on water surface. The samples were kept in a 20-50 ml centrifuge tube. Filled with the water from reservoir sites into samples tube and reserved at 4-10°C to maintain conditions prior to further study in the laboratory. Identified up to species level under compound microscope and using the books or relevant documents. The photo image and monograph of macroalgae samples were processed for making a macroalgae hand book. Thirty-three species of 20 genera in four divisions were found in this study. The Division Chlorophyta was the most dominate distribution (45%) followed by Division Cyanophyta(27%) , Division Rhodophyta (23%) and Division Charophyta (5%) respectively. The *Spirogyra* sp., *Rhizoclonium* sp., *Cladophora*

sp., *Phormidium* sp., *Compsopogon* sp. And *Audouinella* sp. were a common species of Chiang Mai area. The area where found the highest diversity were the old traditional indigenous check dam "Fai Wang Hai" and eight species of seven genera were found in this sites including *Microspora* sp., *Spirogyra* sp., *Tetraspora* sp., *Tetraspora cylindrical*, *Lyngbya* sp., *Chaetophora elegans*, *Stigeoclonium flagelliformum* and *Phormidium formosum*. It was concluded that the distribution of macroalgae were depended on the appropriate substrate, water condition as the nutrients and the physical and chemical properties, light intensity and conductivity. The data of this study was use to initiated the macroalgae hand book that could be use by the student and local people. This book included the distribution of macroalgae ecological data and the development of the simple method for monitoring the environmental conditions by youth and student that could easier communicated and understood with pictures and symbols. In addition, these data could be used by local people who cultivate the macroalgae in the natural stream and river that they are normally use this organism as a nutritional supply and medicinal propose in their daily life. The book also could be used as the Environmental Education tool for students and local citizens in Northern Thailand and the other areas.

Diversity of Macroalgae and Benthic Diatom in Upstream of Mae Chaem River, Kalayaniwathana District, Chiang Mai, Thailand

Thakdanai Paotajai, Rungnapa Tagun, Tatporn Kunpradit
Department of Biology, Faculty of Science and Technology, Chiang Mai Rajabhat University

Macroalgae and benthic diatom plays important rules in aquatic ecosystems as the producers that there are key components of food webs and related to the environmental condition in aquatic ecosystem. There are diverse, abundant and closely linked to environmental factors as well as sensitive to pollution and rapid response to external disturbance. The aim of this study is to survey the diversity and distribution of Macroalgae and benthic diatom in the upstream parts of Mae Chaem River Kalayaniwathana District, Chiang Mai, Thailand. The Mae Chaem River is an important tributaries of The Ping River that essential to the livelihoods the major portion of the population in Northern Thailand. The sampling was carried out from December 2015 to July 2016. Four sampling stations of upstream of Mae Jam River were selected and sampling once a season. Fourteen species of eight genera in three divisions of macroalgae and 62 species of eight genera of benthic diatom were found in this study. The dominant species of macroalgae were *Spirogyra* sp., *Compsopogon* sp., *Cladophora* sp., *Rhizocronium* sp., *Audouinella* sp., *Oscillatoria* sp., *Lyngbya* sp. and *Nostochopsis* sp. Which visible by the naked eye., Growth attached on rocks, cobbles, gravel, They could be found on land including in soil, surface water, on leaves, tree, any surface as well as building-wal, branches of trees or other substrates or within the water current, appeared as filaments thalli and dominant species of benthic diatom were *Cymbella tirgidula*, *Navicula radiosafallax*, *Gomphonema parrulum* var. *Lagenula*, *Gomphonema clevei* Fricke, *Cymbella tirgidula*, *Coconeis placentula* var. *Lineata*, *Navicula viridula* Ehrenberg. The important feature of those diatom is two frustules stick together composing of silica with beautiful patterns that could be used for identification. In addition, there has more brown pigment that makes the cell brown-

ish. The diversity index ranged from 1.143 to 2.548 and the highest value recorded at MJ1 in December 2015. The evenness index ranged from 0.395 to 0.860 and the highest value recorded at MJ3 in July 2016. The highest species richness was recorded at MJ2 in December 2015 (29 species). The chemical and physical variable in each sampling sites were classified in the moderate to good and moderate according to the water quality are close to neutral as standard surface water of Thailand. Overall, the water quality of Mae Chaem River Kalayaniwathana District based on AARL-PC Score method were revealed that the water quality were oligotrophic-mesotrophic status. The data of water quality and its relationship with the organism distribution was transferred to the community via the initiation of water quality monitoring focus groups including the researcher, local organization, students and teacher. The group activities were raised the issues with the easy methods and planning for the local bio-monitoring. The reflection from the local citizens was satisfied with an appropriate simple technique for physical and chemical measurement with the organisms investigation. Therefore, this method could be developed and used as the Environmental Education tool for students and local citizen who lives nearby creek and upstream area of Northern Thailand and the other areas.

The region I came from is famous of its peatlands (peat accumulating mires). West Siberia is known as the most paludified area of the planet. The peatlands cover more than 60% surface area in some places like Tomsk region. The largest mire system of the world – Great Vasyugan peatland system – is situated at the territories of three regions at the West Siberian plain, mainly in Tomsk region.

We can recognize the history of paludification and peatlands development at the territory of Siberia from the beginning of Holocene – 10-12 thousand years ago. Since those time peatlands have accumulated carbon of plant remains within peat deposits reaching now up to 11 m. Peatlands of the West Siberia vary on surface area, ecological types, topology, degree of the permafrost development at the peat deposits, modern vegetation, genesis and evolution as well as ecosystem services and anthropogenous impact. They are vast and endless, especially from the bird's eye view.

Only very limited public in Siberia knows that mires and peatlands are important component of the landscape with special biodiversity and ecosystem services. Mires are widely known as “aggressor” occupying such plentiful areas of valuable land. Wetland centers mission is to protect mires and peatlands and to raising the awareness of wetland issues through education, research, involvement, visitor activities.

Wetland centers started to appear in Russia recently. There are only few (3-4) wetland centers in Asian Russia (Siberia). One of them - Wetland Center of Tomsk State University - has been created in Tomsk region on the base of the oldest in Siberia mire science school as a link of the global network of educational centers for wetlands, Wetland Link International. It aims the purposes of environmental education and exists mainly as Internet resource. However, virtual information is not enough. We need

places where people could directly get to know the nature of the peatlands.

The goal of my work is to create a project of the peatland visit center that could visually show all diversity of peatland flora and fauna, ecosystems and communities, landscapes and functioning. The process of the development of the project of the visitor center on peatland includes the following steps: identification of target audience, concept development, creation of the design project and the working project.

Visit center on peatland can be used as for scientific purposes, so for the education of ordinary citizens. It would be possible to show peatlands, which are considered a distinctive feature of our region, to foreign tourists, students and scientists. This will be a scientific enlightenment center with a training area for thematic classes, where all information relating to the peatlands of Siberia will be presented, and an open area for visitors with a viewing platform. Also people can observe the diversity and behavior of birds from an enclosed space. Visitors will not only know about the biodiversity, but also about the land use on peatlands.

The internal exposition is represented by information stands showing the species of mammals, birds and insects that live nearby, as well as plant species, most typical for peatlands, and also birds migration map. The voices of birds are chosen as the soundtrack. From the observation platform, equipped with binoculars, everyone can get acquainted with the surrounding fauna and flora, without disturbing local inhabitants.

We need to show people that the peatland is not a gloomy and dangerous swamp, but a beautiful place and a home for many representatives of the animal and plant world.

The work is supported by the government order from the Ministry of Education and Science of the Russian Federation (Project No. 5.4004.2017/P).

Comparison of CEPA activities and base facilities in Peru and Japan

Yuki Ozaki
Ramsar Center Japan

Peru is located approximately in the middle of the continent of South America, bordering Ecuador, Brazil, Chile etc. with the west side facing the Pacific Ocean. Peru is an extremely diverse country. The country has 3 main regions according to the traditional method of dividing the country by altitude: coast, mountains, and jungle. Peru joined the Ramsar convention in 1992 and has 13 registered sites. The total land area is 6,784,041ha, ranking third in Latin America. PARACAS was registered in 1992 as the first Ramsar site in Peru. The sandy beach of Paracas an important resting place for migratory birds. As part of the reserve is open as a beach, 250,000 people a year visit for swimming and sightseeing. In recent years, Tourism development and overfishing are taking place, threatening the ecosystem of the protected area. The need for CEPA activities increased, and JICA dispatched volunteers for two years in PARACAS.

This paper compares CEPA activities in Peru and Japan from the viewpoint of base facilities. Its objective is to summarize common points and differences and contribute to Asian CEPA activities.

#545 PARACAS (1992.3) / #615 YATSU-HIGATA (1993.6)

Area: 335,000ha / 40ha

Number of Staff: 25 people / 15 people

Number of Visitors per year: 250,000 people (for swimming, sightseeing, educational visit) / 40,000 people (for exercise, bird watching, volunteer activities, educational visit)

Access: 15 minutes by car from the major national highway / 15 minutes on foot from the station

Volunteer System: Summer volunteer (3 months, live-in, 20 people, students), Weekend volunteer (4 people, students) / Registration system (100 people, 13 years old ~ senior citizen)

Center Structure: (900m²) Permanent exhibition, Theater room, Bench, Walking Trail / (1750m²) Permanent exhibition, Special exhibition, Food and drinking space, Multipurpose space, Library, Bench, Walking trail

CEPA Activities: Delivery courses (irregular), Puppet theater / Nature observation tours, Center guides, Craft workshop, Picture-story show etc., Volunteer activities (27 groups: Newsletter editing, Data analysis, Carving etc.)

• Common point: There is a visitor center, and it has a permanent exhibition. There is good access to town. Both have succeeded in making use of volunteers as a solution to the shortage of staff.

• Differences: In the case of Paracas, there are few staff members in charge of CEPA activities (Only one person at the visitor center). There is no guide and no binoculars in the viewing space. Information has not been updated. The visitor's staying time is short.

Compared with Japan, the Paracas center was not well utilized as a place for CEPA. Although it is a fine building, its activities are hampered by having fewer personnel in charge of CEPA.

On the other hand, it does succeed in playing the minimum role. It accurately conveys the information of the site to many people. There is also a toilet and a promenade.

In order to solve the above problem, I carried out activities thinking about what few people with no space would be able to do. Guide at the boardwalk (explanatory board and binoculars that can be carried)

School Visit to nearby elementary schools (Developed interpretation teaching materials on the theme of wildlife conservation) We installed an information board outside the center and renewed it every month.

CEPA activities can be raised in quality by creative ingenuity.

However, to implement CEPA, both hardware and software are required. Also, it will not start unless you focus on involving people above everything else. Especially, it is important to involve the young generation as volunteers.

Growth and burrows of the Japanese mud shrimp (*Upogebia major*) in the Arao tidal flat

Towaki Ide, Chihiro Fukushima, Syoya Oobuchi, Sinnosuke Harada, Taiyou Kiyota, Yukito Yoshimoto, Ryuki Wada, Fumiko Koyama, Hiroshi Matsuura
Taishi senior high school, Arao senior high school, Kumamoto prefecture

1, Growth of Japanese mud shrimp (*Upogebia major*) Majak

We call the Japanese mud shrimp (*Upogebia major*) "Majak". We were interested in the ecology of famous Majak in the Arao area. To study their growth and development we dug up Majak over a 5 month period of time and recorded their size.

Within 5 months, growth of about 5 mm and transfer of a new generation could be clearly confirmed. During the September to October period, we surveyed at spring tide, which comes every two weeks, and confirmed that the Majak were growing about 5 mm on average and that a new generation of Majak was present. We also checked for the presence of plankton Majak affixed to the Arao tidal flat sediment.

In a business report by Kumamoto prefectural seaweed laboratory, reported in 1986, the size of Majak was recorded as 23.7mm for a 2 year old male, 23.3mm for a 2 year old female, 32.6mm for a 3 year old male, 30.0mm for a 3 year old female, 34.2mm for a 4 year old male, 32.1mm for a 4 year old female. In Arao tidal flat, we could confirm individuals over 30 mm in the spring season. So we supposed these individuals were 3 years old.

2, Burrows of the Japanese mud shrimp (*Upogebia major*) Majak

We compared the data of the burrows which was surveyed by Imamura and Miyazaki from the Arao tidal flat that were 80 cm in depth the data of the burrows from Tokyo Bay that 207.9 cm in depth (Kinosita, k., 2002). And it was obvious that the burrows from the Arao tidal flat were shallower.

In order to confirm many burrows of the Arao tidal flat, we poured resin into a quadrat of 25 cm x 25 cm, and also poured resin into another hole which is a pair outside of the quadrat to avoid resin leaks.

In addition, we thought that Majak seem to block the burrow

even though the burrow continues. So we dug out the resin which was set in the burrow and examined it after catching the Majak. We caught Majak by the traditional method in the Arao region. We put a calligraphy brush into the burrow. Then, when the Majak came up to push out the brush, we pulled the Majak out of the burrow.

On August 31 st, 2015, we poured the resin into the burrows. When we dug up the resin molds, we gathered many burrows with a "Y" shape. We also found 4 small connecting tunnels between the burrows. They were too small to be made by Majak. When we connected the burrows, they made a labyrinth shape. The 4 small connecting tunnels had a diameter of 5.6 to 12.6mm.

3, Perspective

We will continue these investigations in the future. And, despite the fact that many Majak are gathered every year due to Majak fishing competitions and fishery. We want to elucidate the mechanism of growth for Majak of the Arao tidal flat. In addition, just want to think about how many Majak we should catch, to make it a steady catch every year.

In addition, we have plans to exhibit the resin mold of the Majak burrows at Saga. And we would like to discuss the fact that the Majak burrows extend oxygen conditions to deep places in the tidal flat.

Benthos of the Arao tidal flat, its list and specimen

Yukito Yoshimoto, Towaki Ide, Haruki Kume, Ryouki Wada, Natsuko Kobayashi, Hiroshi Matsuura
Taishi senior high school, Kumamoto prefecture

1, List of Benthos of the Arao tidal flat that we could confirm

The Arao tidal flat became a Ramsar wetland site in 2012, and this year will be the fifth anniversary. In the meantime, we have continued the investigation of the Arao tidal flat.

Based on the survey method of Wetland International Japan (WIJ), we conducted 15 minute surveys of the Benthos on the surface and by digging 15 holes. Furthermore, qualitative investigations were also conducted.

We used pocket books published by WIJ, etc. to identify the organisms collected. Creatures that could be confirmed were released on the spot and several individuals that could not be confirmed outdoors were brought to school.

Also we brought typical shape samples back to school, soaked them in alcohol and made them into a preserved specimen. The results are summarized in the table.

From November 2012 until October 2013, 58 species were confirmed.

By October 2014, we were able to record 78 species, including species we confirmed visually, without collecting them. We also learned that three species were not officially listed. By October 2015, we confirmed 90 species of benthos.

We were able to confirm a total of 125 species of benthos by October 2016. It was difficult to judge the type of Polychaeta and more investigation is necessary.

2, Characteristics of Benthos List of Arao tidal flat

In addition to our list of benthos, 80 species of Benthos were confirmed in the Arao tidal flat in the "Arao City History" issued in March 2000. Shigeo Tokuyama, a member of Arao City Cultural Property Protection Committee investigated this with students in Arao Daiichi Junior High School from 1998 to 1999.

According to a survey entrusted to the Kyushu Environmental Management Association by the Arao tidal flat conservation

and wisdom utilization council in 2014, they confirmed 103 types of Benthos on the Arao tideland.

There are many arthropods in every list, especially Decapoda. The next most frequent group was Gastropoda, followed by Bivalvia.

A lot of sand and muddy benthos, which is the characteristic of the Arao tidal flat, were recorded. The benthos of the Arao tidal flats are also characterized into many types. The reason is that the Arao tidal flats are a wide and ecologically diverse. For example, there are *Hakusennshiomanekei* (*Uca lactea*) frequently found in the tidelands of sand near the exit of the bay, and *Siomaneki* (*Uca arcuata*) which are frequently found in the mud flats of the bay.

Compared with the Kyushu Environmental Management Association's list, there are creatures that are not recorded on our list. However, we found various Benthos that were not on the Kyushu Environmental Management Association's list as well.

3, Perspective

We will continue to investigate this in the future and I would like to further enrich the list.

In addition, we would like to create a list of about 50 kinds of benthos for various purposes, such as an organism list that is easy to catch for each season, that is easy to catch even for elementary school students, and that is useful for observation sessions.

We will be attending Asian Wetland Symposium Saga. We are preparing to exhibit specimens of Benthos soaked in alcohol which we are currently preparing at school.

We would like people in the venue to see the real benthos and discuss with many people about the comparison with the list 20 years ago, the continuation of the survey in the future, and the monitoring survey.

The tideland which was left in the city “HIRAKATA-Bay”

Towaki Ide, Chihiro Fukushima, Syoya Oobuchi, Sinnosuke Harada, Taiyou Kiyota,
Takuma Ezoe, Noah Honda, Kokoro Nakayama
Kanto-Gakuin Mitsuura Jr & high school Biology club

We, Kanto-Gakuin Mitsuura Junior and Senior High School biology club. Have been conducting nature observations in Hirakata-Bay for about 60 years. Hirakata-Bay (35 degrees 20 north east longitude 139 degrees 38 minutes) is an elongated bay with a width of about 0.3km and a length of 1km located in Kanazawa Ward, Yokohama City, Kanagawa Prefecture (partly in Yokosuka city) Part of the bay is a small tideland. There is a 1 km square islet called Nojima that closes the mouth of the Bay, barely connected with Tokyo Bay by Nojima waterway on the south side and Nojima canal on the north side. Hirakata-Bay is closed so firmly that seawater exchange is very difficult to occur and four rivers flow into it. Dredging is regularly carried.

Ricefields were developed in the north side of Hirakata-Bay were developed in the north side of Hirakata-Bay during the first reclamation in the 19th century.

Many painters including Utagawa Hiroshige drew Ukiyo-e landscape paintings of the northern side of the Hirakata Bay. After that, Yokosuka Navy Air Corps was placed in the vicinity of the exit of the bay.

Unfortunately sediment accumulated in the Nojima waterway between Nojima and Hirakata-Bay, and it was closed in 1966. Instead, the Nojima canal was built in the north side of Nojima and it became the only passage connecting the Hirakata-Bay and Tokyo-Bay. At that time, the southern side of the bay that remained was filled with land and the Hirakata Bay now is a long narrow water area.

Since the 1960s, domestic and industrial wastewater was discharged into the four rivers flowing into the Hirakata-Bay. Because of the firmly closed nature of the bay, the organisms at the most the bottom almost disappeared. The whole bay was like a settling pond of living and industrial wastewater. A large

amount of sludge was accumulated, a stench filled the surrounding area, many toxic substances including cyan were detected, and in the 1980's, it became “the worst marine polluted water area”

The Nojima waterway was opened again in 1994. The seawater became easier to flow into the bay, and the sludge in the bay was removed to some extent. Also, sewage treatment systems were newly established, and the inflow of new domestic wastewater ceased. Finally, the bay's condition improved so dramatically that many creatures could live in the bay again.

I heard from fishery related people that there still remains some sludge. Because it is a terrain that is easy to eutrophic, there are years when red tide occurs. Transparency in summer can get relatively low and, the transparency in winter was pretty high, can get pretty, enables us to look at the bottom easily. Since the sewage treatment was conducted, It's water quality has been kept the same level as Tokyo Bay.

Hirakata Bay experienced nationwide water pollution first in the past. It was a narrow and shallow watershed with a bad odor, so at that time there was an option to make it a residential area. However Hirakata-Bay was preserved. It now a place for people to relax. It is valuable as one of the few tidal flats left in Tokyo Bay.

Even if there is the worst environmental destruction, it can be revived, on the other hand it is difficult to restore the contaminated places.

Hirakata-Bay makes us realize these two aspects and for these reasons, Hirakata-Bay is a valuable ocean. We think that it is important to raise our voice in order to get more attention

to this area. We will continue to observe the situation of Hirakata -Bay through investigation of birds and fishes, and will continue to act as a body that will care for whatever changes may happen

The activities of Shisei junior high school biology club — Our hometown builds on the beautiful tidal lands, levees and canals —

Takahiro Araragi, Riro Ozaki, Emi Omagari, Chika Nanao, Toru Koga, Mao Eguchi
Shisei Junior High School, Saga city

In this presentation, the members of Shisei junior high school biology club are going to introduce our activities. Seishi junior high school is located in KubotaTown, Saga Prefecture, where is close to the Ariake Sea. This year, a biology club has been established in this school. One of the purpose of this club is a contribution for inshore fishery resource conservation. In addition to that, we have routinely studied about cultures, histories and environments of our hometown in the comprehensive class (We call the class to “Saishi-gaku”^{*1}). Therefore, to study our hometown furthermore and to contribute to activation of communities, we conducted following four activities in cooperation with the Seishi-gaku study group^{*2} ; i) Open Seminar; ii) Field Work; iii) Development of the Fish Breeding Method and Releasing Activity ; iv) Growth Experiment on *Suaeda japonica*.

- i) We held a seminar for local general citizens. We invited a lecturer from a local museum, and asked him to give a lecture about original scenery of our hometown.
- ii) We learned comprehensive water management system constructed in 1600s, and visited Saga City Sewage Clarification Center and Saga Aquaculture Promotion Center to study function of these infrastructures.
- iii) We have examined weather we can cultivate young fish living in the Ariake Sea (e. g. *Acanthogobius hasta*, *Cynoglossus joyneri*, *Sinonovacula constricta*, etc.) in indoor breeding tanks. If we can breed the fishes to adult, we will release them to the the Aiake Sea where they were born.
- iv) We have conducted indoor growth experiments on *Suaeda japonica* which is marshy threatened plant species to conserve it.

As above, we have ever studied about our hometown and achieved some results for activation of our home communities.

Through these activities, we understood that if we want to study situations of our hometown, it's effective that we receive directly guidance from the local specialists. Our theme in the second half of this year is to make a plan and hold a “Symposium for Measures of Community Development” with some students, government officers and specialists in addition to taking place “the Second Fieldwork and Open seminar”. After that, we're going to have an opportunity to evaluate and make an improvement plan of the learning program which had conducted in cooperation with related parties this year.

*1 Sisei-gaku is one of the class in Shisei junior high school. In this class, all students have studied local cultures, histories and environments. In 2014, the former students had developed educational texts of Shisei-gaku in cooperation with teachers and local specialists. And now, current students have been practicing Saishi-gaku using the developed texts.

*2 Seishi-gaku study group has been experimentally established by PTA in this year. The aim of this group is development of Saishi-gaku study program including field work, open lecture and symposium with local people.

THANGMI Ancient Folklore Customs have social, religious, cultural norms, values and traditional biocultural diversity do not disturb the wetland ecosystems, natural forest ecosystem, biodiversity, habitats, flora, fauna is a signal of conservation and wise use is deeply rooted with Baulaha Pokhari (Lake) and Dew Dhunga ecosystems, Dolkha. Nepal is a cradle of ancient civilization Himalayan country with racial and traditional biocultural diversity i.e. ecosystem; species and genetics, wetland conservation have not documented well in landscape. Wetlands oral traditions, intangible, tangible cultural values, knowledge, practices, folklore, customs, norms, religious, spiritual beliefs and significance of traditional biocultural wisdoms link with forest biodiversity are disappearing from society. There are ample opportunity for scientific innovation, restoration, conservation, wise use of Himalayan wetland ecosystems, biodiversity, biocultural diversity and its relation with human dynamic, institutional enhance, ecotourism development and promotion for rural livelihood. The geography 60 to 4000m and temperature varies 42° to -10°C forest biodiversity freshwater wetlands ecosystem are the habitats for diverse flora and fauna and also culturally significant.

Due to the diverse beautiful landscapes and wetland culture, country has 118 natural ecosystems, 2.6 % flowering plants, 9.3% birds, 4.5% mammals, 4.2% butterflies, 2.2% fresh water fishes, 1.6% reptiles and 1.0% amphibian species (IUCN Nepal 2004).

Society e.g. Kirant (indigenous inhabitants) believes the origin of their ancestor in natural landscapes in which ancient folklore, oral tradition, religious, spiritual relationship and way of traditional life is deep rooted on air, earth, water, rivers, rivulets, mountains, rocks, caves, biodiversity, ecosystem, forest, animal, birds, flora and fauna co-relate in conservation and sus-

tainable use. Natural wetland landscapes, lakes, ecosystems, biodiversity and folklore are the ancient historical sacred assets of the society. People visit the area to respect and express their willingness, future plans, show new born babies, good or favorable weather or climate for next crops to ancestor gods, deities with singing and dancing. People bring new harvested crops, maize cobs, fruits, local fowl eggs, cucumbers, and a pairs of life pigeon to votive offer to ancestor god are the ancient oral traditions, bio- culture, and cultural heritage of society in conservation. People release the pairs of pigeon for wishes and long live. Lack of documentation, conservation education, awareness, gaps in young and old generation and local strategy, impacts of climate change, natural disasters, earthquake 2015, and existing natural beauty are being threatened. It is being urgent to take restoration, conservation action in multi-stakeholder approach. Scientific study on species, habitats, traditional biocultural diversity, tradition, life style, religious, spiritual, biological corridor and connectivity are important. It is also important to investigate, document, prepare community protocol, preserve and transform of oral traditions, indigenous knowledge, skills, folklore affinity with biodiversity in Himalayan sacred wetlands in landscapes. The upstream has natural feeding to the downstream freshwater ecosystem which has a vital role for fisher folk for biodiversity conservation, enterprises development and livelihood improvement in people participation. Implement CBD, Ramsar, UNESCO, ICH, cultural heritages in world biological hotspot and Himalayan critical ecosystem with respect to custom and customary system of society is being importance.

Valuation of village ponds as cultural landscape component in India

Gea-Jae Joo, Yuno Do, Ji Yoon Kim

Pusan National University, Korea

Village ponds are a specific type of small artificial reservoir in India. They are constructed for harvesting and preserving local rainfall and water from streams in agricultural landscapes, especially in India, which has lacked perennial rainfall for thousands of years. Village ponds primarily have been used for agricultural and drinking water but also for bathing, ritual, and aquaculture. According to the Ecosystem Services (ES) framework, classifying and evaluating the benefits for people derived from ecosystems, village ponds may have all aspects of ES including provisioning (food, fresh water), regulating (waste-water treatment), cultural (aesthetic appreciation, inspiration for culture, spiritual experience) services; but village ponds have not yet been valued regarding their ES using quantitative valuation techniques such as economic/monetary approaches. Historically, villagers retained the indigenous knowledge of usage and management practices for village ponds. Indigenous forms of knowledge regarding the sustainability of local resources are referred to as traditional ecological knowledge (TEK). Although TEK is most frequently preserved as oral traditions and as such may lack objectively confirmed documentation, TEK for village ponds has not yet been classified. In the present situation, with little concern, village ponds are at risk of disappearing and we will regret losing this critical resource. India is in rapid economic transition. Many rural villages now have dramatically modernized the drinking water supply system. Development of a water supply service for drinking water and a large reservoir for agriculture through modernization and urbanization can replace this traditional component of village ponds. The ES of TEK in village ponds should be as management practices and should be evaluated and classified for sustainable management of village ponds.

Our goal was to confirm the function and importance of

village ponds in the rapidly developing areas as well as rural landscapes. We categorized village ponds based on TEK, evaluate ES of village ponds in India, and establish a framework for conserving village ponds and improving public awareness of interested parties regarding village ponds using modern approaches. Over the last two years, we assessed the benefits of village ponds located in northeast India through field surveys of the Chilika Lagoon basin (State of Odisha). The catchment area (526.3km²) surrounding Chilika Lagoon contains a large number of villages (population; approx. 690,000). We digitized several hundred village ponds and dozens of ponds have been visited. We found that on average each village possesses 2 or 3 ponds with different usages such as irrigation, religious observance, and bathing. The questionnaire included questions on the name of the village, population, the number of the ponds, the number of alternative water sources etc. the possibility of cultural activities being practiced, management schemes, and the dependency (i.e. residential, agricultural, aquaculture, religious practices). Our project will represent the first scientific assessment of the village pond and traditional management scheme's value. The potential results will include the traditional knowledge of village ponds created by the local community to manage the pond for their cultural, economic, and domestic needs over a long time. Moreover, we are sure that the well-organized traditional management of the village pond will be applicable to increase the value of abandoned ponds in urban landscapes. The traditional knowledge based restoration will contribute in enhancing ecosystem health and the resilience of human society by strengthening ecosystem functions.

Building Capacities for Wetland Ecosystem-based Disaster Risk Reduction and Climate Change Adaptation in the Philippines

Joy M. Navarro Biodiversity Management Bureau – Department of Environment and Natural Resources

Amy M. Lecciones Society for the Conservation of Philippine Wetlands, Inc.

Dolores Nuevas EbA Project Implementation in the Philippines, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

With the approval of the Philippine-authored Resolution on “Wetlands and Disaster Risk Reduction” at the 12th Meeting of the Ramsar Convention Conference of Parties (COP12), the Philippines has affirmed the vital role of wetland ecosystems in reducing disaster risk. Through this Resolution, the Philippines supports the need to develop and implement management plans that integrate the principles of ecosystem-based management and adaptation against water-related natural hazards. The mainstreaming of ecosystem-based disaster risk reduction (eco-DRR) and ecosystem-based adaptation (EbA) to climate change adaptation measures in spatial and management plans and into all relevant policies, action plans, programs and project designs is also affirmed by this Resolution. Furthermore, the Resolution also encourages the establishment or strengthening of CEPA programmes to “increase awareness on the role of wise use, management, conservation and restoration of wetlands in disaster risk reduction and on the role of wetlands in contributing to reducing vulnerabilities and mitigating disasters”.

As part of the operationalization of the Philippine-authored Ramsar Resolution, the Biodiversity Management Bureau of the Department of Environment and Natural Resources, in cooperation with the Society for the Conservation of Philippine Wetlands, Inc. conducted a series of learning events on Mainstreaming Wetland Ecosystem-based Approaches to Disaster Risk Reduction and Climate Change Adaptation (Eco-DRR and EbA) from July 2016 to June 2017. The first of the series was piloted in selected critical inland wetlands while the last was focused on capacitating wetland practitioners from the Luzon Island Group. There is plan to conduct another round for the Visayas and Mindanao clusters for next year. Integration with existing projects implementing ecosystem-based adaptation is also aimed at. Meanwhile, the SCPW had also been conducting their regular youth ecological camps which incorporate concepts on environmental protection and natural resources con-

servation in relation to disaster risk preparedness and climate change adaptation and mitigation in the local context of a municipality or groups of contiguous municipalities.

The learning events aimed to develop the capabilities of technical staff of DENR in operationalizing the Ramsar Resolution on Wetlands and DRR and in assisting local government units in integrating the adoption of the Resolution into local plans and programs. They also intended to strengthen and enhance the capacity of the DENR staff, particularly the wetland managers, in assessing the vulnerability of wetlands to natural hazards at the appropriate social and spatial scale to enable the designing of effective risk reduction interventions including ecosystem-based solutions and approaches to reduce the vulnerability and exposure of people and ecosystems. Moreover, wetland managers will be able to mainstream the principles of ecosystem-based approaches and adaptation against natural hazards to the management plans as part of their regular functions related to wetlands.

The paper will focus on the Philippines’ efforts and challenges in building technical capacities for the operationalization of the Ramsar Resolution XII.13 entitled “Wetlands and Disaster Risk Reduction”. It will highlight the challenges as well as lessons learned from conducting a series of learning events on mainstreaming ecosystem-based approaches to disaster risk reduction and climate change adaptation through wetlands conservation and management. The importance of developing partnerships for the successful conduct of such events will also be emphasized, as well as accessing national climate funds such as the People’s Survival Fund. It will then discuss the various techniques which had gained positive participant feedbacks as well as some of the other key enabling and limiting factors that should be considered in developing modules for this kind of capacity-building activity.

Using Art in Engaging and Enabling the Public to Act to Conserve Wetlands

Yi-Fen Jan, Chin-Ling Wu, Shih-Hung Chen

Guandu Nature Park Management Office, Wild Bird Society of Taipei

In recent years, Guandu Nature Park has devoted itself to adopting an art-based approach to engage the public in knowing the values of wetlands and biodiversity. Already a well-managed wetland reserve and a leading wetland education center in Taiwan, Guandu Nature Park is still striving to find innovative ways to expand its influence to a wider public. During the experience of organizing an environmental art event, the Park has discovered that by using art as a medium for transmitting ideas of environmental protection can have a different communicate effect to inspire people to take action.

Dating back to 2006, the Park started the Guandu International Outdoor Sculpture Festival as a way to finding back visitors with the circumstance of the avian flu outbreak in 2005. The pandemic disease has made the public panic about getting near to birds therefore further prevent them from visiting the Park. The art festival became an alternative solution to weaken the strong impression of the connection between

Guandu Nature Park and birds. Meanwhile, new audiences such as art-lovers were also attracted to visit the Park for the first time. The event was held annually by inviting international artists to create eye-catching, site-specific installations using natural or eco-friendly materials. Many art volunteers were also specially recruited to participate in the process of artwork creation. It has successfully created a buzz for the Park and gained its popularity gradually among the public.

In 2016, after celebrating its 10-year anniversary in the previous year, the event has come to a new stage by resetting its title into “Guandu International Nature Art Festival.” Public participa-

tion, art intervention, and nature conservation are still the key elements of this event, and it is expected to serve as a catalyst to deepen the public’s awareness of the environment, as well as care for the local cultures. The event has transformed into much more than just an art exhibition and has included a range of features and activities: the artist-in-residency program, the volunteer participatory program, and diverse community-based education programs to combine the ecological observation with artistic creation. All aims to reflect the unique vibrancies of local history, environment, and culture Guandu area.

Guandu is situated at the confluence of flowing rivers and brackish water. This estuary wetland is a great habitat for a rich variety of organisms, attracting flocks of migratory birds. An agricultural landscape with largest and the last rice paddies of Taipei City is still being kept in this region as well. It is Guandu Nature Park’s mission to safeguarding the Guandu wetland ecosystem and to improving the public’s comprehension of the ecological value of this place.

As the issues that Guandu Nature Park faces continue to broaden, Guandu International Nature Art Festival, therefore, plays a vital role of engaging people from a sentimental perspective to establish their personal aesthetic experiences in a natural landscape. These experiences might be a key to encouraging people to change and act. The interdisciplinary dialogues and interactions happening during this art project have also inspired each participant to reflect upon their own relationship with the land.

Increasing capacity of local communities to implement wetland conservation and Eco- DRR and EbA activities in the Laguna de Bay Region and Marikina-Pasig River Watershed

Amy M. Lecciones, Wilhelmina Ricamunda, Aaron J.M. Lecciones, Zenaida M. Ugat, Jose Carlo H. Quintos, Darryl M. Estorba
Society for the Conservation of Philippine Wetlands, Inc.

In 2014, The Society for the Conservation of Philippine Wetlands, Inc, with support from The UPS Foundation embarked on an initiative aimed to increase the capacity of local organizations to take actions for wetland conservation that will contribute to the effective reduction and management of disasters and help in implementing ecosystem-based climate change mitigation and adaptation measures. It takes a different route from the usual intervention that directly train people on actual DRR measures by dealing instead with the more basic organizational aspect. This refers to the organizational capacity to access resources and how to manage them efficiently and effectively to come up with the desired outcome which is a resilient and climate change-proof environment.

The project selected 10 local organizations composed of fisherfolks, environmental groups, local media, and DRR-focused NGO from areas vulnerable to disasters in the Marikina-Pasig River and Laguna de Bay area. It has three components: (1) learning about wetlands and the ecosystem benefits derived from them as well as the threats and ways to conserve them; (2) assess the readiness of local organizations to embark on wetland conservation measures through a participatory capacity needs assessment and design and implementation of modules to improve their project management and resource mobilization skills; and (3) implement wetland conservation measures by proposing an activity (or a project) that will be given seed fund by the SCPW.

The project employed innovative learning tools, resources, methods and approaches that enabled these organizations to raise funds, build strong local partnerships, and have clear action plan on how to reach their wetland conservation and Eco-DRR (Ecosystem-based Disaster Risk Reduction) and EbA (Ecosystem-based Adaptation) related goals. The training sessions was delivered through lectures, mentoring sessions, sharing of experiences, practical application of learning experiences in real situations including a field visit to an example of a best practice activity. It employed a combination of in-house

training sessions, in-office practicum sessions, cross-visits, internships, and actual project implementation. The Modules focused on organizational profiling and readiness, project development and management, resource mobilization and sustainability, and communication and sharing of experiences among the participating organizations. The Modules include helping them prepare proposals to access resources for wetland conservation.

As an application of their learnings, the Project allocated P20,000.00 (USD500) to fund an activity proposed by each organization. Among the projects proposed and implemented by the beneficiary organizations are: the construction of rainwater harvesting facility and a greenhouse to ensure supply of vegetable seedlings for distribution to communities especially after occurrence of disasters; community-based early warning system; production of gill nets to help mitigate the infestation of knife fish in Laguna de Bay and processing the catch into products as additional livelihood; production of a Youth-oriented television show to be shown through a local cable channel, among others. The activities implemented received counterpart funding from the trainee-organizations that sometimes exceeded the seed fund provided by the SCPW. Additionally, these organizations are now able to access funds and other support from various sources including from the Local Government Units, Department of Science and Technology, Department of Trade and Industry, among others. As a result of this initiative, the trainee-organizations updated their registration documents, ie business permits; enhanced their vision, mission and integrated wetland conservation and Eco-DRR and EbA in their strategic and action plans, and were able to leverage funds from various sources. More importantly, they were able to understand and appreciate the relationship between the integrity of wetlands and the vulnerability of local communities to disasters and other impacts of climate change. This realization urges them to do more to conserve their local wetlands.

Distribution and growth of *Pectinatella magnifica* (Leidy, 1851) in four large rivers, South Korea

Eui-Jeong Ko, Jeong-Soo Gim, Hyo-Gyeom Kim, Hyunbin Jo Pusan National University
Hyun-Woo Kim Suncheon National University
Gea-Jae Joo Suncheon National University

Internationally, distribution survey of *Pectinatella magnifica* (Leidy 1851) has increased sharply in the 21th century. This species originated from North America but now is considered invasive species in Europe and Asia. *P. magnifica* is one of freshwater bryozoans that they are colonial sessile invertebrates and have asexual dormant bud (=statoblast) that it can tolerate with harsh condition. In the summer of 2014, this species had an outbreak in the four large rivers of South Korea. We have studied 1) the distribution of colonies in the nationwide four large rivers 2) attachment characteristics of colonies and 3) the growth patterns from germination to initial growth. *P. magnifica* prefers temperate climate region but is affected by monsoon season, distribution surveys to find a colony were conducted in June (before monsoon) and October (after monsoon). To find colonies, the littoral zone of each study site was examined up to 1 m depth, along a 100m long riverside transect. The colony attached substrates were divided into natural and artificial substrates to determine the substrate preference of the colonies found in the distribution survey. Two artificial substrata were installed within several survey points where colonies were previously reported. The number of statoblasts and colonies on the substrata was counted weekly. Also, we observed changes in the size of several of the colonies found. Our results showed the *P. magnifica* was distributed nationwide. In the entire survey, *P. magnifica* colonies were collected at total 24 sites in four large rivers. At first, *P. magnifica*, which was found in stagnant water, extended its distribution to the lotic water. In our survey, results

of the distribution were different for each survey, but it was repeatedly disappearing and rediscovering in the mainly discovered sites. Given the tributaries that connect the large rivers and the area where they were initially discovered (i.e. dam, weir), it is possible to anticipate the prosperity of *P. magnifica* in the large rivers as well as in the tributaries. Freshwater bryozoans are known that they do not show species specificity for substrates. 531 colonies were used to identify substrate preferences in 4 large rivers.

Our results also showed that a large number of the colonies tend to attach to aquatic plants. However, there were no significant differences between substrates. Statoblasts have been observed continuously from our artificial substrata. Regardless of the number of statoblasts accumulated, it is considered that the point where the formation of colonies was begun is likely to continuously increase the number of colonies through growth and diffusion around habitat. The smaller size of the colony, the greater the likelihood of maintaining shape in the event of a change in rainfall or water velocity.

However, surviving colonies may continue their volumetric growth despite changes in water bodies. Because this species can form colonies longer than 1 m in length. In conclusion, our study for *P. magnifica* is the first distribution survey that was conducted nationwide in the South Korea. Also, it is comparable because repeated surveys were conducted using the consistent method.

Ramsar Biwa-Kids Ambassador Project

Shigekazu Ichiki*, Kana Hatta*, Ryo Onoue**, Daisuke Nakamura***, Yumiko Nomura****, Munetsugu Kawashima*****
*ILEC, **Shiga Prefectural Government, ***Shibukawa Elementary School, ****Yuda Elementary School, *****Shiga University

In Shiga Prefecture, there is Lake Biwa designated as Ramsar Site. The Shiga Prefectural Government has hosted "Biwa Kids Ambassador Project" (Biwakko Project), an environmental education program targeting children to support sustainable environmental conservation effort and to train younger generation for the future of Lake Biwa since 2008. The International Lake Environment Committee Foundation (ILEC) has been entrusted with this project since 2015. Prof. M. Kawashima, Mr. D. Nakamura, Ms. Y. Nomura and other guest lecturers have been engaged as educators of this project. Here, we make a presentation about what this program is and how it works.

In 2015, six students (10-12 year old) selected from the elementary schools in Shiga participated in this program as the Ambassadors to learn about "lakes and their food culture". The highlight of the program was an international exchange activities in November held in Chiang Mai, Thailand, in collaboration with the universities and elementary schools. Before visiting Thailand, the Biwa Kids learned about Lake Biwa, and its food culture and traditional fishing methods.

They experienced a traditional fishing method in Lake Biwa, and several cooking lessons using the lake's endemic fish. But by fishing with beach seine, they knew what they caught was mostly invasive species such as large mouth bass.

One of the recipes they learned was how to prepare Funazushi, a fermented sushi made with Funa fish, which tastes like blue cheese. They enjoyed not only interesting taste of the food but also discovered the importance of environmental conservation and the value of local food culture passed down through generations to generations in the Lake Biwa basins.

The Biwa Kids visited Chiang Mai, Thailand in November, 2015. They participated in the exchange program themed on "lakes and their food culture" jointly organized with the local

elementary schools and universities. The six kids successfully made presentations on what they had learned about their home-town lake, Biwa and its food culture. Another mission they have proudly completed was to cook Japanese food using ingredients purchased from the local market. They enjoyed tasting what they prepared (such as miso-soup, fish-flavored rice, and tempura, etc.) and also discovering an exotic flavor of the Thai food prepared by Thai children.

In 2016, the study theme was "to learn about rice farming, irrigation and creatures around rice pads." Newly selected six Biwa Kids went to local rice fields to find various creatures in the channels, and were dispatched to Bali, Indonesia, where the 16th World Lake Conference was held. The kids attended the lectures on Balinese culture and Subak at the Udayana University, and then headed north to the Subak Sembung, one of the Subak sites, where they explored various aquatic creatures. They experienced a lot of memorable moment like an enthusiastic welcome at the local elementary school and an impressive opening ceremony of WLC17.

After their return to Japan, the Biwa Kids reported their year-long activities to Vice-Governor of Shiga Prefecture, and to other students at their schools. Through the precious experiences, they have become more aware of the environmental issues.

The successful execution of the project made us convinced that these kids would play important roles in conserving the environment of Lake Biwa in their future.

This November, newly selected ten Biwa Kids will study Lake Biwa and attend the kids program which will be held in Arao-higata, Ariake Sea just before the AWS.

About the effectiveness of simple questions during nature observation for promoting development of self-expression

Hideharu Masuda, Masumi Kimoto

Nature Conservation Society of Japan (NACS-J) liaison to Saga prefecture

Nature Saga is a voluntary organization that nurtures a love of nature through nature observation. The primary members of Nature Saga are nature observation instructors certified by the Nature Conservation Society of Japan (NACS-J). The activities of NACS-J are science based, and Nature Saga is also trying, as NACS-J liaison to Saga prefecture, to pursue a growth of scientific understanding. The members of Nature Saga have expertise in various kinds of fields which cover many types of natural environment in Saga prefecture, and each member organizes nature observations focusing on what he/she loves.

The wetlands in the middle area of Kasegawa (or Kase River) that runs from the north to the south of Saga city, and Tafusegawa (or Tafuse River), the tributary of Kasegawa are two of the most important focuses of Nature Saga's observations. One member has been holding nature observations with various citizens for about 12 years on the rice fields in the tributary around Kasegawa and Tafusegawa. And Nature Saga also has over 12 years of experience observing the Tafusegawa Riparian Park.

In recent years, Nature Saga has organized observations for families with small children, because we believe that environmental education is the key to our goal, which is nature conservation.

Nature Saga members, as nature observation instructors, provide support to parents who carry their children, or push them in strollers so that they can participate in nature observations. Reducing the parents' limitations is a very important step when starting to get into nature.

Wetland of middle area of river is a great place to conduct environmental education, because it is easy to access from residential areas of Saga city and it has a great diversity of natural creatures. Giving parents and children the opportunity to meet something that truly inspires them during the observation is

very important. The middle area of the river has various kinds of plants, aquatic insects, fish and birds. So the possibility of coming across something they find interesting is high.

To make the experience special, we often give goals to the children on the tours such as "find your favorite creature" or "let's discuss what you see at the end." Asking simple questions at the beginning of the tour is important. Small children who have just started speaking two-to-three word sentences can answer if the goals are simple enough. At the end of the tour we ask the group what they liked, and the small children, while nervous in front of the group, often manage to answer. Parents get to witness their child's ability to communicate grow, as the children develop their expressiveness. This makes it an important memory for everyone.

Not a few young parents who participate in our nature observation did not have experiences in the nature when they were younger. They grew up in a time of economic growth, where test scores and exams were the most important. Japanese society has been preoccupied with those values for a while. But in recent years, people have thought more about coexisting with nature. Additionally, we are starting to realize that healthy brain development makes us smarter individuals than test scores.

A simple question and answer session during nature observation is incredibly valuable to the development of a child's brain. We believe that nature observation will increase the effectiveness of environmental education as a whole.

The Role and Process of Wetlands Education through Environmental Education and ESD in Japan

Kantaro Tabiraki

United Graduate School of Agricultural Science Tokyo University of Agriculture and Technology

The purpose of this presentation is to examine the educational meaning of a place of a wetland and to obtain proposals for the improvement of Wetlands Education in Japan. Although many educational programs for water sites, including rice fields, rivers, wetlands, and oceans exist individually, little study has been done to construct a systemization of education about water in a general framework. Therefore, it is important to create such educational programs to develop human resources for the effective conservation of wetlands; this viewpoint is discussed using a case study of the Reintroduction of the Oriental White Stork in Toyooka, Hyogo prefecture. Toyooka has tried to provide CEPA and an opportunity for Environmental Education and ESD. It should be effective to focus on the educational programs in the area that requires conservation of wetlands in a wide area at the beginning, so it is necessary to conduct a fundamental research on the role and process of Wetlands Education. Furthermore, by seeing these educational programs as a fundamental practical model of ESD, I would like to reevaluate cultures and skills related to a wetland and to rethink the way of intersection between School Education and Social Education as a comprehensive Citizen Education.

In this study, the kinds of CEPA required by the Ramsar convention's programme, along with the role and process of Wetlands Education, are examined through a case study of the "Lower Maruyama River and the surrounding rice paddies" Ramsar Site in Toyooka. Furthermore, the study focuses on two issues, "cooperation" and "responsiveness," from an analytical perspective concerning Environmental Education and ESD. At present, the problem is that the sport park will be moved for its development under a flood control project for the Ramsar Site in Toyooka. The land-use planning problem must be reviewed at

this time and throughout development or conservation from three perspectives: 1) the process for seeking a possible site for a sport park is inappropriate, 2) the sense of "Community Development through the Reintroduction of the Oriental White Stork" is played down, and 3) the need for CEPA in consideration of the problem is emphasized repeatedly. In other words, it is necessary for possible target groups and stakeholders concerned with wetlands to adopt a way of learning through experience and sense as part of the story of the conservation of wetlands.

The second to be noticed is that a harmonious coexistence between human and nature. Unfortunately, it has become an issue that one stork released by Toyooka were accidentally shot by a hunter. In this respect, hunters would be needed an educational program with a focus on CEPA such as a trans-disciplinary approach which is not only shooting skill but also some ESD components. It is sad thing of the shooting of the stork. But also, a hunting as a management for wildlife is even more important after people have killed the natural predators of the species hunted. This killing is often because of fear or because the predators kill farmer's animals. Considering with the restrictions on firearms and hunting in Japan and some countries which storks fly around, ESD, including a hunter education would be very beneficial to help preserve and help with the reintroduction of various animal species.

A further study of how Wetlands Education play a role of wildlife conservation should be conducted. The study also aims to develop learning material using active learning toward all people, including the hunter. Based on the above, it attempts to find educational ways as Wetlands Education to impart culture and history to future generations in a sustainable manner rather than dredging up a problem in Toyooka.

How can a senior high school biology teacher contribute to CEPA activities at the Arao Tideland.

Kazuya Nakayama

The Arao tidal flat conservation wisdom utilization consultation meeting

Currently, I am a teacher of biology at Kumamoto Prefectural Senior High School. This high school is also close to the Arao tideland, which was registered a wetland of the Ramsar Convention on July 3, 2012. It is on the east side of the central part of the Ariake Sea.

What I can contribute as a CEPA activity in this Arao tideland is to let many people know about the tiny living creatures in the tidal flats and the importance of tideland ecosystem diversity.

First of all, as a biology teacher at a senior high school, I suppose that the activities with our high school students themselves are CEPA activities.

The school name was Kumamoto Prefectural Arao High School in 2012. I started scientific research on Benthos of the Arao tideland as a subject of "task research" which the science and mathematics class will take for 2 years. From the beginning, I received a lot of support from the people related to WIJ and the secretariat. The theme of the research was as follows. In the classes from 2012 to 2013, "Research on the Arao tidal flat". In the class from 2013 to 2014, "Think about Arao tidal flame from the crab's mouth." Classes from 2014 to 2015 are "Benthos of Arao tidal - Livelihood separation, coexistence, symbiosis -".

This research won the best award in the west Japan, Shikoku, and Kyushu district, high school science and mathematics department, issue presentation announcement meeting. In addition, we presented a poster titled "Growth and burrows of Japanese mud shrimp (*Upogebia major*) in the Arao tidal flat" at an annual conference of the Japan Association of Benthology in 2016.

Today, the Taishi senior high school science club is studying the relationship between temperature and benthos in the Arao tideland. In addition, we are doing activities that arouse interest and teach the importance of wetlands to those who do not know about the Arao tidal flats. Our students joined some activities as

volunteer staff so that many children could enjoy contact with the Arao tidal flats and benthos living there. I would like to support and raise this CEPA activity through Taishi senior high school science club's activities for several years until my retirement age.

Next, I'd like to contribute increasing opportunities to teach about the tideland ecosystem diversity and the importance of word-of-mouth communication.

I have been researching with senior high school students so far and I was able to meet many people who participate in tidal flats and wetland conservation activities. And I had the opportunity to work with the people of "the Arao tidal flat conservation wisdom utilization consultation meeting". For example, I joined the activities to plan and manage the events at lecture and cultural centers, "participation in improving the Arao tidal flat as a fishing ground".

I'm engaged in activities to better understand the Arao tidal flats by connecting children with young generations and large people on many occasions. I would like to contribute to connecting the people who I got acquainted with, the stakeholders of the Ariake Sea, by making use of the Waterfowl and Wetland Center of the Arao tidal flat planned by the Ministry of the Environment and Arao City.

I believe that this can be done after retiring as a senior high school biology teacher.

Collaborative activities around the Hizen-Kashima Area: MAE-UMI Citizens' Association Activities

Yasuhiro Nakamura, Sakuji Higuchi, Naoki Fujii
MAE-UMI Citizens' Association

In the past, the Ariake Sea was said to be a bountiful. However, because of recent environmental problems, the number of marine organisms, and especially shellfish, has decreased drastically. There are various reasons for the environmental problems in the Ariake Sea such as the Isahaya Bay reclamation project. The agents responsible for the decrease in the catch and other changes in the Ariake Sea are in agreement that something needs to be done, but there are conflicting opinions about the methods to be used. In particular, it has been difficult to reach a consensus on the methods to deal with the Isahaya Bay reclamation project problems. Further, people who do not depend upon the fishing industry for their livelihood have become less interested in visiting the Ariake Sea, with interest in the ocean continuing to wane. Under such circumstances, an "Ariake Sea regeneration policy" based on the understanding of the coastal region in the Ariake Sea has not yet been developed.

To deal with these issues, for six months from November 2013, preparations were made for a meeting to seek the cooperation of local citizens, with a citizens' association named the MAE-UMI Citizens Association finally being established in April 2014. MAE-UMI members are made up of groups engaged in regional promotion, fishery companies, faculty members, lawmakers, and other citizens. The main activities of this group are to hold monthly meetings and hold events related to the Ariake Sea in cooperation with other groups in the area. At the monthly meetings, information such as activity reports, forecasts for various organizations, and Ariake Sea status reports are presented and discussed. In addition, members of the Association introduce relevant topics on the Ariake Sea; for example, in 2015, the reasons for the high nori cultivation in the Kashima waters were discussed. Since 2015, biological observation

meetings have been conducted through walking tours of the Ariake Sea coastline.

Externally, in 2015 and 2016, an event titled "Enjoy! Ariake Sea" was also held, in which science corners were set up for adults and children, and exhibitions related to the Ariake Sea were held such as the promotion of Kabayaki; a dish made by broiling mudskippers in a thick sweet sauce; and a bus excursion titled "Let's go around the Ariake Sea!" The event was held at Michi-no-eki "Kashima" (roadside Station) and attracted many people. In 2015, farmers in Saga Prefecture told stories of nori-seaweed and in Yanagawa City, participants were invited to an event called "ARIAKE-MON" where they could try dishes made from Ariake Sea products. In 2016, a tour around the Ariake Sea coastal area by bus was arranged, on which lectures were given that included: a tour of the Arao tideland, one of the Ramsar registered wetlands; a tour of the Ariake Sea on the Ariake Ferry; a lecture on Unzen mountain; and a lecture by the temple priesthood in Ooura. It was hoped that these activities would increase the public interest in the Ariake Sea; however, as there are few members, we would like to broaden the scope of the activities.

From a bird to a policy: a brief history of wetland conservation in southern Taiwan

Cheng Chung-chieh
Wetlands Taiwan

In Taiwan, the earliest record of pheasant-tailed jacana (*Hydrophasianus chirurgus*) was made by British naturalist Robert Swinhoe in 1865, nearby the Lotus Pond in Zuoying, Kaohsiung City. To 1970s, water caltrop (*Trapa natans*) fields, pheasant-tailed jacana preferring habitat and breeding environment, distributed over Lotus Pond. However, because of the urban development and constructions, pheasant-tailed jacana in Kaohsiung disappeared more than 30 years afterwards. In 1989, according to Wildlife Conservation Act, pheasant-tailed jacana was announced and classified as "rare and valuable species (II)" in Taiwan.

In 2001, a birdwatcher found a pheasant-tailed jacana on the eastern side of the Lotus Pond. This discovery caused the concern of conservationists, and then the non-governmental organization "Wetlands Taiwan" recommend the Kaohsiung city government to executive the "Pheasant-tailed jacana return home plan" to restore the Zhouzai wetlands. Few years later, furthermore, Wetlands Taiwan and Kaohsiung city government made a great effort to conserve Yuanjhong wetland, the 30 hectares coastal area belonging to Ministry of National Defense. After many years of cooperation between non-government organizations and public sector, Zhouzai and Yuanjhong wetlands became the most important bases for habitat and breeding of pheasant-tailed jacana in Kaohsiung City. Under the joint initiative of the Wetlands Taiwan and other NGOs, the Kaohsiung City Government has been making the "Kaohsiung Wetland Eco-Corridor" policy since 2003, constructing and connecting 21 wetlands continuously, and has now become the very important achievements of Kaohsiung City Government by constructing sustainable environment.

In 1990s, private enterprises applied to the government to develop the Binnan Industrial Park in the Qigu district of Tainan

City, much possible to make serious environmental pollution, not only to affect the livelihood of fishermen, but also to destroy the one of world's most important wintering habitat of black-faced spoonbill (*Platalea Minor*). Fortunately, it has been declared termination finally under the strong protest an campaign by the NGOs and residents, and especially the joint and assistant of international NGOs (ex. SAVE International, BirdLife International) and conservationists (ex. Dr. Jane Goodall). In 2002, this area was designated black-faced spoonbill conservation zone. In 2009, Taiwan's eight national park-Taijiang National Park was set up, and it's Taiwan's first national park that take the wetlands as the main conservation focuses. In view of the diversity of the wetland environment in the coastal areas of Yunlin, Chiayi, Tainan and Kaohsiung in southwestern Taiwan, the scholars and conservationists have further promoted the conservation of the southwest coastal wetland eco-corridors in Taiwan.

More than ten years of grand achievement of wetland conservation in Taiwan, nevertheless there are still many wetlands facing the critical threat of development and destruction. In 2007, the central government began to executive the policy of "Taiwan's Wetlands of Importance", selecting, surveying, and classifying 75 important wetlands (82 sites after 2011). February 2 (World Wetlands Day), 2015, Taiwan officially implemented the "Wetland Conservation Act", declared Taiwan's wetland conservation to a new milestone.

From the non-government organization viewpoint, this report base on some cases of wetlands conserved and restored by Wetlands Taiwan, especially on Qigu, Sicao, Zhouzai, and Yuanjhong wetlands, and briefly show how Taiwan has move forward from a bird habitat(individual wetland) conservation and restoration to a local government's environmental policy, finally completed the wetland conservation law.

The massive noxious golden apple snail *Pomacea canaliculata* populations were wiped during rainy season; A case study on Chenderoh reservoir, Perak, Malaysia

Siti Norasikin Ismail, Nurul Izzati Abdul Wahab, Muzzalifah Abd Hamid, Mashhor Mansor
School of Biological Sciences, Universiti Sains Malaysia

Approximately twelve years ago, massive noxious golden apple snail *Pomacea canaliculata* populations invaded 2500ha of Chenderoh Reservoir. Chenderoh Reservoir is the oldest man-made lake in Peninsular Malaysia. Chenderoh Reservoir was built for the purpose of hydro-electric power generation. The dam was commissioned in 1930 across the Perak River. The noxious populations of *P. canaliculata* were originally recorded from the adjoining rice field areas. Consequently, the rice fields were abandoned due to the low production and non-profitable harvest after three to five years of establishment. Eventually, the population of *P. canaliculata* were spread into the Chenderoh Reservoir. The dispersal of these populations had brought concerns towards the lake environment. Based on previous study, a high distribution of golden apple snail population in freshwater ecosystem may cause a serious loss of the aquatic plants. The infestation also has reduced the number of native Asian freshwater snails species especially *Pila* due to the inter-specific competition to get the available food resources. Evidently, each female individual was observed to lay approximately 500 eggs in one egg mass. Although the eggs were immersed in the water, however the percentages of the eggs to hatch are about 60%. In addition, the egg masses were recorded to attach on floating weeds such as *Eichhornia crassipes*, particularly on the stems and leaves of aquatic plants with 43% occurrence. Besides, *P. canaliculata* was found to lay eggs on other hard medium such as boats, rocks, fish cages and emerged bamboo pile with 14% occurrence.

Apparently, *Phragmites australis* or common reed from Poaceae family was the most preferred plant (41%) for egg depositions whereas the least preferred plant for egg depositions was *Neptunia oleracea* (3%) from Fabaceae family. Moreover,

the snail populations were also attached to *Pandanus helicopus* populations which could be found along the lake's shore. Nevertheless, the recent big flood during the rainy season from February to April 2017 had wiped out the whole populations of golden apple snail in the lake ecosystem. There was no egg depositions observed at 15 points of sampling sites throughout the lake area and subsequently the adult individuals were also absent. During the rainy season, the flow of water is faster compared to dry season. Therefore, it wiped out the eggs and individuals of golden apple snails. The attached plants were also damaged by the hard water current and thus the chance for the snail populations to survive is low. In addition to high water levels, the slosh of surface water against the emergent vegetation has resulted in the massive destruction of golden apple snail populations in Chenderoh Reservoir. Apparently, the findings from this study showed that those three environmental variables are responsible in controlling the golden apple snail populations. Thus, the management of lake water level by Tenaga Nasional Berhad (TNB) is crucial to eradicate the resurgence of this noxious population. As the invasive *P. canaliculata* is considered to be in the top 100 of the "World Most Invasive Alien Species", therefore, the behavioural studies and ecological assessment are needed in order to control and reduce the economic loss especially in the agriculture sector and subsequently for a healthier lake environment.

Habitat use of Siberian warbler species at a stopover site in Far East Russia

László Bozó South-Békés Nature Conservation and Birdlife Associatio
Wieland Heim Münster University, Institute of Landscape Ecology
Tibor Csörgő Department of Anatomy, Cell- and Developmental Biology

In general, passerine migrants seem to use a wider range of habitats at stopovers compared to the breeding season, behaving as generalists in terms of habitat selection. Knowledge on the habitat use of Siberian songbird species during migration is very limited, while their preferences during the breeding period and from their wintering sites are known better. This is also caused by lacking information regarding their migration routes, and in contrast to the situation in Europe, there are just a few ringing stations in East Asia, where it could be examined.

The goal of our study was to examine the habitat use of warblers (Thick-billed Warbler *Iduna aedon*, Black-browed Reed Warbler *Acrocephalus bistrigiceps*, Pallas's Grasshopper Warbler *Locustella certhiola*, Yellow-browed Warbler *Phylloscopus inornatus*, Dusky Warbler *Ph. fuscatus*, Radde's Warbler *Ph. schwarzi*, Pallas's Leaf Warbler *Ph. proregulus*) on an autumn migratory stopover site in Far East Russia. For this we have ringed 3776 individuals of seven species between 2011 and 2014 on the fall migration periods within the Amur Bird Project at Muraviovka Park. The variety of vegetation of Park area provides an opportunity to examine habitat use of migratory species. The birds were trapped with mistnets, which were placed in different habitat types: homogeneous reedbeds, sedges and grassy swamps interspersed with willows and raspberries, rich shrub-layered mixed forest, very dense scrub and stubble. We also studied the effect of the vegetation height for species-specific habitat use. For further analyses species were separated in two groups (Group 1: "reed warblers", Group 2: "leaf warblers"). Additionally, we compared the observed habitat use in our study site with the breeding habitat types based on literature. In the study we also want to reveal the importance of the wetland habitats in East Asia.

The number of Thick-billed Warbler, Black-browed Reed Warbler, Pallas's Grasshopper Warbler and Dusky Warbler correlates positively with vegetation height, while Yellow-browed Warblers and Pallas's Leaf Warbler use mostly the woods.

Radde's Warbler occurs in bigger number in the bushes, while the Dusky Warbler uses both bush types as well as grass and sedges. The Black-browed Reed Warbler occurs almost exclusively in wetland habitats. The Thick-billed Warbler preferred both homogenous reedbeds, grass and sedges swamps habitats, but regularly occurs in the bush types as well. No strong habitat preference was founded for Pallas's Grasshopper Warbler, but most birds were mistnetted in reedbeds and grass and sedges swamps.

This results highlight the importance of the protection of a wide variety of habitats. Each species use a special habitat both on migration and breeding, which most likely caused by differences in foraging methods and preferred foods. Three out of the 7 species regarding to the wetlands on migration as well, and unfortunately the wetlands are one of the most endangered habitats of East Asia.

If the number of these habitats (reedbeds, marshes, other wetlands) will decrease drastically in future, the population of these species might decrease as well. Similar measures would be need on the complete migration route for the protection of these species and habitats.

Faunal inventory in the mangrove areas of the three islands of camotes, Central Philippines

Serapion N. Tanduyan Cebu Technological University / Ponciano C. Bontia CTU-Main Campus
Rosalyn Pascual-Opiniano CTU- Argao Campus, Cebu City / Rachel Luz Vivas-Rica CTU-Main Campus
Ricardo B. Gonzaga, Virginia D. Bensig Cebu Technological University / Hemres M. Alburo CTU- Argao Campus, Cebu City

Camotes Islands have 717 hectares of mangroves areas. Because of its great use to humans, these are exploited by the fisher folks. The importance of mangroves can not be overemphasized. This is the home and nursery grounds for some commercially important species of animals and plants. This ecosystem is under stress due to some natural and anthropogenic activities. Hence this affects the animals living in this ecosystem.

The inventory of fauna in the mangroves and mangrove communities of Camotes Islands was studied. This is the Phase 2 of the program entitled "Inventory of Mangroves and Mangrove Communities in the Three Islands of Camotes".

There were eight mangrove areas where the study was conducted. Area 1 is Timarong, Poro, Cebu; Area 2 is Teguis, Poro, Cebu; Area 3 is Unidos; Area 4 is Mc Arthur, Tudela, Cebu; Area 5 is Villahermosa, Tudela, Cebu; Area 6 is Puertobello, Tudela, Cebu; Area 7 is Upper Poblacion, Pilar, Cebu and Area 8 Lower Poblacion, Pilar, Cebu. Based on the result of the study, mangrove ecosystem of Camotes Islands has 35 families, 34 are identified and 1 family is unidentified. They are Acanthuridae, Apogonidae, Atheridae, Balistidae, Bothidae, Carangidae, Centrisidae, Clupidae, Gerreidae, Gobiidae, Hemiramphidae, Labridae, Leognathidae, Lethrinidae, Lutjanidae, Mugilidae, Mullidae, Muranidae, Monacanthidae, Nemipteridae, Ophiocephalidae, Ophichthidae, Percophidae, Platycephalidae, Plotosidae, Pomacentridae, Scatophagidae, Scorpaenidae, Serranidae, Siganidae, Sphyraenidae, Syngnathidae, Terapontidae, Tetraodontidae, Unidentified spp. Furthermore it has 61 genus and 74 species.

For the invertebrates, it shows that there are 19 families namely: Alpheidae, Arcidae, Gastropoda, Penaeidae, Strombi-

dae, Portunidae, Palinuridae, Portenopidae, Sepiolidae, Volutidae, Holothuroidea, Scyphozoa, Stomatopoda, Xanthidae, Octopoda, Diogenidae, Thallasinidae, Ostreidae, and Cypraeidae. It has 19 genus and 25 families.

Based on the frequency of species occurred in 8 mangrove areas of the islands of Camotes by family, it shows that Area 2 ranks first followed by Area 3; Area 6 as third; fourth is Area 5; fifth is Area 1; sixth are Areas 7 and 8 and the last is Area 4 of Mc Arthur, Tudela. For the invertebrates, Area 2 ranks first followed by Area 3; third are areas 1, 5, and 6; fourth is Area 4; fifth is Area 8 and the lowest is Area 7.

For the dominant species of fish common to all areas, it was found out that *Atherinomoropus ogilbyi* ranks first followed by *Siganus canaliculatus* and *Sphyraena barracuda* as third, then *Arrhampus scleropsis* as fourth; *Halichoeres argus* and *Lethrinus atkinsoni* as fifth; *Mugil cephalus* and *Gerres filamentosus* as sixth and *Argus synanceja* as seventh.

For the invertebrates *Charybdis hawaiiensis* ranks first followed by *Metapenaeopsis* sp. as second; *Portunus pelagicus* and *Sepioteuthis essoniana* as third; *Octopus macropus* as fourth and the fifth is *Strombus mutabilis*.

Conservation and Management of Himalayan High Altitude Wetlands in India

Pankaj Chandan
WWF-India

Himalayan high altitude wetlands are crucial for biodiversity and sustainable economic growth not only locally but also at the river basin and regional levels. In addition they regulate micro-climates and have immense livelihood, cultural and spiritual significance for the communities living amongst them. High altitude wetlands, which include lakes, marshes, seeps, peat bogs, in the Indian Himalayas have several characteristics that make them unique in terms of their biodiversity value. The plants and animals that occur in and around them are often endemic and highly adapted to their locations.

These wetlands also play an absolutely essential role in the hydrological regime of some of the world's largest and most important rivers: namely the Indus and Ganges.

The vegetation in the region is sparse and productivity peaks only in short summer season. This harsh environment is thus home to highly adaptable flora and fauna. Several species of mammals are found in the region, like the Blue Sheep (*Pseudois nayaur*), Urial (*Ovis orientalis vignii*), Tibetan Argali (*Ovis ammon hodgsoni*), Tibetan Wild Ass (*Equus kiang* king), Himalayan Marmot (*Marmota himalayana*), Red Fox (*Vulpes vulpes*), Tibetan Gazelle (*Procarpa picticaudata*), Snow Leopard (*Uncia uncia*), Lynx (*Lynx isabellina*), Wild Dog (*Cuon alpinus laniger*), Tibetan Wolf (*Canis lupus chanco*), Tibetan antelope (*Pantholops hodgsoni*), and Wild Yak (*Bos grunniens*).

Indian high Himalayan region dotted with some of the World's most unique and spectacular wetlands, also holds the distinction of being the known breeding ground of many species of migratory birds. Several species of birds use these wetlands as their breeding grounds, such as Black-necked Crane *Grus nigricollis*, Bar-headed Goose (*Anser indicus*), Brown-headed Gull (*Larus brunicephalus*), Great-crested Grebe (*Podiceps cristatus*), Ruddy Shelduck (*Tadorna ferruginea*), Lesser Sand Plover

(*Charadrius mongolus*). These wetlands also have profound social, economic and cultural values at the local level where many wetlands in particular are considered sacred both locally and nationally.

Unplanned developmental activities and unregulated tourism activities in some areas of Indian Himalayas are a direct threat to the unique high altitude wetlands of the region. An important indirect threat to these wetlands is by the disturbance and degradation of natural habitat due to overgrazing of pasturelands by ever-growing livestock population. Despite their importance, Himalayan high altitude wetlands are under increasing threats from climate change, tourism and unsustainable exploitation not only of the wetlands themselves but also of the catchments draining into them. And there is a risk that these threats could lead to negative knock-on effects right down the rivers systems that they supply. By way of response, WWF – India's more than a decades programme of technical and social interventions at these high altitude wetlands have helped to raise awareness; strengthened and empowered wetland communities; developed sustainable wetland management plans; assisted with policy and regulatory framework formulation and facilitated the conservation and wise use effort - all based on good science.

The present paper presents an overview of current status of high altitude wetlands in India mainly in the Indian states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh. The paper also presents an overview of conservation initiative that WWF-India has taken to conserve these unique ecosystems. In this conservation initiative, Local Communities, Indian Armed Forces, Different Government Departments, Local Educational Institutions and Tour Operators are major partners.

Post-Project Appraisal of Urban Wetland Restoration: A Case of Mangrove Restoration Project in Jhongdou Wetlands Park, Kaohsiung

Po-Hsiu Kuo, Hsiao-Wen Wang

Institute of Ocean Technology and Marine Affairs, National Cheng Kung University

Through an urban renewal process Jhongdou Wetlands Park was restored from an abandoned plywood factory capped with landfill to an eco-park. The park was designed to function as a key patch of an ecological corridor and it combines multiple functions including landscaping, recreation, environmental education, flooding detention and habitat restoration. The core strategy is to create an urban habitat by restoring six native mangrove species of Taiwan in the park, including *Lumnitzera racemosa* (mangrove), *Avicennia marina* (black mangrove), *Kandelia obovate* (mangrove), *Rhizophora stylosa* (mangrove), *Ceriops tagal* (mangrove) and *Bruguiera gymnorrhiza* (mangrove). The latter two species have been extirpated from Taiwan in the past several decades due to habitat loss.

This research performed Post-Project Appraisal method to determine if the original ecotone planting design of mangroves was successful in assigning the correct species to the correct elevation and, therefore, assuring optimum survival, distribution, and growth. A survey of the restored mangroves to map the distribution of those planted mangrove saplings survived was conducted.

Mangrove species, growth status, and abundance were recorded. Water quality at nine selected locations in the park was measured. The data was analyzed to determine how water quality influenced each species of mangroves. The results of mangrove distribution survey indicate that planted saplings of *L. racemosa* had the greatest range of elevation distribution and grew under the largest range of water quality parameters. *A. marina* had the second most widely distribution and tolerance to water quality variation. Both of the two species grew well, but, interestingly, their dominant distribution varied from the original design. Water quality data indicates the high salinity may have decreased the distribution and growth of some of the planted mangrove species. It is likely that the mangroves survived were merely doing so on the upper limit of their salinity range. Lower salinity in rainy season may pose less stress to the

mangrove saplings allowing certain saplings to not only adapt to the changes in salinity but also to tolerate future increased stress. By performing Post-Project Appraisal to review the project goals, two major lessons were learned: (1) It is critical to have clearly stated project objectives with specific success criteria. The concept of Adaptive Management and communication with stakeholders is needed when setting these objectives. Furthermore, the project objectives should be continually re-evaluated throughout the entire restoration project. If the designer of the original project had collaborated more effectively with other key players and used applied scientific hydrology/ ecology monitoring information to create specified success criteria to reach the goal of 'optimal conditions for mangrove growth', and not just followed the original objective to 'enhance nature and build landscape', then the alternative fresh water resources to mitigate the high salinity or low dissolved oxygen caused by misjudging the quality and quantity of the water resource can be obtained. (2) There is a need for park designers to account for river restoration schemes in terms of geomorphic compatibility, watershed hydrology and sediment transport processes. If a designer can incorporate with specialists that deal with restoration schemes, including across disciplines of hydrology, geomorphology, and ecology, the success of mangrove restoration may be more effective. To ensure effective and sustainable growth of mangrove species in the future, it is important to use management techniques adapting the dynamic changes within the restoration project. To achieve the goals making mangroves not only survive but to also thrive, managers should monitor changes within a restoration ecosystem and take action to respond to the changes within the watershed and between the ecosystems. By doing so, we may have been able to ensure the environmental connection of the Park as a sustainable stepping stone of the Kaohsiung Wetlands ecological corridor.

Landscape design and the evaluation of the artificial wetland at the Nishinotani dry dam reservoir in Kagoshima, Japan

Tomoko Minagawa, Atsushi Tanabe Kumamoto University

Yukihiro Shimatani Kyushu University

The Shinkawa River is a second-class river that flows through the city of Kagoshima and into Kinko Bay. It frequently flooded the center of Kagoshima. Kagoshima Prefecture built the Nishinotani Dam upstream on the Shinkawa River to prevent flood damage. The catchment area of the dam is small, and it was built as a dry dam, which requires no operation. A dry dam stores water only during floods. Nishinotani Dam's measurements are a 21.5m bank height, a 135.8m length of bank top, a 6.8km² catchment area, a 0.13km² flooding area, and 793,000m³ total water storage capacity. Floods expand from the downstream end of the reservoir. The flooded area differs depending on the size of the flood. Due to erosion and the accumulation of earth and sand inside the reservoir, there is a possibility that fields with different spatial environmental conditions may be formed. Kumamoto University, Kyushu University, and Kagoshima Prefecture jointly designed wetlands at the Nishinotani dam reservoir. In the reservoir, we planned five ponds, some waterways, and terraced paddy-field-shaped wetlands. The wetlands were formed in conjunction with the excavation of the reservoir to ensure reservoir capacity. The major diameter of the pond is about 30 – 55 m, the depth of the pond is about 0.2 – 0.7m, and the gland levels are set for a frequency of floods of once a year to once every five years. The ponds were designed to have different conditions such as different water qualities, amounts of organisms, and degrees of turbulence caused by running water and earth and sand.

There is some created wetland by a dry dam in Austria, but its

scale is small.

Nishinotani Dam hosts the first artificial large-scale wetlands in the world. In addition to preserving biodiversity, these wetlands promote the water purification function of wet plants. Additionally, in creating wetlands, we aimed to suppress the transition of vegetation and to maintain long-term storage capacity. From the beginning of the dam plan, we spoke a great deal with local residents and made our plans reflecting the opinions of residents even in the development of the dam environment. In the workshop, residents and participants from Kagoshima prefecture, Kumamoto University, and Kyushu University exchanged information on the previous scenery, livelihood, river shape, natural environment, and life forms of the Nishinotani area. We extracted directions for maintenance and important elements that should be carefully considered. Design was carried out based on this information. One year after the completion of the dam, there are places where riparian erosion and accumulation of sediment can be seen, mainly in the area of running water (the river), and the topography is gradually changing. We recorded 35 aquatic insects, 9 of these are aquatic Coleoptera fauna inhabiting lentic. The different community structure in the wetlands of the midstream and downstream portion that inflow the water of swamp and of the upstream that inflow the river water. It is growing and becoming inhabited as a wetland. It is functioning as a habitat for animals and plants, and it will play a role in the conservation of endangered floodplain-dependent species and biodiversity.

Located in the northern part of Hokkaido, the Sarobetsu Mire is one of Japan's largest high moor. It was formed in the downstream area of the Sarobetsu River over a period of 4,000 to 5,000 years. Once covering a vast area of 14,600 hectares stretching approximately 27km north to south and 8km east to west, the wetland area decreased drastically as a result of large development projects launched in the 1960s. The remaining wetland became desiccated because of these land use changes in surrounding areas. In order to restore the original state of Sarobetsu Mire, the Sarobetsu Nature Restoration Project is being implemented by the Ministry of the Environment. Various efforts are being made under the project while imagining the state of wetland vegetation when designated as a national park in 1974.

A distinctive approach taken in Sarobetsu Mire is the conservation of wetland along the drainage channel. At an important part of the Sarobetsu Mire, excavation of the drainage channel was begun in 1961 to prevent floods in the Sarobetsu River. The removed soil was pumped out using a dredger and then laid on the banks of the channel. Drainage ditches were also dug to remove the moisture from the excavated soil. As a result, the groundwater flowed out to the drainage channel and caused desiccation, thereby changing the vegetation along the channel from high moor vegetation dominantly covered with sphagnum and wild cranberry (*Vaccinium oxycoccus*), to *Moliniopsis japonica* communities. Ochiai-numa Pond near the channel also dried up.

In order to prevent the degradation of the remaining high moor vegetation, efforts are being made to dam drainage ditches to prevent the lowering of groundwater level in surrounding areas. This has been highly effective in Ochiai-numa Pond; these operations will restore the water level and thereby

reduce the lowering of groundwater in a wider area. Observation after damming has confirmed the rise and stabilization of the groundwater level around the pond and continues to monitor the restore progress of high moor vegetation corresponding to this.

Another unique approach in Sarobetsu Mire is vegetation restoration at the peat mined site. Peat mining at Sarobetsu Mire started around 1970 and spread over 150 hectares mainly in the high moor area during the following 30 years. The peat sucked up by the dredger is pumped to the factory, and after the fiber for use as a soil conditioner is filtered out, the remaining muddy water is returned to the site of mining. Many fine humic substances contained in this muddy water, these became massed together in the process of being returned to the site of mining and formed a pasty floating island. This floating island that covers some mined sites has a property that the surface easily flows when rain falls and it dries extremely if the fine weather continues, because it is composed of fine humus. For this reason the plants have not rooted for many years, and they have been left as bare places.

There were several places where white beak-sedge roots from the margin area to the bare ground of floating island. From this observation, it was considered to encourage the rooting of white beak-sedge first to advance the transition of vegetation. Therefore, through the demonstration experiments that combine several types of mulching and ruffling, we have led the most effective method and expanded to the remaining peat mined site left as bare field.

Nature restoration in the Sarobetsu Mire is still in progress, and we are promoting the project adaptively while evaluating the response of the natural environment.

Aster tripolium (sea aster) and greening of the sea wall in Tokyo Bay

Noboru Kuramoto, Rasuna Mishima, Hisako Okada Meiji University
Tim Gardiner Essex Nature Club

Aster tripolium L. is an endangered plant in Tokyo, whereas in England it is a keystone species of salt marshes. We have studied *A. tripolium* in Tokyo Bay, Japan, since 2000, and in the River Thames and Thames Estuary, England, since 2015. In contrast to Tokyo Bay, which supports only several small populations of this plant, there are many large populations in the Thames Estuary.

We initially studied the *A. tripolium* population in the mouth of the Tama River, south west of Tokyo Bay. All population in the Tama River was extinct by vegetation succession until 2013. Mr. Takashi Ueno wanted to conserve the population and requested that the Tokyo Metropolitan Government managed the vegetation for *A. tripolium*. However, the population was not deemed worthy of conservation as there was another population in the Tokyo Metropolis at Kasai Rinkai Park.

We therefore subsequently studied the Kasai Rinkai Park population. There are two small local populations in Kasai Rinkai Park and Kasai Kaihin Park. Kasai Rinkai Park is located along the Kasai waterfront area of Tokyo Bay. This park, which opened to the public in 1989, is relatively new, and is the largest park within Tokyo's 23 wards. Kasai Marine Park is located in front of Kasai Rinkai Park and consist of two beaches and sea.

Tokyo birders (members of the Tokyo branch of the Wild Bird Society of Japan) and citizens of Tokyo have been working to convert Kasai Sanmai-Zu into a Ramsar convention wetland. In 2017, Ms. Yuriko Koike, the governor of the Tokyo Metropolitan area announced that Kasai Kaihin Park will be made into a Ramsar convention wetland.

The East Beach of Kasai Kaihin Park has been designated an environmental conservation zone. The *A. tripolium* population here is growing on mud in the intertidal zone of the East Beach.

We have also been studying the micro-distribution of *A. tripolium* on the seashore of Kasai Rinkai Park. *A. tripolium* was found growing in the mud on concrete blocks of the lowest floor of the sea wall flood defenses in Kasai Rinkai Park, which is located in the intertidal zone. The width of the lowest floor is 980 cm and *A. tripolium* grows over ca. 750 cm from the sea edge. We found that the distribution of *A. tripolium* is correlated with the thickness of the mud on the concrete blocks.

A. tripolium grows only in mud that is over 3mm thick, and does not grow in freshly deposited mud. If there is mud on the sea wall in Kasai Rinkai Park, a larger population of *A. tripolium* might grow there.

In 2015, we displayed a poster presentation on the notice board of Kasai Rinkai Park, and in 2016 arranged three activities related to seashore vegetation observation.

Furthermore, in 2016, we made a proposal to the Tokyo Metropolitan Government that small projections should be installed in Kasai Rinkai Park to trap mud.

In contrast to the sea wall in Tokyo Bay, which is a hard wall constructed entirely of concrete, the sea wall of the Thames Estuary is a soft wall, the middle part of which is constructed of mud. The port engineers state that the sea wall in Tokyo Bay must be harder than that in the Thames Estuary as the wave power in Tokyo Bay is greater than that in the Thames Estuary. We intend to study the wave power Tokyo Bay and make the sea wall green by facilitating the colonization of salt marsh plants. We hope that the sea wall will be green from Kasai along the entirety of Tokyo Bay.

Temporal and spatial variability of macrobenthic fauna in the high intertidal mud flat of the Ariake Bay

Sakura Maesaki Graduate School of Agriculture, Saga University / Masumi Koriyama Organization for General Education, Saga University, Atushi Nakamura, Takuya Ishibashi Faculty of Agriculture, Saga University

In Japan, the largest area of mudflats exists in Ariake Bay in western Kyushu, Japan. Higashiyoka-higata is located off the Higashiyoka shore in the Ariake Bay and is one of the biggest tidal mud flats in Japan. In order to examine the temporal and spatial variability of macrobenthic fauna and its habitat environment in Higashiyoka-higata of Saga City, we conducted ecological field surveys throughout the year. We collected the data on the distributions and population densities of macrobenthic epifauna and infauna and the sediment environments every month during June 2015 - December 2016. In the macrobenthic epifauna investigation, five observation sites (S1-S5) were located on the Higashiyoka-higata. We counted the number of benthic organisms that live on top of the sediment at 10m, 30m, and 60m away from shore of S1-S5 using laser range finder (Bushnell, Elite 1500). On the other hand, in the macrobenthic infauna investigation, we sampled the sediments (25x25x15 cm³) at 10 m, 30 m, and 60 m from the shore along the survey line near S2. Then, sediments samples were sieved with a 1 mm mesh sieve, and the number of individuals and the species of macrobenthic infauna were obtained.

There was a marked difference in the spatial distribution of macrobenthic epifauna at the survey sites in Higashiyoka-higata. That is, population densities of crustaceans such as crabs were low in the sediment environments (S1 and S2) with high organic matter content (IL = 18.07±0.41%) and reduced sediment condition (Eh = -31.42±14.20mV), and population densities of fishes such as *Periophthalmus cantonensis* and *Boleophthalmus pectinirostris* were high throughout the investigation period. Sediment environments (S3-S5) with high individual density of crustaceans were lower organic matter content (IL = 16.90 ± 0.27%) and oxidized sediment condition (Eh=84.33 ± 14.45mV) compared to that with low individual density of crustaceans. These results suggested that bioturbation of burrowing

crabs includes the diffusion of oxygen through burrow walls into anaerobic muddy sediments and its concomitant enhancement of in situ microbial decomposition. The high crab densities area corresponded roughly to the distribution of naturalized *Shichimenso* that is an annual *Chenopodiaceae* plant and a halophyte which can endure salt.

The temporal variation of macrobenthic infauna biomass showed a clear seasonal pattern. That is, macrobenthic infauna biomass tended to increase in summer and to decrease in winter. And, there were significant differences in macrobenthic infauna biomass between the sampling point of 10 m and the other sampling points (ANOVA, P<0.05). The macrobenthic infauna biomass in the sampling point of 10m and other sampling points ranged from 1.67 to 44.67 inds / 25x25x15 cm³ and 5.67 to 167.33 inds / 25x25x15 cm³, respectively. The compositions of macrobenthic infauna among sampling points were different. At the sampling point of 10m from the shore, the proportions of mollusca (*Bivalvia* and *Gastropoda*) and annelida *Polychaeta* were 31 %, 31 %, and 34 %, respectively. On the other hand, at the sampling point of 60 m from the shore, the proportions of mollusca *Bivalvia* and annelida *Polychaeta* were 34 % and 52%, respectively. Species diversity of and evenness macrobenthic infauna were calculated by Shannon-Wiener index (*H'*) and Pielou's evenness index (*J'*), respectively. As results, average values of *H'* and *J'* ranged from 1.20 to 1.43, and from 0.58 to 0.61, respectively. There were no significant differences in the diversity and the evenness of species among sampling points (ANOVA, P>0.05). The previous research reported that *H'* ranged from 1.09 to 1.59 in the middle and low intertidal area of Higashiyoka-higata. Thus, we found that there was no significant difference in the species diversity of macrobenthic infauna in the whole intertidal zone of Higashiyoka-higata.

Evaluation of burrowing pattern and burrow structures of crabs in the muddy tidal flat of the Ariake Bay

Takuya Ishibashi Faculty of Agriculture, Saga University / Masumi Koriyama Organization for General Education, Saga University
Sakura Maesaki Graduate School of Agriculture, Saga University
Maho Yamaguchi, Atushi Nakamura, Haruka Ueki Faculty of Agriculture, Saga University

Macrobenthos are common in tidal flat and play an important role in purification functions. Organic matter decomposition in sediments may be mediated by the activity of macrobenthos. They can affect sediments chemistry by bioturbation such as burrow activity, tube-building, ingestion, defecation, respiration, and mucus secretion. The process of bioturbation, associated with the burrowing and feeding activities of infaunal macrobenthos, is one of the most important ways in which benthic macrofauna modify the physical, chemical, and biological properties of sediments. Fiddler crabs are often the dominant macrobenthic species and one of the principal agents of bioturbation in intertidal muddy sediments. Therefore, the influence of crab bioturbation on material cycle in intertidal flat caused by their activities cannot be ignored. The objective of this study is to evaluate of burrowing pattern and burrow structures of crabs in the muddy tidal flat of the Ariake Bay.

In order to investigate the temporal variation of burrow number of crabs, photo-quadrate (50x50cm²) of tidal flat surface were taken at intervals of 30 minutes using fixing time-lapse camera (Brinno, BCC100), and burrow numbers in quadrate were counted. Next, we investigated crab burrows to elucidate its burrow structure. Burrow casts were obtained using polyester resin (PC-747S, Kyusyu Toryo Co.,Ltd.). Liquid resin was poured in several burrows. After several hours, resin casts were pulled out and recovered. In the laboratory, burrow's depth, length, and surface area that covered aluminum foil with resin casts were calculated by Image J. Volume was detected water volume spilled out from container into resin casts.

A total of 46 burrow casts were obtained, which *Uca arcuata* and *Cleistostoma dilatatum* burrow casts were 28 and 18, respectively. Structurally, the burrows consisted of J shape type and I shape type. In the case of *Cleistostoma dilatatum*, 65.4% of burrows were J type and 26.9% of burrows were I type. On

the other hand, J type and I type of *Uca arcuata* burrows were 50.9% and 42.4%, respectively. The *Uca arcuata* and *Cleistostoma dilatatum* burrows depth ranged from 3.4 to 18.3cm (7.2±7.0cm) and from 3.3 to 14.4cm (7.9±9.2cm), respectively. The relationship between carapace width and various burrow parameters was found. That is, depth and surface area and volume of burrow tended to increase exponentially with carapace width. Formulas to estimate burrow parameters from carapace width (CW,mm) as follow: in the case of *Cleistostoma dilatatum*, (1) depth (mm)=20.093CW^{0.5251}, R²=0.26; (2) surface area (mm²) =764.64CW^{0.5841}, R²=0.30; (3) volume (mm³)=4673.8 CW^{0.4845}, R²=0.19; in the case of *Uca arcuata*, (4) depth (mm)=13.079CW^{0.5661}, R²=0.15; (5) surface area (mm²)=184.05CW^{1.0651}, R²=0.38; (6) volume (mm³)=127.60CW^{1.62}, R²=0.40.

The existing burrows number of *Uca arcuata* in quadrate during neap and spring tide in August-September

2016 ranged from 14 to 18 inds/50x50 cm² (15.1±1.6 inds/50x50 cm²) and from 15 to 22 inds/50x50 cm² (16.9±3.2 inds/50x50 cm²), respectively. The difference of existing burrows number of *Uca arcuata* between neap and spring tide was not significant (t-test, P>0.05). The remaining rate of *Uca arcuata* burrows in quadrate for 1 week during neap and spring tide was 31-100% and 44-60%, respectively. Thus, the renewal rate of *Uca arcuata* burrows during neap and spring tide in summer ranged from 0.57 to 5.14 inds/m²/day and from 4.57 to 10.86 inds/m²/day, respectively. Based on the renewal rate of burrow and burrow parameters of *Uca arcuata*, the soil-turnover rates induced by borrowing activity of *Uca arcuata* were estimated to be 69.3-654.9 cm³/m² and 844.0-1607.8 cm³/m² in neap and spring tide, respectively. We found that soil-turnover rates of *Uca arcuata* depended strongly on the fluctuation of sediment water content with time and frequency of inundation due to tide and rainfall.

The transition of river morphology and minor restoration in Kamisaigo river

Takuma Ono, Hironori Hayashi, Yukihiro Shimatani

Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University

In recent years, it is said that various physical environment is important for habitats of fish. Many river restoration works have been promoted in Japan. In 2007, technical standards for river channel planning on small and medium rivers was notified by MLIT (Ministry of Land, Infrastructure and Transport). However, there are many failed examples due to the problems caused by our misunderstanding about river flow dynamics. For example, Channel Narrowing changes the hydraulic environment in river and the habitat constitution living creatures. For that reason, effective river restoration method is not well established. Aims of this study are to report the results in detail recorded about minor restoration methods in river and the process of river itself. In this study, we surveyed transition process of river innovated small restoration methods in Kamisaigo river from 2011 to 2016. Kamisaigo river was executed river restoration over about one kilometers, where installed various minor restoration at each section. And we surveyed fish survey, physical environment survey, transverse survey and proportion of each habitat. From the result, the channel narrowing was occurred in every station with taking about three years, after that the river width was relatively stable. After three years, the river width tends to transition while repeating to occurred the river width widening after flood period. In the section where the stream flow path was not artificially constructed, the flow path was apt to fluctuate. Habitat such as pool and riffle was not fixed, it disappeared and formed repeatedly. In the section where the stream flow path was artificially constructed, the flow path was not apt to fluctuate, and stabilize the shape of the stream flow path. In the section where the minor restoration method was installed, the effect of keeping the stream width was confirmed. Also habitat diversity was improved around the minor restoration method such as big rock and log structure. Also, *Oryzias latipes* have

increased dominantly in the pool made by rock in 2016. In other words, it was suggested that various habitat of around the rock always keep various kinds of fish. However, some rocks were gradually buried in the sand after river restoration. When introducing rocks, it was suggested that measures such as introduction to the center of the river as much as possible are necessary. Also, it was suggested that excessive vegetation management of rivers is one of the factors that greatly change the stream flow path. The section installed the solid bank of a minor restoration method was confirmed the effect of keeping the stream width and habitat diversity the entire section not only around the solid bank. The solid bank has the effect of diversifying the flow of water at the time of the flood, so it was inferred having the effect of keeping the stream width and habitat diversity. However, since it was not find out in this research so far, that it is necessary to conduct a hydraulic analysis in the future. Also, from transverse survey, the river bank formed gentle slope tended to be gradually higher and steeper in every station. Rising the river bank and the channel narrowing seemed to be a close relationship, we need to survey further.



Prediction of Drought Using Coupled Ocean-Atmospheric Phenomena in the Watershed of Maharlu and Bakhtegan Lakes, Iran

Bahram Choubin, Farzaneh Sajedi-Hosseini Sari University of Agriculture Sciences and Natural Resources
Hamidreza Gharechaei, Abolfazl Abesht Department of Environmental; United Nation Development Program (UNDP)

Nowadays, water resource management is an important issue in arid and semi-arid regions due to the increasing human activities such as agriculture, industry, dam construction, and etc. Precipitation changes may alter underlying water resources conditions and increase the need for new water management programs and strategies especially in highly uncertain climates within arid and semi-arid regions. It seems that the forecasting of precipitation can be helpful to mitigate consequent problems and better management of water resources; mainly due to the highlighted outcomes of this issue in arid and semi-arid climates.

The study area, watershed of Maharlu and Bakhtegan Lakes in Iran, consists the three sub watersheds and four lakes including: sub watershed of Kaftar lake (where Kaftar lake is located), sub watershed of Maharlu lake (where Maharlu lake is located) and sub watershed of Bakhtegan lake (where are Bakhtegan and Tashk lakes are located). The lakes are important in aspect of tourist sites and also ecological values as the sites for migrating bird species from Siberia during winter such as Flamingos (*Phoenicopterus ruber* and *Phoenicopterus roseus*) and Dorna (*Grus leucogeranus*).

The lakes water level specifically in case of Tashk and Bakhtegan, which are among biggest lakes of Iran, have decreased mainly due to human activities and droughts in recent years. Low water level in the lakes has accelerated environmental threats so migrating bird species (about 220 species) has decreased over 2008-2014 period. In addition, it accelerates creation of salt domes in the lakes. About 117000 hectare of Bakhtegan Lake has been converted to salt marsh over last 26 years that caused increasing of 12 % of aerosol (or haze) in watershed area. Thus, understanding the amount of precipitation in Maharlu-Bakhtegan Watershed can be helpful to better managing of

water resources for agriculture, industry and ecological water rights to prevent environmental crisis such as increasing of the salt domes and haze, and decreasing of migrating birds.

The main objective of this study was investigating relationship between large scale climate signals and monthly precipitation in the Maharlu-Bakhtegan Watershed, Iran.

The Standardized Precipitation Index (SPI) of 1, 3, 6 and 12 months was calculated and their relationships was evaluated over 12 time-lags based on the Cross-Correlation Function (CCF). Then, the most effective signals obtained from CCF method was selected as input models. Stepwise regression combined with CCF was used to improve performance of Multivariate Linear Regression (MLR). Among the eight selected signal by CCF, AMO (Atlantic Multidecadal Oscillation), NINO3.4 (East Central Tropical Pacific Surface Temperature), NINO4 (Central Tropical Pacific Surface Temperature), NTA (North Tropical Atlantic) were capable enough to construct regression equations. Moreover, Multi-Layer Perceptron (MLP) network and Neuro-fuzzy models were also considered and predictions were done to 12 steps ahead.

Results revealed that MLP performance was better than other models based on root mean square error (RMSE), correlation coefficient (R), Nash-Sutcliffe efficiency coefficient (NS) and Taylor diagrams. According to the results, Watershed precipitation of Maharlu and Bakhtegan Lakes can be predicted 12 month ahead with Sea Surface Temperature (SST) anomalies of Atlantic and Pacific oceans.

Estimation of Environmental Risk of Pollution Water in the Rivers

Tynybekov A.K., Azamatov N.A., Osmonkanov N.O., Iskenderova J.N., Tumanova I.B.
KSU by I. Arabaev

This article examines the state of water of a river system, a method for the evaluation of ecological risk on the example of the Barskaun river.

Despite the abundance of water resources, Kyrgyzstan faces water shortages for both irrigation and drinking needs. This trend may intensify in low-water periods, and every year the deficit will be felt more and more.

A significant part of the water taken in the republic is lost when used. The cause of the losses lies in the unsatisfactory technical condition of irrigation and water distribution systems, the deterioration of equipment, and the use of imperfect irrigation methods. Agricultural production based on irrigated agriculture is the leading sector of the Kyrgyz economy and consumes the lion's share of water (93%). Among the countries where agricultural lands are artificially irrigated, Kyrgyzstan occupies one of the leading places (78%). However, inefficient use of water is noted.

The existing water supply and drinking water supply infrastructure in Kyrgyzstan is also in critical condition, and most of the country's centralized water supply systems are not functioning effectively.

Receptors (taking a negative impact or carrying toxic substances) of environmental risk may be the abiotic and biotic material components of the ecosystem. Abiotic receptors include water, suspended matter, bottom sediments and ice.

The study of their contribution to the pollution of coastal lake water areas by persistent organic substances possessing carcinogenic, mutagenic and teratogenic properties is extremely important for the assessment of environmental damage Lake bioresources. The science of risk was formed in the last quarter of the 20th century, and it will certainly be one of the leading in the new century. The reason for this is in a place that has taken on a risk-related problem. The most important feature of the science of

risk is its interdisciplinary character with the close interaction of the natural and human sciences.

In the industrialized countries, funding for scientific research in the field of risk analysis and assessment is constantly increasing. For example, in the US chemical industry 25- 30% of funds for scientific development are allocated for solving the risk problems, and more than 50% for pharmacology. Abroad, a circle of specialists of a new type was formed - risk experts, which, according to sociologists, will constitute a new elite stratum of the postindustrial society. Unfortunately, in the Kyrgyz Republic, the science of risk has not yet developed. In the former Soviet Union, there was practically no risk science.

Strictly unambiguous mathematical definition of risk does not exist. The risk can be described and explained by examples and in this way gradually refined. Thus, to risk - this is due to the decision making, management decision in uncertain situations and its implementation. We must learn to measure, evaluate the result of this decision, the risk with a certain accuracy. And for this we must be able to somehow rank, compare the decisions made on their future possible results, and in this way choose the least secure solution. It is necessary to create a theory of risk. But it is possible to create a mathematical theory only if there is a mathematical model of the process under consideration. Here we clearly distinguish between the model of the process, the object that we are examining, and the risk model that arises when the model of the given process, the object, is realized. On the models of the object many of its properties are studied. The problem is how to present the risk in the language of a mathematical model.

In Japan, ingenuity of flood control and water utilization has long been taken. There are 60% of mountainous land in Japan, plains tend to be less. Therefore, various measures had been taken to increase the agricultural productivity in the plain section. Various flood technologies had been developed against the flooding of rivers caused by floods. In addition, efforts had been made to efficiently secure fresh water, maintenance of irrigation canals for water use for rice cultivation and other purposes. In addition, efforts had been made to efficiently secure fresh water and maintenance of irrigation canals and reservoirs for use of water for rice cultivation and the like. Many such Japanese old water management systems had been lost, however some still exist as traditional techniques.

Means techniques for achieving the purpose such as concrete, heavy machinery and dams are becoming highly advanced in the present age. However the old days there was no such means techniques. Therefore, it has been devised by limited materials such as wood, stone and human power, experience value and view of nature. In other words, ideological technology had developed. The Japanese traditional water management system is a collection of advanced ideological technology.

In recent years, Green Infrastructure and ECO-DRR (Ecosystem-based Disaster Risk Reduction) have attracted worldwide attention. The Japanese traditional water management system is technology based on the idea to understand and utilize nature. It contains a lot of ingenuity to alleviate disasters and enjoy the full benefits of nature's blessings. This idea seems to be highly compatible with the technical thought of the Green Infrastructure and ECO-DRR.

ECO-DRR is a technical thought of reducing disaster risk by natural ecosystem. A typical example is a mangrove forest distributed in the estuarine region of Southeast Asia. With this mangrove forest, there is a proven track record that a tsunami

energy dissipation effect was obtained.

The Japanese traditional water management system is made for the purposes such as flood control and water use. This system utilizes the natural materials, there is a device that does not destroy a large natural environment. Therefore, many of these cases function as part of the ecosystem. In addition, by maintaining the system, we are constantly providing a place where humans are involved with nature. For this reason, ECO-DRR and Japanese traditional water management system are common at ideological stage.

Examples of Japanese traditional water management systems with potential as ECO-DRR are as follows. Open Levee In The Downstream Basins Retarding Basin

Main Function: Retarding (When flooding in the river, accumulate flood upstream to reduce the flow of the downstream flood.)

Ecosystem: Spawning Emergency Evacuation (A wetland environment suitable for spawning fish can be temporarily made. At the time of the flood, it becomes a refuge place of fish and insects.)

Secondary: Nutrition Provision (In the flooded place, nutrients and earth and sand which are carried from the mountain enter.)

Creeks Of Saga Plain

Main Function: Agricultural Water Domestic Water (Creek stores freshwater at sea level 0 meter) Ecosystem: Natural Fish Pond (One of the leading freshwater fish habitats in Japan. Many kinds of freshwater fish live.) Secondary: Flood Control Inland Navigation

Besides this, various cases such as Flood Restraining Forest Belts, Irrigation Ponds, Fascine Weir, Trees Planted to Arrest Shifting Of Sand and the like have the possibility to function as ECO-DRR besides the original function as well as the bank.

Response of biotic components after hydrological intervention in the tropical lagoon

Ji Yoon Kim¹, Yuno Do¹, Gu-Yeon Kim², Gea-Jae Joo¹, Ajit K. Pattnaik³, Krupasindhu Bhatta³, Gurdeep Rastogi³

¹Pusan National University, ²Kyungnam University, ³Chilika Development Authority

Lagoon ecosystems have been severely degraded by anthropogenic activities, which result in ecological and hydrological changes in the system. Detailed understanding of the recovery processes of restored lagoon systems has been impeded by the underlying complexity of integral environmental components. Chilika Lagoon, the largest brackish lake ecosystem in East Asia, experienced severe problems such as excessive dominance of freshwater exotic plants and rapid debasement of biodiversity associated with decreased hydrologic connectivity between the lagoon and the ocean. To halt the degradation of the lagoon ecosystem, the Chilika Development Authority implemented a restoration project, creating a new channel to penetrate the barrier beach of the lagoon. The opening of the new mouth provided a favorable increased salinity regime throughout the lake, with higher fluctuations and improved water clarity due to sediment flushing through the new mouth. The aim of this study was to understand different recovery responses of lagoon biota in a restored lagoon, and temporal and spatial changes at each recovery stage after lagoon restoration. Using a satellite-derived normalized difference vegetation index (NDVI) dataset, we compared the trend of vegetation changes after the lagoon restoration, from April 1998 to May 2014. We also compared temporal response of lagoon animals based on the local monitoring literatures. Response of lagoon animals during restoration periods was estimated from the annual production records or population survey results of local monitoring reports. We established temporal data of planktons, fish, birds, and mammals from 2000 to 2014.

Compared with other biological studies, long-term analysis of NDVI in the restored lagoon revealed that diverse biological taxa responded differently, and had a different range of recov-

ery rates after the restoration event. In this study, plant productivity was decreased for half a year after the restoration, and took about twelve years to return to previous productivity levels. It seems that a rapid decrease of NDVI was caused by the sudden dieback of proliferated freshwater species. The large decrease of NDVI in the freshwater region was caused by dieback of freshwater species in response to the salinity change at the very early stage of restoration. After restoration, gradual increases of brackish lagoon vegetation, including *Potamogeton* sp. and sea grasses, were identified in the field. Other lagoon biological taxa, including phytoplankton, also showed a rapid recovery response to the levels of the 1980s after the mouth restoration. The biomass of fish and prawns in Chilika Lagoon showed a seven-fold increase (i.e., 8500 tons in 1986, 1600 tons in 1998, and 11,878 tons in 2002) during the two years after the opening of the new mouth. Increased fishery production was maintained and stabilized for several years. Number of Irrawaddy dolphins showed gradual increase in the population number (98 in 2006, 138 in 2008, 153 in 2013). It was notable that diverse biological taxa showed different recovery responses after lagoon restoration event. Generally, plankton, and fish had rapid increase (2-3 years) after recovering connectivity between lagoon and ocean, while aquatic vegetation and large mammals had gradual increase (4-12 years) to reach previous natural condition.

The Setiu Wetlands in Terengganu, a state in the east coast of Peninsular Malaysia, represents a coastal floodplain formed by the Setiu-Chalok-Merang-Bari riverine complex with unique presence of several inter-connected ecosystem types. The Setiu Wetlands not only provide a great array of ecosystem services such as flood control, erosion mitigation, nursery ground for juvenile marine fishes and provision of natural resources for the local population's traditional livelihoods, but also support a rich biodiversity. The wetlands also have great potential as an ecotourism destination that can generate economic returns to the local communities and to the state. Records to date indicates that Setiu Wetlands harbours 29 species of mammals, 176 species of birds, 36 species of reptiles and amphibians, 56 species of butterflies and 217 species of plants. Of significance is the fact that Setiu is among the very few places in Malaysia where viable populations of the critically endangered Painted terrapin are still present. The wetlands is classified as nationally important for its ecological and conservation values, and is listed in the Malaysian Wetland Directory (1987) on the basis of its extensive Melaleuca forest, mangrove forest, remnant peat swamp forest, nesting beaches for freshwater and marine turtles, and unique formations of the Setiu and Merang coastal lagoons.

Hence, Setiu Wetlands is undeniably one of Malaysia's most spectacular natural treasures. However, it is also fragile, thus efforts to prevent it from further degradation would be critical. The collapse of the wetland's ecosystem could mean the end of its many ecosystem services and its biodiversity. It is the contention of WWF-Malaysia that protection are afforded particularly for areas of high conservation value in the Setiu Wetlands with improved and holistic management effected within the landscape. This could, hopefully provide a fighting chance for the eco-

systems and biodiversity of the Setiu Wetlands to continue being part of our environment, in order to build a future in which humans live in harmony with nature. Over the years, the wetlands have experienced progressive conversion primarily for agriculture and aquaculture expansion. The lagoon and its fringing mangroves particularly have been subjected to tremendous aquaculture development and increasingly, the Melaleuca forest has also being targeted for conversion to agricultural activity especially involving oil palm plantation by both companies and smallholders. Additionally, construction of an artificial river mouth to facilitate navigation of fishing vessels, development of jetties and installation of bunds for coastal protection have resulted in the alteration of river channels and coastal morphology as well as changes in the wetlands hydrological regime. The widespread conversion and changes in land use are sending warning signals due to the resulting degradation and loss of substantial areas of wetlands besides other negative impacts including on the wetlands ecological functions and services.

In pursuing conservation efforts in Setiu Wetlands, one of WWF-Malaysia's key approaches is to advocate for threat minimization using information and recommendations derived from ecosystem monitoring to establish baselines and to understand the changes and impacts through collaboration with research bodies and experts. Among the main studies undertaken are the land use and land cover change analysis in oil palm development, population study of Painted terrapin, riparian vegetation mapping, water quality monitoring, high conservation value (HCV) assessment and scientific expedition. The respective studies employ specific methods that include field sampling and data collection, on-site observation and verification, laboratory analysis, satellite image interpretation and GIS analysis. The findings of these studies are vital in helping to provide key inputs for informed decision to realize the sustainable management and protection of Setiu Wetlands for the benefit of all in the long term.

Shorebirds and Threatened Spoon-billed Sandpiper in Ariake Tidal Flats - Trends and Importance of Conservation

Minoru Kashiwagi¹, Takuro Hattori^{1,2}, Shigeki Takano^{1,3}, Kimiko Kouno^{1,2}, Sayaka Nakamura^{1,4}, Nobuhiro Hashimoto⁵

¹Ramsar Network Japan, ²Fukuoka Wetland Conservation Study Group, ³Yatsushiro Bird Society, ⁴Wild Bird Society of Japan, Saga Chapter, ⁵Nanko Wetland Group

At the last two Ramsar COPs in 2012 and 2015, three tidal flat sites in Ariake Sea, Arai-higata, Kashima-shingomori-higata and Higashi-yoka-higata in Kyushu Island, Japan, were designated as Ramsar Sites of International Importance. In fact, tidal flats on the coasts of Ariake Sea and neighbouring Yatsushiro Sea support significant number of shorebirds as their staging sites according to national monitoring project, Monitoring Sites 1000. These areas are important for shorebird migration because it is situated at crossroads of the East-Asian/Australasian Flyway of shorebirds between southern non-breeding sites and northern breeding sites: crossroads of both populations using Eurasian continent via Korean Peninsula and those using Japan Archipelago. They are also important supporting threatened species including Spoon-billed Sandpiper and Nordmann's Greenshank. It is understandable that this sea area has many characteristics similar to Yellow Sea. In fact, it was connected with Yellow Sea many years ago as is shown by the existence of common endemic benthic species in both sea areas.

However, the result of past monitoring since 1970s show that the condition of Ariake /Yatsushiro Seas has not been good for shorebirds. Shorebird population using habitats in Japan in their northward migration recently is almost half compared with the result during 1973-84.

In September 1997, Japan Environment Agency released a "Wetland Inventory of Shorebird Sites in Japan" based on survey data organised by the government in the period of 1988 to 1996, incorporating those published by a national network of local NGOs, Japan Wetlands Action Network. The inventory noted three important sea areas in Kyushu Island: Ariake /Yatsushiro Seas including Isahaya and Higashi-yoka Tidal Flats; the Sea of Suoh-nada surrounded by three islands of Kyushu, Honshu and

Shikoku including Nakatsu Tidal Flat; and Hakata Bay Area. Among these, Isahaya Bay had the largest population together with Fujimae Tidal Flat in Ise-Mikawa Bay in

Honshu Island. Both sites supported around 10 000 individuals of shorebirds on their northward migration.

However, in April 1997, Tidal Flat of Isahaya Bay was closed by a sea dike due to a reclamation project went on inside the dike. Inflow of salt water to the tidal flat was blocked as a result. Isahaya Tidal Flat, the richest shorebird site in Japan, was destroyed. Some part of the shorebird population that foraged in this tidal flat could change their stopover site to nearby Higashi-yoka and other tidal flat in Ariake /Yatsushiro Sea. However, the total population size in the whole area became smaller, meaning there were shorebirds that failed to survive because they were truthful to their lost habitat.

Degradation of shorebirds in Japan, after mid-2000, became remarkable except for some sites in Ariake /Yatsushiro Seas, and the Sea of Suoh-nada. In this situation, these remaining sites should be protected also to recover other sites on the process of degradation. This degradation corresponds to the situation in Australia at the southernmost end of the flyway, for which specialists suspect the impact of development that has been proceeding in the whole coastal area of Yellow Sea used by larger population of shorebirds. The authors would like to propose the importance of conservation and restoration efforts not only to Japan but also to the whole flyway that are going on in habitats still supporting a considerable size of population. We expect that the presentation gives an idea of the impact of development project going on especially in Yellow Sea.

Handicraft and Souvenir Making Using Water Hyacinth (*Eichhornia crassipes*) and Tikog (*Cyperus malaccensis*)

Ana Michelle J. Talitod, Josephine L. Araojo, Emmilie T. Ibonia, Ferit Temur, Salome Acopiado
DENR 13, Protected Area Superintendent - Agusan Marsh Wildlife Sanctuary

Traditional Handicraft-making using a wide variety of indigenous materials such as Bamboo, Rattan and Abaca were known to be the cultural signatures of many indigenous tribes as well as several Weaving Associations in the Philippines. They are the raw materials for weaving baskets, mats and strong textiles. Handicraft-making is also one of the growing industries in the country today.

The wilderness of Agusan Marsh Wildlife Sanctuary (AMWS) caters wide varieties of plant species that can be used as weaving materials in Handicraft making other than the aforementioned. Such plants are the Water Hyacinth and Tikog or Balangot.

Water Hyacinth (*Eichhornia crassipes*) is an aquatic herb with long roots, runners and clump form. This herb is an invasive species and was seen as a nuisance to the daily lives of the people living in indigenous communities within the Marsh. The plant is infamous for drifting troubles to communities as it clogs irrigations and water systems and reducing fishing range. Tikog or Balangot (*Cyperus malaccensis*), on the other hand is a perennial, grass-like plant often gathered from the wild and used locally for weaving into mats. They are also abundantly found along the riverbanks, creeks and lakes of the Agusan Marsh and typically neglected by the majority of people.

With these indigenous raw materials readily available, a series of training courses for Water Hyacinth Slipper Making from 2014 to 2016 were conducted by the Department of Environment and Natural Resources (DENR) through the Office of the Protected Areas, Wildlife and Coastal Zone Management Services (PAWCZMS) to equip the People's Organizations (POs) from the communities of Caimpugan Peatland, San Francisco, and Lake Panlabuhan with Handicraft skills in making slippers.

They were trained on the proper harvesting of water hyacinth, drying, bleaching and weaving them to be the straps and soles of the slippers.

Currently, the water hyacinth slippers are the most established and famous among the handicraft products in AMWS. They are commonly marketed on local bazaars and fairs. As of 2016, the PO of CANFFMULCO (Caimpugan Natural Farmers and Fisherfolks Multipurpose Cooperative) and TMOSPLAMO (Tribong Manobo of Sitio Panlabuhan Agusan Marsh Organization) were able to generate an income of Php. 18,000.00 and Php. 30,000 respectively.

Last June 2017, DENR through the Office of Protected Area Superintendent of Agusan Marsh Wildlife Sanctuary also conducted a Training Course on Handicraft and Souvenir Making using Water Hyacinth and Tikog to equip the communities from the municipality of Talacogon, Agusan del Sur particularly those barangays within the Talacogon Peatland and Lake Himbang with Handicraft skills in making souvenir items such as baskets, boxes, table runners, mats and coasters. The participants were trained on different weaving patterns using the Water Hyacinth and Tikog to make the aforementioned crafts. They are also oriented on the possible marketing opportunities as well as sustainable harvesting of the materials.

The skills they've acquired during the training proved to be worthy in providing the recipient communities with alternative economic benefits not only to the women but also to men that chose to involve themselves in handicraft making. DENR are currently planning to provide the said communities with additional enhancement and training courses as well as provide capability development on branding, packaging and marketing of the products.

Social Innovation for Biodiversity Preservation in Wetlands Kahokugata; Vegetable Cultivation for Establishing a Sound Material-Cycle Society "Suzume-Yasai", and Rice Cultivation by Cooperation in Farmers and NPO "Ikimono-Genki-Mai"

Hisashi Takahashi
Kahokugata Lake Institute

Kahokugata in Ishikawa Prefecture is the shallow lake in the location near the sea. Origin was the inland sea-lake which was the brackish water which connected with a sea until about 50 years before. 2/3 of a lake was reclaimed by the state-operated reclamation project which has started in 1963. At the same time, the surrounding wetlands were altered. Degradation of biodiversity in Kahokugata and circumference areas has formed by the recent years' environment alteration which starts from this project. Preservation of biodiversity in this area is a pressing problem. Two business is performed by Kahokugata Lake Institute aiming at a solution of a problem of biodiversity preservation in wetlands around Kahokugata at present.

"Suzume-Yasai" which means "Sparrow vegetables", is a business of the vegetable cropping. *Paspalum distichum* L. var. *indutum* which is an alien plant which flourishes excessively at Kahokugata and wetlands around it is used as a compost on this business. Kahokugata is the lake where eutrophication was done, but the Uchinada sand dune which is immediately aside of Kahokugata is the oligotrophy environment. Sound material recycling is promoted by taking the plant lush in Kahokugata which is an eutrophic lake and using it by the Uchinada sand dune which is the oligotrophy environment. A cost of the water-side management are served by selling vegetables on this business at the same time. When business of "Suzume-Yasai" spreads, and use of the compost is developed in the field in Uchinada sand dune, and use of chemical fertilizer becomes little, nitrogen concentration of the groundwater which flows into Kahokugata from Uchinada sand dune will be low, and improvement of the water quality of Kahokugata can be expected. The present problem is that composting facility is not

been developed. Therefore it's still small-scale business.

"Ikimono-Genki-Mai" which means preserving all wildlife is a business of the rice cropping. NPO cooperates with farmers, and this business is put into effect to make the farmland a habitat of wildlife. Helicopter spraying of insecticide isn't performed at the rice paddy where "Ikimono-Genki-Mai" is grown. A herbicide isn't used for a ridge. A contract farmer requests a creature investigation from NPO and receives authentication of the reliability. The rice certified adds extra value as "Ikimono-Genki-Mai", and is sold. "Ikimono-Genki-Mai" is certified in each 1 rice paddy, and is bagged. The location of the field, cultivation method and the confirmed information on wildlife are recorded on a wrapping bag. This is mechanism of the best traceability. 7 farmers participate at present, and "Ikimono-Genki-Mai" is grown at 10 rice paddies.

Additionally there is 1 field of lotus root. A problem by restricting use of agricultural chemicals has not formed up to now. The change in the inhabit situation of the large-sized organisms isn't confirmed, but it's confirmed that small-sized organisms is increased. The farmer who hopes for participation in this business is the possibility which will increase from now on. The present problem is securement in a market.

Securement in an original market in the respective farmer is behind schedule. Each farmer depends on the market NPO has reserved.

RiceBED Project, for Mainstreaming Biodiversity in Rice Paddies by Networking People of Various Sectors in Japan and Overseas

Masayuki Kurechi, Minoru Kashiwagi
Ramsar Network Japan

RiceBED Project – it is an acronym for Rice Paddy Biodiversity Enhancement Decade Project. It was in 2013 that Ramsar Network Japan (RNJ) kicked the project off. It is an action project focussing on capacity of rice paddies to hold biological diversity.

Making best use of the capacity of rice paddies, it aims to mainstream enhancement of biodiversity in rice paddies. The project calls for those people, in various areas geographically and socially, interested in maintaining and enhancing biodiversity in rice paddies. It invites their participation by declaring implementation of at least one action they can practice to enhance biodiversity in rice paddies. RNJ plays a role to provide a platform for participants to exchange information on related activities. In this way, the project aims to create a new trend for enhancing biodiversity in rice paddies by bundling power of participants while expanding the basis of people concerned about conservation of biodiversity in rice paddies.

In 2010, at CBD/COP10 in Nagoya, the Government of Japan was instrumental in suggesting the twenty 10-year targets aiming to restore lost biological diversity that were adopted as the "Aichi Biodiversity Targets."

Ramsar Network Japan (RNJ) suggested a framework to widen the field for their implementation beyond the scope of CBD, which was realized as "United Nations Decade on Biodiversity" (UNDB) through the discussion of the CBD/COP10.

RNJ has launched the "Rice-paddy Biodiversity Enhancement Decade" (RiceBED) to provide a platform for a wide variety of activities that put into practice the contents of the resolution (X.31 in Ramsar) and decision (X/34 in CBD) on enhancing rice paddy biodiversity adopted by the Ramsar and CBD, respectively.

Ramsar Network Japan drew up an action plan in 2012, with participants from local governments and organizations, as well as individuals who have already been engaged in this field, and the "RiceBED Action Plan" was put together.

This Action Plan gives concrete shape to the action necessary to achieve the Aichi Biodiversity Targets and international rice

paddy resolutions. Activities aiming for completion in 2020 are now being initiated and carried out all over Japan.

We call on all agriculturalists, citizens, corporations and government authorities with an interest in rice paddy biodiversity to join hands with us to carry out this plan to pursue and achieve the goals of the Aichi Biodiversity Targets and rice paddy resolution.

Number of participants in the project counts over 200 individuals and organisations until now.

RiceBED has been also developing a global platform involving Asia, Africa and Neotropics.

Activities thus far:

Seven local meetings and three meetings at national level/ joined partners meetings of Double 20 Project.

Engaged in establishing Local Biodiversity Strategy of local governments. Informal Civil-Government Meetings for the Implementation of the Rice Paddy Resolution; a framework to discuss and exchange information on enhancing biodiversity in rice paddies; 57 times since 2009.

International action: released Rice BED Action Plan in English at the CBD/COP12 (Korea in 2014)/ organised a side event with Japanese Government on rice paddies inviting speakers from Asia, Africa and Neotropics at the Ramsar COP12 (Uruguay, 2015)/ Join JICA project in Uganda and Costa Rica/ . .

Awareness-raising activities; Home page, mailing list, newsletters, some documents both in Japanese and English.

Toward 2020:

The goal of RiceBED Project is 2020:

*Target for 500 registrations of action in the year.

*RiceBED becomes a leading project, mainstreaming biodiversity in rice paddies. Further information and registration form to the project, see the following:

*RiceBED Project Access Guide <http://www.ramnet-j.org/doc/ricebedproject-e2.pdf>

*RiceBED Project HP (English) <http://www.ramnet-j.org/tambo10/tambo/en/>

What is the rainwater underground harvesting tank "Tametotto"?

Shinji Kawano
Daiken Co., Ltd.

The rainwater underground harvesting tank (nickname) "Tametotto" is a mechanism that can store and use a large amount of rainwater with just maintenance, with water quality comparable to that of drinking water, with easy construction in a short period of time. We got inspiration from the wetland's water holding capacity and water purification ability and got guidance from Kyushu University and developed it.

Moreover, the upper portion of the installation can be used for "Tametotto," and it can be installed in the garden, the parking lot, the evacuation center of the area, the park etc. Usually it is used as water for garden tree sprinkling, washing water in toilet and washing water for washing. When "torrential downpour" or "local heavy rain," etc., it can be used as living water even in the event of a disaster because it will be operated by hand pump as a countermeasure against flood damage by storing it.

As a result, we have set up "Tametotto" in each of the two elementary schools in Atapu Province of Laos, People's Democratic Republic of Laos at the request of the United Nations Habitat in 2014. Both of them have a capacity of 100 tons, "drinking water" for residents is the purpose. With the establishment of "Tametotto," 400 people in Taoum village, 400 people in Pusai village, 220 people in 35th house of Pusai village, 220 teachers and staff of two schools totaled about 650 people, for a minimum of 2 months in the dry season, 1 It will be possible to secure 2-3 liters of drinking water a day.

From the United Nations Habitat, we taught five reasons about "reason for adopting" reason.

1. Low installation cost. (In Laos it was possible to make it about 15,000 yen per ton of water storage.)
2. Short construction time. (We were able to create 100 ton class water storage in Laos in one week.)
3. Installable by local people as no specialized skills are required.
4. Local materials can be used.
5. Post-installation maintenance is easy.

We received a letter from Laos 1 year after installation, reported that I was able to use water for 4 months during the semi-annual dry season where it did not rain, and I was able to make vegetables using saved rainwater. It was a good evaluation. So in May of this year, I received my second request from the United Nations Habitat and built the third "Tametotto" for Laos.

For the future "Tametotto," we are planning to develop as a mini dam near the residence, not aiming for a huge cost like Japan and a huge amount of time, a large dam near the mountain. "Tametotto" is to exist in the vicinity of the living environment, to secure stable water for daily life and to "life-saving facilities" to protect human life from torrential rainstorms, want to develop to countries such as Laos, Vietnam, Indonesia etc. thinking about. And I would like to contribute to local consumption of water resources in Southeast Asian countries even a little.

The “Wise Use” of Green Infrastructure: Community-Based Revitalization of Urban Wetland in Gowanus Canal, New York City

Kyohei Takizawa¹, Yukihiro Shimatani², Satoquo Seino, Taku Watanabe¹
¹Japan Society of Civil Engineers, ²Japan Wetlands Society

The purpose of this study is to examine the activity and planning process of a conservancy program that aims to revitalize an urban wetland by a community-based, green infrastructure program. Cities worldwide have a common problem with combined sewer overflow (CSO), which has a negative influence on water quality in urban waterways and wetlands. We conducted interviews and surveyed documents of environmental groups, citizens, and city officials that manage the Gowanus Canal in Brooklyn New York City (NYC), where Green Infrastructure have been implemented by the city administration, with the cooperation of Gowanus Canal Conservancy (GCC).

New York City's Green Infrastructure Program have been implemented from 2010. This program intend to prevents storm-water runoff from entering the City's sewer systems, and to reduce CSO discharges into NYC's waterbodies. As a result, the water quality in NYC's rivers is expected to improve. The goal of this program is to control runoff from 10% of impervious surfaces in NYC.

The Gowanus Canal was constructed in 18th Century on the site of a former saltmarsh and creek. The Canal is one of America's most polluted waterways, due to historic industrial contamination and 377 million gallons of CSO into the canal every year.

GCC is a nonprofit conservancy founded in 2009 that serves as a community-based environmental steward of the Gowanus Canal. GCC envisions “the evolution of an Open, Clean and Alive Gowanus Canal and Watershed with accessible, connective open space; clean water, soil and air; and vibrant ecological, business and cultural activity.” GCC's master plan is to revive the waterfront by negotiating with administration, raising public awareness, event implementation with a citizen like a

“EXPO Gowanus” and environmental education at school.

Declared a Superfund site in 2010 by the US Environmental Protection Agency (EPA), the Canal has plans to dredge heavily contaminated sediment. The NYC Department of Environmental Protection (DEP) is designing and constructing green infrastructure across the watershed to reduce CSO from 2010. Some rain gardens and bioswales in the watershed are managed by citizens and GCC. GCC operate the volunteer programs collecting garbage in the city and making composts to reuse into rain gardens and bioswales.

Since 2015, GCC has led a planning process with approximately 300 community members, partner organizations, land-owners, elected officials, and agency representatives to identify open space priorities from a diverse range of neighborhood stakeholders. In 2016 GCC summarized the master plan composed of GOWAUS GREENSCAPE and GOWANUS BLUE. GOWAUS GREENSCAPE is a plan for green park network whose core is canal's wetland. In the other hand, GOWANUS BLUE is a stewardship across the watershed building green infrastructure to eliminate CSO. Through the analysis of the research, the most important keyword is abstracted : a stewardship. GCC recognize a stewardship as making a connection citizen's activities in the area to CSO problem.

Activities that help reduce CSO, such as planting trees in rain gardens and bioswales, foster a public awareness of the participants' connection to the entire watershed and strengthen their sense of public commitment. The GCC fosters watershed stewardship among their members by linking the restoration of wetland with community improvement and beautification.

Onga River Reconstruction Project: East Side High-Water Channel Design to Balance the Flood Control and People-Friendly Open Space

Tomoki Takebayashi, Akihiko Higuchi, Fumiko Taura
Kyushu University Faculty of Engineering

Introduction: Nogata Riverside Park of Onga River is one of a few contemporary examples in Japan that has successfully improved the riverfront from a drainage channel to a people-friendly public open space. In 2004, the author's teacher and the author's graduate student group were asked by Ministry of Land, Infrastructure and Transport Kyushu Regional Development Bureau Onga River Office (MLIT) to prepare an alternative plan for Onga River's riverfront in the central area of Nogata. In this region, citizen-involved river reconstruction works have been conducted and more than 60-times citizen meetings were held since 1996. Major attendee is Nogata Kawazukuri Koryukai, a not-for-profit group aiming to revitalize Onga river. After a series of intensive discussion with a concerned local citizen group, the design team prepared a design plan to balance the flood control and the creation of organic open space.

East Side High-water Channel Design: The east side one was lowered with newly built stonewalled terraces. While, the west side shoulder of the flat high-water channel was cut down to make a gentle slope connecting the downtown Nogata and the water both physically and psychologically. Different from the west side, the east side high-water channel tends to be eroded due to the west-curved waterway. The existing concrete embankment walls along the water's edge of the channel protect the eastern high-water channel from the erosion. However, this does not mean that the walls are unchangeable. A series of terrace stonewalls and grass fields in between could function as strong enough barriers to protect the flat plain from the erosion. This terrace structure will provide safe access to the water and also help to create integrated and harmonious open space with the west side riverfront.

Outcomes: Grass covered organic topography and set-backed stonewalls has been realized over the entire east side. While the

stonewalls are reinforced by the joint concrete as a solid wall, the joints of the stones on the wall's surface are kept empty so that local wild grasses could grow and cover the wall naturally in a few years. A wooden boat slip is placed in front of Mizubekan, riverfront activity center/flood shelter. A stone-paved square is also prepared as a part of the slip. The slip as well as all the stonewalled terraces on the east side are connected each other by both gentle slopes and stone steps for smooth pedestrian access. After the completion of the project, the number of daily visitors has increased by 50% both in weekdays and weekends in one year. Also, the increase of the cross-sectional area of the waterway has improved the river's security of flood control.

Conclusions: This project shows it is possible to secure flood control and to create a people-friendly public open space on an urban riverfront simultaneously. The critical factors to realize the design include followings: 1) The design team tried to involve citizens in design processes and to know citizen's needs to use river open space as well as the past landscape of the riverfront. Here contribution of Nogata Kawadukuri Koryukai was indispensable and their stories were helpful for designing the desirable landscape of Onga river. 2) The design tried not to use many materials; there are only grasses, stones that are the same stones used in previous constructions, and woods. This design strategy contributed to strengthen the space integrity of the entire landscape of Onga river. 3) The design ensures the wheelchair-friendly access slopes and paths.

Not only people in wheelchairs but family with baby strollers and seniors become possible to access to the water's edge easily. This water accessibility enhances the space attractiveness.

Potential of Nature Tourism in Rural Environs around Keoladeo National Park, Bharatpur (Rajasthan, India)

Satya Prakash Mehra¹, Sarita Mehra¹, Milind Pandit¹, Swati Samvatsar²

¹Rajputana Society of Natural History, Rajasthan, ²JalaSRI Watershed Surveillance and Research Institute, Jalgaon, Maharashtra

Keoladeo National Park (KNP) is one of the world's best birding sites. The presence of avifaunal diversity and congregation attracted community of birders, photographers in form of amateurs and researchers. Both natural climate cycle and manmade interventions in management of ecological conditions have affected the site to the great extent. In such conditions, the surrounding environ is playing vital role in providing ground for the faunal diversity especially wintering avifauna. Further, the rural and cultural aspects are the add on feature of the surrounding environs.

On the line of Citizen's Science, an attempt has been made to assess the ecological functions of the surrounding landscapes of KNP taking habitats, avifauna and anuran diversity as key indicators. The present investigation identify different types of the habitats around KNP on the lines of IUCN, as per the observations made on the birds from 2007 to 2017 whereas the aquatic avifaunal diversity in the wetland along with trends of avifaunal diversity in the agricultural fields habitats of adjoining villages of KNP were observed for the period of eight years (2010 – 2017).

The case study of Chak Ramnagar village has been detailed in the present paper. The study emphasizes the relevance of inclusive programme to revive the eco-centric perception of the people. Based on the principle of "Conservation Practices for Sustainable Livelihood", a team of authors under a banner of their NGO implemented an integrated program of resolving problems of one of the deprived group of communities of Bharatpur residing around Keoladeo National Park, viz., Banjara community (gypsy community of India) is known for their age-old practices of water harvesting.

In general, ten types of major habitats were identified from the surrounding environs. Specifically, seven types of habitats were

listed. About 230 species of birds were recorded from different types of habitats. The habitats of adjoining villages of KNP harbored about 150 species of birds, among which over 70 species were of aquatic. Interestingly, 116 species were recorded from agriculture fields of the adjoining villages of KNP. The distribution pattern and status of the wetland bird species and wetland dependent bird species along with the trends in the habitats were discussed in the paper along with the threats and pressure on the protected areas in general and KNP in particular.

Discussing the case study along with the avifaunal diversity, the intervention of the authors' team through value addition given to the grass artefacts production forming Self Help Groups has been briefed. The linkages of the local biodiversity with income generation changed the perception of the Banjara community and making them involved in the revival of local ecological setup in and around their villages. The paper on case study highlights the challenges of the community and the relevance of the local biodiversity along with the discussions on the socio-ecological status. Such programs entail local participation in conservation practices to preserve natural resources, fulfilling the aims set by global conservation groups for World Heritage sites.

The eco-model of Rajputana's Shakuntalam is also discussed in the present investigation which highlights the intervention at individual level to conserve and protect the natural environment. such steps are necessary especially around the World Heritage and Ramsar Site such as Keoladeo.

Threats indicate that both natural climate change cycle and anthropogenic impact will put increasing pressure upon existing protected areas and that much biodiversity conservation will need to take place beyond these reserves.

Cultural ecosystem services of temperate coastal area of Japan: from the visitors of tidal flat, sandy beach, and rocky/coral area

Takehisa Yamakita

Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Ecosystem services are considered as important concepts to connect biodiversity and human well-being. However evaluated coastal ecosystem services are very limited. In general here are not many researches directly connect biodiversity and human well-being. Even in the monetary based evaluation which has standardized technics, evaluations are still in early stage. For example Costanza et al. (2014) modified their monetary based evaluation of coral reefs in 1997 from 8000 USD to 350000 USD par ha. Among these increase on the prices, 104000 USD was caused by recent increase in the knowledge of cultural ecosystem services. In the case of Martin et al 2016, they collected the papers contain "coastal and marine ecosystems" from 2004 to 2014 by systematic survey. They could find only 24 papers which evaluate cultural ecosystem services. In addition half of these papers were published in the last one year 2014. As shown here it is not easy to evaluate cultural ecosystem services but the researches are increasing.

In the case of Japan, coral reef leisure and tidal flat was evaluated under committee established by the Ministry of the Environment. It showed high prices for Coral services (234.4 billion yen) but not high for cultural services of the tidal flat based on travel cost method of shellfish gathering only (91 thousand yen).

From 2016 we started a research program named "Predicting and Assessing Natural Capital and Ecosystem Services (PANCES)" under Environment Research and Technology Development Fund (S15), Ministry of the Environment, Japan. Through our project we assess and predict the social and economic value of natural capital and ecosystem services.

As a first step our group focused on temperate coastal area of Japan and evaluated several cultural ecosystem service indica-

tors such as number of visitors or travel cost estimate. As the elements of the coastal area sea bathing, shellfish gathering, fishing, and diving are considered.

To evaluate demand and supply of the diving spot we conducted quantile regression analysis on current diving spot distribution and distribution of coral reef. As a result there are relationships between the maximum number of diving spots and coral reef area in 10km grids. Using this statistical model we compared gaps of demand and supply and potential diving spot. Besides high gaps in Okinawa southern subtropical island, there is high gaps in the Kyushu area which at the most south in temperate area. This means high potential of the use of the coral as tourism in the supply side of the ecosystem. For the farther consideration of potential use on such area, we need to understand demand side aspect such as infrastructures, transport or locally existing industry such as fishery.

We also evaluated about temporal changes in the distribution of sea bathing spots. The sea bathing was started in the 1870's and spread into several prefectures in the Pacific side and Kyushu area in 1910. Compare to the increase in the numbers of spots even in the country side recent days, the Tokyo Bay showed different trend of the distribution. Before 1970's there are several area of the sea bathing spots even inner side of the bay. In the 1970's almost all of the area stopped because of the landfill and decrease in the water quality. However in 1989 the development of artificial beaches creates some spot to touch the water. Even in this situation i.e. alteration of natural capital into artificial capital, water quality could not afford to create the sea bathing spots yet, in the most of the inner part of the bay. Consideration of both artificial and natural capital will be the next challenging issue to evaluate this situation.

The coastal area of Higashimatsushima City, Miyagi Prefecture in northeast of Japan, was severely damaged by the tsunami caused after the Great East Japan Earthquake in March 2011. The City immediately began the process of land restoration for disaster prevention collective relocation with 1,288 lots (of which 571 lots are public housing). Building lot delivery were started from June 2014 and completed in November 2016. Ever since, home building in the newly restored area has been very active and 80% of the lots are already finished.

One of the remaining issues is how to utilize the devastated lands that the City purchased from citizens after the tsunami. The area was originally a combination of residential neighborhood, rice paddy and wetland but cannot be used for residents as the above sea level is too low. Of those 174 hector, 99 hectors are already allocated to be used for agriculture and industry-related-purposes, however, 75 hector still remains undecided.

The City wishes to regenerate the wetland and the surrounding area as a strategic site to reconstruct tourism and promote mental well-being of citizens and tourists who visit the area. Furthermore, the area with the surrounding forest is part of a schooling project, the Mori-no-Gakko (school in the forest) Project, and classes of Miyanomori Elementary School are part of the official curriculum. Classes includes biological observation of plants and insects, and woodworking using timber from

forest thinning in the area and such. When taking the class to the forest during the nurturing season of accipiter gentilis (northern goshawks), a native birds of prey in Japan, the route is changed so that the class does not bother the nurturing bird. The area was rich with flora and fauna and the City believes it to be promising to regenerate the wetland.

With the regeneration of the wetland and the bird sanctuary as the precious natural value, the coastal area will be the center of touristic content and also part of the environmental education program for human resource development.

The Seletar Kids Art Education Project – A project to document the Wetland Jewels of Malaysia

Wong Yun Yun

Nature Classroom, Malaysia

'Seletar', the 'Orang Laut', or the 'sea people' in Malay language, is one of the 18 indigenous ethnic groups in Malaysia. They are Austronesian and were once part of the sea nomads that lived in boats at coastal areas and estuaries along Straits of Johor (between Malaysia and Singapore). After the independence of Singapore in 1963, most of the Seletar tribes were relocated to Johor, the southern state of peninsular Malaysia.

Today, the Seletar people lives across 9 villages in southern Johor. Even though they have settled on land and stop living freely on the sea like their ancestors, they are still depending heavily on sea for livelihood and resources. They still practice traditions and culture that closely related to sea and the mangrove forest. Many of them are animist but some converted to Christian or Muslim.

Due to rapid development such as the large scale reclamation project along Johor Straits, the Seletar people are facing drastic changes in their homeland and lifestyle. Quality of life is dropping as the sea getting more and more polluted and exploited for urbanisation. The Seletar children are found very difficult to adapt the mainstream education system. They are sometimes marginalised due to their weaknesses in academic achievements.

As sea nomads that used to live in boats and now living at settlement surrounding mangrove forests, the Seletar are highly intertwined with natural environments through years of interactions. We understand that Seletar people inherited some fascinating culture and old stories which are still remain unknown to the world. These beautiful cultural heritage are worth to be learned and conserve. However, Seletar language do not have any proper writing system. Besides, many younger people prefer to speak Malay language and those old Seletar customs could be fast disappearing.

The 'Seletar Kids Art Project' were initiated to help the younger generation of Seletar to rethink and to document their history, culture, homeland and lifestyle through art education. We are currently conducting a monthly art class for the Seletar kids between the age of five to fifteen. We guided them in an interesting way, such as storytelling, drawing, colouring and making handcraft and art pieces related to their family, their village, their myths & folklores as well as their daily life.

By implementing the project, we hope this could encourage Seletar kids to learn better in schools. After several monthly session, we discover that many of them are highly interested in learning and very talented in art. Our next target is to collect the children artwork as well as the Seletar's folklores and historical tales for subsequent documentation and publication of their beautiful untold stories at Johor Straits.

In AWS Saga 2017, we would like to share with the world on how

1. Seletar people, as one of the very few sea tribes in Malaysia, survive and thrive at mangrove wetland
2. How politic, social and economic development affect the livelihood of Seletar people.
3. How to empower indigenous people through educational art program

Valuation of village ponds as cultural landscape component in India: preliminary study

Injun Son¹, Hogeum Joo², Gu-Yeon Kim³, Ji Yoon Kim¹, Yunso Do⁴

¹Pusan National University, ²State University of New York at Stony Brook, ³Kyungnam University, ⁴Kongju National University

Village ponds are a specific type of small artificial reservoir in India. They are constructed for harvesting and preserving local rainfall and water from streams in agricultural landscapes, especially in India, which has lacked perennial rainfall for thousands of years. Village ponds primarily have been used for agricultural and drinking water but also for bathing, ritual, and aquaculture. According to the Ecosystem Services (ES) framework, classifying and evaluating the benefits for people derived from ecosystems, village ponds may have all aspects of ES including provisioning (food, fresh water), regulating (waste-water treatment), cultural (aesthetic appreciation, inspiration for culture, spiritual experience) services; but village ponds have not yet been valued regarding their ES using quantitative valuation techniques such as economic/monetary approaches. Historically, villagers retained the indigenous knowledge of usage and management practices for village ponds. Indigenous forms of knowledge regarding the sustainability of local resources are referred to as traditional ecological knowledge (TEK). Although TEK is most frequently preserved as oral traditions and as such may lack objectively confirmed documentation, TEK for village ponds has not yet been classified. In the present situation, with little concern, village ponds are at risk of disappearing and we will regret losing this critical resource. India is in rapid economic transition. Many rural villages now have dramatically modernized the drinking water supply system. Development of a water supply service for drinking water and a large reservoir for agriculture through modernization and urbanization can replace this traditional component of village ponds. The ES of TEK in village ponds should be as management practices and should be evaluated and classified for sustainable management of village ponds.

Our goal was to confirm the function and importance of village ponds in the rapidly developing areas as well as rural

landscapes. We categorized village ponds based on TEK, evaluate ES of village ponds in India, and establish a framework for conserving village ponds and improving public awareness of interested parties regarding village ponds using modern approaches. In order to understand the morphological characteristics of the Indian village pond, a 30-km² geographical quadrat was established and the ponds inside of the quadrat were digitized using the GIS program. The density of village pond was 14.6 ponds / 10km² and the median of pond size was 341.1 m². Over the last two years, we also assessed the benefits of village ponds located in northeast India through field surveys of the Chilika Lagoon basin (State of Odisha). The catchment area (526.3km²) surrounding Chilika Lagoon contains a large number of villages (population; approx. 690,000). We found that on average each village possesses 2 or 3 ponds with different usages such as irrigation, religious observance, and bathing. The questionnaire included questions on the name of the village, population, the number of the ponds, the number of alternative water sources etc. the possibility of cultural activities being practiced, management schemes, and the dependency (i.e. residential, agricultural, aquaculture, religious practices). Our project will represent the first scientific assessment of the village pond and traditional management scheme's value. The potential results will include the traditional knowledge of village ponds created by the local community to manage the pond for their cultural, economic, and domestic needs over a long time. Moreover, we are sure that the well-organized traditional management of the village pond will be applicable to increase the value of abandoned ponds in urban landscapes. The traditional knowledge based restoration will contribute in enhancing ecosystem health and the resilience of human society by strengthening ecosystem functions.

“Citizen Social Responsibility” in conserving water resources

Satya Prakash Mehra¹, Sarita Mehra², Er. Milind Pandit³, Swati Samvatsar⁴, Ajit S. Gokhale⁵, Sheila Roy⁶

¹Advisor – RSNH & RREDC, ²CEO & SG – RSNH & Director - RREDC, ³Treasurer & Program Director – RSNH,

⁴Director, JalaSRI, Watershed Surveillance and Research Institute, ⁵CEO – Natural Solutions, ⁶Adjunct Assistant Professor

Unsustainable consumption of the natural resources is causing irreversible impacts on the natural setup of the region and it has long been feared that human activities are causing massive destruction to the environment at every level from local to global.

Among natural resources water is among the vital component. An attempt has been made through this investigation the level of human concern for the environment with prime focus on water, aquatic habitats and biodiversity.

The present investigation reviewed aspects of reviving water sources in the arid and semi-arid zones of country, in general and state of Rajasthan, in specific. The case studies from the south-western (Jalore-Sirohi) and north-eastern (Karauli-Bharatpur) parts of Rajasthan were discussed with the observations on the involvement of the community people. The comparative studies were carried out on the self-initiated activities without external support and activities supported by external agencies on the aspects of resolving challenges in water sector. The appraisal was carried out through questionnaire based interview surveys. The paper further established relationship of formal legislations associated with the water and humans, water and aquatic bodies, habitats and biodiversity in India. Discussions and commentaries were made on the existing judicial interventions related to the water sector. Besides formal water legislations, a number of other water-related principles and policies have emerged over time.

It was observed that traditional water sources were replaced by the modern system which affected the prevalent conservation practices of the arid and semi-arid region. The south-western parts were having the traditional measures of adaptation towards water scarcity and the conservation measures were

inherited through cultural ethos in the people. With the development of the modern canal system, the challenges of water scarcity was resolved but on the cost of disappearance of eco-cultural traditions. On the other hand, the north-eastern parts were well adapted to the flood conditions prevalent in the area along with efficient irrigation system designed with the human settlements. With the check on the water flow patterns and other anthropogenic activities the region shifted into the dark zone. Since the people of the area were least involved in the conservation practices, therefore, sources of water were affected to the great extent. Brief discussions were made on the interventions carried out in the areas of Bharatpur and Karauli with special emphasis on impact of interventions around the World Heritage and Ramsar Site – Keoladeo National Park. The result of the investigation suggested that ‘need’ induces the necessity of the interventions but ‘involvement’ of the people decides success of the interventions. Intervention from the self-initiated activities had high impact as compared to externally initiated interventions.

Despite of the existing judicial measures for the water sector in India, there is need of the broader framework to include human rights, environmental conservation, equity and sustainability dimensions etc. focusing duty and responsibility under a common Water Law. As individuals, we can all rein in our own water use to help conserve what is becoming an ever more precious resource. The recommendation from the investigation was growing need of CITIZEN SOCIAL RESPONSIBILITY (CiSR) Act along the provisions of the Constitution of India.

Wetland ecosystems along the Kuala Gula coastline support an enormous diversity of life due to the generally high productivity of coastal wetland systems such as mangrove forests and inter-tidal mudflats. Biodiversity significance can be measured in many ways. Kuala Gula: A Wetland of International Importance encompasses a multitude of habitats including the buffer areas of a river and its tributaries, mangrove islands and mangrove coastal forests. It is area of importance to fishing activities, which has supported the livelihood of the local communities. The mudflat and the swampy areas of the Kuala Gula mangroves have been the place of stopover and feeding for various species of migratory and resident birds. The mudflats and the swampy areas of the Kuala Gula mangroves has been the place of stopover and feeding for various species of migratory and resident birds, including the globally endangered Milky Stork. During the migration season between August and April every year, more than 200,000 migratory birds representing some 50 species are estimated to stop over here. Some of these birds come from as far as Siberia in Russia, Kazakhstan, Japan, China and Mongolia.

Kuala Gula has been identified as one of the 10 eco-tourism areas in Perak State. Kuala Gula is recognized as area of important to fishing activities which has supported the livelihood of the local communities.

Today, it is estimated that a total of 7,188 people live in Kuala Gula and its proximity. Out of that total, approximately 35 % (2,450) of the population is directly involved in the fishing industries through activities such as fish and prawn catching as well as cockles rearing. In addition, they also involved in tricked-down fishing activities such as fish, dried shrimp and shrimp paste (belacan). Although some fishing and farming communities have good income, many are still operating at subsistence

level or receive low wages as daily paid workers with household income less than RM1,000/month.

The income based on coastal and mangrove resources are declining; local communities in the fisheries and agriculture sectors are facing problems to adapt and take advantage of the changing economic scenario from subsistence to cash economy facing a lack of knowledge, capacity, capital and market access. The natural resources at Kuala Gula are declining because of aquaculture and reclamation for development activities and settlements and well as coastal erosion.

Social movements is another aspect of local people at Kuala Gula in maintaining local resources. It becomes a significant element in protection and conservation of natural resources. Case studies in Thailand and Indonesia have been proved that there is a need for different sectors in the society to consider inter-related of local people movements in protecting their resources. Various efforts and campaign activities have been conducted at Kuala Gula. These include community forums, dialogues, trainings, workshops, seminars, and intellectual discourses.

This paper will discuss efforts and changes in processes, content, and forms of local social movements at Kuala Gula in protecting local resources. These include cultural capital, political and economic power, and the cooperation of alliances (technical, academic, and social capital networks).

Community based management of beach litter in Itoshima Peninsula, Fukuoka

Shuyuan Geng¹, Satoquo Seino², Mitsuhiro Aizu³

¹Graduate Student, Graduate School of Engineering, Kyushu University; ²Associate professor, Graduate School of Engineering, Kyushu University;

³Research Fellow, Research Institute of Environment for Sustainability, Kyushu University

The length of Fukuoka Prefecture coastline is about 669 kilometers, with 304 kilometers coastal zone is under the protection of the Genkai-nada Coastal Protection Act, and Itoshima zone is one of the most important marine regions along Genkai-nada coastal area. Not only the Genkai area designated as a quasi-national park but also the beautiful scenery of beaches with their white sand and green pine trees have been selected among Japan's 100 Best White Sand and Green Pine Beaches. One of the most significant trends affecting its future shoreline management is marine litter (or marine debris) which is estimated to be increasing explosively with the number of tourists has increased greatly during the last decade. However, municipal cleaning activities, unquantified input from rivers, wind, sea, and scarce and incomplete data collection add to the uncertainty on litter at that coastal zone.

Marine debris (also known as marine litter) has been identified among the most problematic and persistent marine pollutants, widely accepted as a detriment to the marine ecosystem, which affects all the oceans of the world. Although numerous scientific and community-based approaches to surveying and beach cleanups including outreach programs targeting the involvement of volunteers and coastal residents have been deployed. In Itoshima zone a little is known about the litter composition on beaches from the Regional Action Plan for Prevention and Management of Marine

Litter in Fukuoka. Furthermore, it is largely unknown what the contribution of Itoshima's recreation and non-recreation to beach litter found on the beaches of Itoshima zone is. More data is required to properly assess the extent of the marine debris issue and the effectivity of possible solutions. An answer to more extensive data collection could be citizen science.

To better understand the presence of litter on the beaches of Itoshima zone, the purpose of this paper is to develop a baseline for understanding the composition and distribution of beach litter. For the purpose of my work, a social survey and survey regarding monitoring the beach litter in the study area (i.e., standing stock survey) are conducted over a period of one year from 2016.

The results show, (1) incomplete data collection affects local residents understanding of issues regarding marine litter, (2) the most abundant form of litter observed was plastic (commonly pet-bottles) across all sites, and marine litter from unidentified sources caused by the breakdown small plastic pieces can found anywhere on beaches, (3) nearby land is used affect the amount and type of debris found at a location. The surveys revealed that education campaigns must be developed continually to raise their public awareness. Moreover, more scientific data (the information on the types, quantities, and distribution of beach litter) is urgently needed to assess the effectiveness of appropriate coastal management policies.

In conclusion, the data, methodology, visual representations, and mapping platform resulting from this work are a first step in directly supporting local Itoshima community advocacy and policy, while contributing to larger institutional strategies for addressing the issue of marine litter in Fukuoka. It is recommended that municipal government should support volunteer-based surveys. Moreover, these investigations suggest that beach litter monitoring will be recognized to help focus surveys and removal efforts as more targeted monitoring and removal in the future.

Afghanistan is a landlocked country with 650,000 km² area in central Asia and is famous for its cultural and natural richness. The natural and cultural heritages suffered not only from decades of war and conflicts but also from the continuous drought for years.

Three types of wetlands that are reported includes rivers, lakes, marshes and reservoirs. The wetlands play a significant role in maintaining human livelihood and in creating pristine ecosystems in the desert. Unfortunately, due to drought and war, three rivers, Sistan River, Qul Bagrami and Abchakan were turned into wastelands. Many of these wetlands are located in the area rich in natural cultural heritages. The Government of Afghanistan not only attempts to protect and conserve these wetlands but also has initiated special efforts to restore them along with the revival of cultural values, both tangible and intangible. Danbura, an Afghan concert is being planned to be held in Band Amir in July 2017. The purpose of this concert is to

(1) encourage and attract internal and international visitors there for creating employment (2) support renovation programs and (3) protect the environment from further damage and degradation.

With the growing popularity of ecotourism, there are a good use of the wealth of wetland and cultural heritage to attract more tourist as well as to improve the livelihood of the people living around and about the site with the all-out support of the concerned parties e.g. government, the private sector, non-governmental organizations, conservation bodies and local communities.

Water and wetlands play an important role in Islam. Water is indispensable as the Muslim need to perform Wudu (ablution) prior to prayer. Water has been mentioned in the Quran over 60 times. Therefore the Quran outright rejects wasting of water.

According to the Quran, "God made all the things from water". But water needs to be contained in a space that is what is called wetland. Therefore, both water and wetlands are very important in the Islam religion and culture. And the conservation activities are drawn from the principles of Islam. Another point that is quoted in the Quran is that "Mose chose 12 springs and instructed each tribe to go to one spring". Likewise, in Lake Hamun, people make a long reed boat to navigate the shallow water. The conservation of Lake Hamun depends on the conservation of reeds. In other words boat culture needs to be protected by the conservation of reed, which can be protected only when wetlands are protected.

The management of resources is one of the humanity's most ancient activities and has left its traces in cultural settings. From management point of view, there are three governmental departments; National Environmental Protection Agency, Ministry of Irrigation and Agriculture, and Ministry of Culture. Each agency has its own responsibility. In addition to the government bodies at the highest level, there are a few non-governmental organizations at the grassroots. To create sustainable solution for wetlands related problems and better understanding of cultural, emotional, moral, social, and spiritual dimensions, the government is planning to involve both local communities and authority as well as in the conservation and management of all resources along with a strong focus on traditional culture, customs, values and norms. In this paper, cultural values, cultural activities and challenges that directly affect the conservation of wetlands in Afghanistan are discussed. Additionally, the integration of natural and cultural values and attributes that is indispensable to catalyze the conservation, wise and sustainable development of wetland are also discussed.

Fundamental research on residents' water use and consciousness related to river environment

Hironori Hayashi¹, Masahiro Fujioka², Yukihiro Shimatani¹
¹Kyushu University, ²Fukuoka City Government

Since around 1990, the concept of green infrastructure, mainly in the Europe Union and the United States, has developed. On the other hand, in Japan, the river law was revised in 1997, and the environment was legally positioned for the functions required for rivers. Therefore, It is recognized that to give due consideration to the environment in river improvement is one of the most important matters in river management.

Knowledge and evaluation on the impact of rivers with different environmental levels on human use and consciousness are not sufficient. From the viewpoint of developing measures related to green infrastructure, accumulation of scientific knowledge on human use and consciousness on different river environment levels is urgent as well

In this research, we conducted surveys on people's actual situation and consciousness survey for two rivers with different environmental levels (whether or not river refurbishment considering the environment was done). One river is named Kamisaigo river which was maintained by the renovation method considering natural environment and human use. And the other one is named Tokunaga river which was maintained by a renovation method with conventional concrete. We tried to clarify the influence of differences in river environmental level on river use / consciousness of people in both area. The catchment population of both rivers and the surrounding development situation are almost the same. The survey method was in accordance with the river space utilization actual situation survey "river waterside census manual (Ministry of Land, Infrastructure and Transport)". For the questionnaire survey, we targeted elementary school children (fourth to sixth graders) located near each river and their parents. The questionnaire was done in a way to collect after distribution. Main questions included concerning age, sex, frequency of use of river and its contents, environ-

mental consciousness, attachment to the area, concerning the sense of justice and morality, about the intention to pay based on the virtual market evaluation method (CVM) .

From the results of the actual situation survey, the following was clarified. (1) The variety of activities are higher for rivers with higher environmental levels. (2) The number of river users on the waterfront increases by about 8000, (3) there is no big difference in the number of river users per population. From the results of the questionnaire survey, the following results were clarified. (1) Environmental awareness of people's rivers is higher for rivers with higher environmental level. (2) As rivers with high environmental level have more river usage frequency, usage becomes diversified. (3) As river with higher the environmental level have the higher attachment to the area of elementary school students and parents (4) The people who lives along the river with higher environmental level has higher willingness to pay in CVM. There were no differences between rivers in communication skills, justice and morality of children. This research revealed that when the river environment level is high, people's waterfront use becomes diverse. It became clear that the environmental consciousness to rivers increases as the river environment level is high. These results indicate that river improvement considering the natural environment has a good effect on people's use.

Development of ESD program focusing on conservation ecology of *Suaeda japonica* Makino (Chenopodiaceae), a threatened wetland halophyte

Takashi Shimoyamada¹, Satoquo Seino²

¹Shisei Junior High School, ²Ecological Engineering Laboratory, Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu

Conservation ecology is concerned with the origins and preservation of biological diversity. It seeks to understand how the rich variety of plants, animals and other creatures exists in the ecosystems around us, and how diversity has been maintained by natural processes.

The ecosystem concept is central to this conservation ecology, which aims to protect biological diversity and sustainably manage the biosphere. It is important to be aware of how extinction can accelerate as a result of the disruption of basic ecosystem processes (Cox, 1993).

In this report, we develop an Education for Sustainable Development (ESD) program based on conservation ecology and biology and related knowledge, making use of the *Suaeda japonica* Makino (Chenopodiaceae) plant for teaching material. This program connects school education and social education as an "open curriculum" for school.

Suaeda japonica (referred to below as "this species") is native to wetlands around estuaries and seashores in northern Kyushu in Japan, including an area around our town. Due to the loss of wetlands and changing ecosystem processes in recent years, this species is on the decline nationwide and facing extinction regionally.

The first documentation of this species was by Makino (1909). Its Japanese name "shichimen-sou" means turkey herb and is derived from the changing colors of its leaves, invoking images of the face of a turkey. Its tinted autumnal leaves are a defining feature and tidelands are beautifully colored by them. The autumn foliage is popular for tourists.

This changing of the leaf colors in autumn is caused mainly by a decrease of chlorophylls and an increase of betalain pigments (Shimoyamada, Iwashina, Yamada, 1995 in press). Betalain is a well-known group of red and yellow pigments that are specific to Centrospermae.

This species is native to salt marshes, a glabrous annual that belongs to the Chenopodiaceae family of flowering plants. The genus *Suaeda* has four species in Japan: *Suaeda japonica* Makino, *S. maritima* (Linn.) Dumort, *S. malacosperma* Hara, and *S. asparagoides* (Miq.) Makino.

These species are all native to coastal areas or estuaries and are distinctive halophytes. Approximately one hundred species form this genus and all are native to salt deserts or marshes of the world.

In the ESD program about this species, students will discuss wetland ecosystems in intertidal zones, land reclamation projects, and river runoff linking the forest and the sea, from ancient times to the future. Students will learn that wetlands and intertidal areas are declining and that now is a critical time for the survival of flora and fauna in these ecosystems. Finally, they will recognize the need more public attention, creative research, environmentally-conscious development and positive actions that should be directed to these areas.

This report on ESD will be part of the development of an "open curriculum" that integrates school education and public education with the goals of creating a sustainable society and developing human resources.

It is hoped that this ESD program will promote an understanding of the problems occurring in wetlands, seas and river basins related to many living creatures including humans, and to encourage voluntary actions with a global perspective and good judgment as citizens.

It is hoped that the results of this ESD program will ultimately be applied through the conservation and management of this species and other halophytes in wetlands.

We also hope that this approach will be applied to other species in other ecosystems.

A 3D Voxel-Based Model of Peatland Hydrology

Aryo Adhi Condro, Hidayat Pawitan, Idung Risdiyanto

Department of Geophysics and Meteorology, Bogor Agricultural University, Indonesia

Contribution of tropical peatland is of importance to the global climate, mainly due to its regulating services by storing a huge amount of carbon. Tropical peatland has been estimated as storing carbon of about 88.6 Gt C (range 81.7-91.9 Gt C), equal to 15-19% of the of the global peat carbon pool, where 68.5 Gt C of this is distributed in Southeast Asian region (77%), equal to 11-14% of the global peat carbon pool, with the largest share from Indonesia of about 57.4 Gt C or 65% of the tropical peat carbon pool, followed by Malaysia of about 9.1 Gt C or 10% of the tropical peat carbon pool. Findings from previous researches suggest that peatlands provide significant environmental services: with very high carbon stocks, water stocks, and biodiversity. However, during dry seasons, peatlands are very vulnerable to widespread fires, since peatlands provide either aboveground fuel biomass on the surface or belowground fuel biomass on the sub-surface. Hence, wildfires on peatlands imply to huge losses of environmental services.

To understand the complexity of peatland hydrology, a three dimensionally explicit modelling approach was used in this study, capturing hydro dynamics of peatlands, either occurring on the surface or within the sub-surface of peat layers. Furthermore, objectives of the study were: (1) to develop and validate a three dimensionally explicit model of peatland hydrology; and (2) to simulate ENSO scenarios to explore peatland hydrological behaviors under ENSO conditions and various land cover types. The model was evaluated on high conservation value area of oil palm plantation in West Kalimantan, Indonesia, where some parts of the area were burnt during El-Nino episode in 2015.

In general, the model captures spatio temporal dynamics of

surface water due to land- atmospheric interactions on various land cover types, and spatio temporal dynamics of sub-surface water due to water diffusion within peat layers, which is three dimensionally explicit, represented as voxels. Temporal resolution of the model is daily, and three dimensional spatial resolution of the model is 60 m x 60 m x 0.1 m, with extent area of about ~900 ha and maximum peat depth of 4 m.

The model was validated using field-measured data from 5 observation points, with goodness of fit of about 87%. Under ENSO scenarios, the simulation findings suggested that drought propagation during El-Nino period from surface into sub-surface of peat layers had a time lag of about 2.5 months. With regards to land cover effects on peatland hydrology, the simulation findings suggest that regardless the types of land cover on the surface, peatlands stored a relatively huge amount of water, depending on the peat depth. Total water amount within peat layers were ~60.2 thousand m³/ha, ~59.2 thousand m³/ha, ~60.0 thousand m³/ha, and ~59.1 thousand m³/ha, for barelands, shrubs, burntlands, and forests, respectively. Nevertheless, as a caution that other than hydrological function of peatlands, forest conservation and restoration efforts on peatlands play important roles on supporting other ecological functions of peatlands, e.g. as specific habitat to conserve peatland biodiversity and increasing aboveground carbon stocks.

Animated voxels are available at: goo.gl/HDRMYN (for the El-Nino 2015 episode) and goo.gl/g1sXPI (for the La-Nina 2016 episode). The model's codes, its input data, and a short user's guide are available at:

http://modelingcommons.org/browse/one_model/5060

Chilika is the second largest brackish water with shallow coastal wetland in Asia designated as Ramsar site in 1981 which assemblage of marine, brackish and freshwater ecosystems. This is also the largest wintering ground of migratory water fowl of Asiatic sub-component and the habitat of many vulnerable and endangered species listed in IUCN Red List. It supports the largest waterbird population among the wetlands in India with 8,00,000 to 10,00,000 numbers includes 250 species annually. This unique natural resourceful lagoon provides an ideal nesting, feeding and roosting place for thousands of aquatic birds both migratory and residential. This highly productive eco-system provides livelihood to 0.1 million fishers from 132 fishermen villages in and around the lagoon.

Mangalazodi is freshwater zone coming under northern sector of Chilika with marshes, emergent vegetations and reed beds. It has a variety of micro habitats zone with wet meadow, very swallow water open patches, with nyphae and water hyacinth with phragmites. The approximate area of 58.59 sq.km. is consisted of emergent vegetation zone dominated by reeds & phragmites and 11.79 sq.km. of marshland with wet meadow. Exclusive phragmites and reeds provides shelter for fresh water birds such as Common Coot, moorhens, rails, crakes, migratory warblers and bitterns.

Rampant poaching of aquatic birds both was a regular practice of the local people previously. The Forest Department of State Government arrested the poachers and put into jail in the year 1997 & 1998. A local social worker, Mr. Nanda Kisore Bhujabala organised meetings under the leadership of Dr. Ajit Kumar Pattnaik, IFS, the then Chief executive of Chilika Development Authority (CDA) to sensitise the poachers on conservation of birds. As a result, the leader of the poacher, Mr. Kisore Behera

and his group took oath to leave poaching in 1999. They started a Community Based Organisation namely Mahabir Pakhi Surakshya Samittee and started conservation of birds. They got training of eco-guide with the Support of CDA. The local stakeholders were also started supporting them in their conservation activities. Accordingly the poachers became conservationists and started eco-guide for tourists. It came to the notice of Government and awarded with the prestigious State level environment award namely "Bju Pattnaik Award for Wildlife Conservation" with a certificate including 1,00,000 INR. In due course another 2 CBOs have been formed and engaged in bird conservation activity, namely Mangalazodi Eco-tourism and Mangalazodi Conservation Tourism Trust. Annually on an average of 5000 tourists are visiting this zone. In 2016 winter, 147 species of migrating bird of 3,50,000 in number have arrived in this zone.

Now the migratory bird such as clossy idis and duck species of spot-villed, lesser whistling & grater whistling have started nesting here.

In this zone, the birds are tertiary consumers that help recycle nutrients back into the eco-system through guano. The major factor for the high biomass production of macrophytes and the lucrative fisheries in Chilika is the amount of guano deposited into the Chilika eco-system by the waterfowl estimated to be around 33.8 tons of nitrogen and 10.5 tons of phosphorous. Waterbirds prune the vegetation while they eat and this does not only maintain the fresh sprouting of tender shoots and leaves with rich proteins, but also controls its excessive growth. This fresh growth will benefit the fish and invertebrates. The foraging actions by the waterbirds leads to the thinning of vegetation in the lake, this enables the free movement of fish in the areas with dense vegetation as well.

Peat accumulating mountain wetlands of South Siberia: biodiversity and ecosystem services

Irina Volkova
Tomsk State University

West Siberian plain is well known by the largest peatlands of the world situated here. However, mires and peatlands can be found not only at the vast plains of Siberia but in the mountains too. Siberian mountain mires are unique type of wetlands that can be found at the large mountain land at the south of West Siberian plain, in Altai Mountains. Our research started in 1996 and covered more than 100 mire massifs where about 800 geobotanical relevés were conducted. The research objective was to establish a scientific basis for the protection of mountain mires – rare natural wetland type in continental Asia – in Altai Mountains (about N 49°04'–55°38' and E 83°57'–89°52'). Altai is a large mountain country (about 150 thousand km²) with a range of various climate, relief, hydrology and vegetation conditions in different parts. Thus, the climate varies from hyper-humid on the western macro-slope of Kuznetsky Alatau ridge in the north of the Altai region where precipitation reaches 3000 mm per year to arid with only 120 mm per year in the South-Eastern Altai. Mires occupy concaves and flat areas such as large depressions, high-mountain circuses, river valleys, saddles, flat tops, the slopes fouts and even gentle slopes of the mountain ridges. Siberian mountain mires are sources of supply to many river basin heads, including the upper Ob' – the largest Siberian river.

Peat mires started to develop in Altai Mountains in the middle of Holocene, at the end of time period called the Holocene climate optimum, about 4.5-5 thousand years ago, having accumulated up to now maximally 3.9m peat deposit depth. Plant remains of sedges (mainly the remains of *Carex altaica*), brown mosses and sphagnums are found most frequently at mountain mires peat deposits. Today, mountain mires are covered by sedge, sedge-brown moss, dwarf shrub-sedge brown moss and sedge-sphagnum plant communities.

Mountain mires act as natural filters, reservoirs, and sources of clean water as well as providing a significant contribution to

biodiversity. There is no doubt that mires have a critical role in the carbon cycle, and hence, in the maintenance of biosphere stability under conditions of increasing human impact. Mires as vital landscape features are critical for conserving and promoting biodiversity and are apparent especially in arid regions of Altai, where they are natural refuges for hygrophilous plants, animals and their communities. They differ from other ecosystems by the large variety of habitats they include. This habitat diversity increases with the altitude and allows the existence of not only characteristic mire plants (sphagnum mosses, cranberry, marsh cinquefoil *Comarum palustre*, buckbean *Menyanthes trifoliata*, etc.) and animals, but also a significant amount of alpine and plain species (originating in steppe, tundra, forest). Many of these species are rare, endangered, or vulnerable.

While a strategy of natural resource management and wise use is developed for the Altai region, there should be special attention given to mires and other wetlands. We hope that our research of mires will help solve a number of problems of science and nature protection and will promote the performance by the Russian Federation of its international obligations, accepted in frameworks of the Ramsar Convention on Wetlands and the Convention on Biodiversity.

Undoubtedly, some of the Altai mountain mires deserve the status of wetlands of international importance as unique mires (peatlands, wetlands) of intra- continental mountain systems of Asia. The results were obtained while fulfilling the government order from the Ministry of Education and Science of the Russian Federation (Project No. 5.4004.2017/P) and by the grant of the Russian Foundation of Basic Research No 15-29-02599. The results were obtained while fulfilling the government orders from the Ministry of Education and Science of the Russian Federation (Projects No. 2142, No. 5.4004.2017/4.6)

Habitat Restoration: Bringing Back the Brackish Water in Guandu Nature Park

Pin-Hsiu Lisa Chou, Tsai-Fu Yeh, Lan-Feng Fan, Hwey-Lian Hsieh

Wild Bird Society of Taipei

Guandu Nature Park is located in northern Taiwan along the Tamsui River and it is within the tidal range from the river mouth, hence the wetland contains a mosaic of brackish and freshwater. The Park serves as a major stopover for migrating birds along the East Asian Australian Flyway, and has been considered as an Important Bird Area (IBA) by Birdlife International. In the past, large stretches of agricultural fields dotted the landscape, but dramatic changes in the soil and water chemistry - an influx of salinity in the water and overdraft of groundwater - rendering farming difficult in the area. Since then, agricultural fields have largely been abandoned and some were replaced by freshwater ponds, grasslands and rice paddy fields. This mosaic of habitats makes Guandu unique and a home to a variety of organisms.

Over time, this once vibrant marsh has slowly converted towards more of a grassland environment and the decline of birds (waterfowl and shorebirds) became noticeable. As a part of management, the Park schedules annual habitat restoration projects, where mechanical removal of sedimentation buildup and vegetation occurs. These projects hope to prevent succession from further progressing and restore the wetland back towards a marsh. Yet, despite these efforts, bird numbers have continued to decline.

Past data suggests that this decline of bird numbers and benthic organisms are related. In particular, the absence of certain macroinvertebrates (particularly members of the Polychaeta family) may explain the decline of waterfowl and shorebirds within the Park. It is believed that one of the causes for the decline is due to the levee located south of the Park, as it blocks water flow and prevents biotic exchange between the wetland within the Park and the Tamsui River. Park management began to consider the possibility of reopening the sluice gates on the

levee to allow for brackish water to reenter. This would facilitate exchange between environments (outside and inside of the Park), which would increase salinity and nutrients. Furthermore, it would allow a temporary biological corridor to form. The Park worked together with Taipei City to establish a new set of valve system for the sluice gate, this would allow for brackish water to enter the Park during high tide periods.

Since 2016, the sluice gate has been opened twice a month for a period of four hours during high tide to allow for exchange. The Park monitors both chemical and biological changes. Water chemistry measured at the time of the opening of sluice gate and at high tide, where changes in salinity from as low as 0.47 to as high as 31.34 were recorded. Biological changes such as in macroinvertebrates in benthic samples, fish and birds were also monitored. Notable changes after the opening of the sluice gate were an increase in Polychaeta in the benthic samples, species such as *Laonome albicingillum*, *Neanthes glandicincta*, and *Capitella* species. Other changes include, increase in the distribution of both shrimp and fish species commonly found in estuarine environments. Changes in bird numbers were not as evident; however, several circumstances at the end of 2016 may have affected bird numbers. It is possible that changes in bird numbers will not be as quickly and continual monitoring will be required.

The opening of sluice gates not only brings on positive change to the wetlands within the Park, but is also bringing hope that the overall habitat may be returning to a more suitable state for birds and other wildlife. The Park will continue to monitor changes and adjust management practices according to the changes observed.

Biodiversity of the Kampar

Prayitno Goenarto¹, Donny Gunaryadi²

¹Restoration Ecosystem Riau, ²Fauna Flora Internasional

In 1989 the lakes within the Kampar Peninsula were listed in the Directory of Asian Wetlands as important areas of peat-swamp forest on Sumatra, Indonesia. Today, 20 over years later, these lakes are now gazetted as wildlife reserves, and the Kampar Peninsula is now classified as an Important Bird Area (IBA), Key Biodiversity Area and a Class II Tiger Conservation Landscape.

The Kampar Peninsula covers 673,000 ha of peat-swamp forest, fibre plantations oil palm, rubber, and sago farms, and is possibly the largest contiguous area of peat-swamp forest remaining on Sumatra. 235,000 ha of these wetlands are managed by the APRIL Group, and 130,000 ha of this are under the Riau Ecosystem Restoration (RER) Programme. Initiated by APRIL in 2013, the RER Programme brings together private and civil society groups, as well as government regulatory agencies, in a landscape level approach to protect, assess, restore and manage previously degraded peatland.

Since 2010 APRIL has been conducting inventories of these wetlands, recording a total of 299 bird, 152 plant, 74 mammal, 107 amphibian and reptiles and 89 fish species.

Around 49 species are listed in the IUCN Redlist as threatened (CR, EN, VU). These inventories represent the first documentation of the biodiversity of the Kampar Peninsula, and is especially important in light of the current conservation status of peatlands on Sumatra.

Fourteen of the 299 bird species recorded are globally threatened. The survey revealed new distributional records for Bonaparte's Nightjar and Black Partridge. Eight out of Sumatra's ten hornbills are known to occur. The Kampar Peninsula also supports peat-swamp associated species such as the Hook-billed Bulbul, Storm's Stork and the White-winged Duck.

Seventeen of the 74 mammal species recorded are globally

threatened, including the critically endangered Sunda Pangolin, Sumatran Tiger and Flat-headed Cat.

Additionally, 5 out of 6 cat species found on Sumatra were observed, with the exception of the Asiatic Golden Cat.

From the 22 amphibian and 85 reptile species, 10 are globally threatened. The surveys also revealed new distributional records for the recently described cryptic frog species *Hylana rawa*, and *Hylarana parvaccola*, both endemic to Sumatra.

Ten species of turtles were documented, seven of them globally threatened including the critically endangered Painted Terrapin. The the Estuarine Crocodile and the False Gharial were also recorded

Eight of the 152 vascular plant species recorded are globally threatened, with the critically endangered and peat-swamp endemics *Shorea platycarpa* and *Vatica teysmanniana* both recorded. Of the 152 species recorded, 112 were woody plants (trees), possessing large but shallow buttressed roots, adaptations to waterlogged environments. The remaining 40 plant species include orchids and pitcher plants. Preliminary fish surveys documented 89 species that are dependent upon narrow and extreme conditions which include low pH and dissolved oxygen levels, but high tannin levels. A new species *Pectenocypris nigra* and the world's smallest fish *Paedocypris progeneretica* were notable discoveries.

In conclusion, the biodiversity surveys on the Kampar Peninsula reveal a vast and unique species composition within this peat-swamp forest environment. Future surveys are expected to reveal new discoveries and insights into this important and understudied ecosystem.

The White-winged Duck (*Asarcornis scutulata*) is a tree-nesting duck ranging from Eastern India to the island of Sumatra, Indonesia. The Sumatran population is distinctive in appearance from the Northern mainland population with more white coloration on the head and wings. Some authors suggest the Sumatran population should become a separate subspecies. Its range on Sumatra has been drastically reduced over the last 30 years and the species today is listed globally as Endangered (EN). It is a protected species in Indonesia.

The Kampar Peninsula is one of the most important areas of peatland on Sumatra, covering some 673,000 ha of peat swamp forest, fibre plantations, oil palm, rubber and sago farms. It is possibly the largest contiguous area of peat swamp forest remaining on Sumatra. A 235,000 ha area of these wetlands is managed by the APRIL Group, and 130,000 ha of this are under the Riau Ecosystem Restoration (RER) Programme.

Initiated by APRIL in 2013, the RER Programme brings together private and civil society groups, as well as government regulatory agencies, in a landscape level approach to protect, assess, restore and manage previously degraded peatland.

Since the 1990s, the White-winged Duck has been a focus of conservation efforts, and the Asia Wetland Bureau (AWB) Indonesia Programme conducted island-wide surveys in all suitable habitats within existing and proposed protected areas on Sumatra. There were no records of White-winged Duck in the wetlands of the Kampar Peninsula, which was already primarily a production forest landscape. The closest protected area to the Kampar Peninsula where the duck was observed was in Kerumutan Wildlife Reserve, south of the Kampar River.

Since the initial surveys by AWB, no additional surveys were conducted in Sumatra until High Conservation Value Assessments began in 2005 with the development forest plantations in

Riau's coastal peatlands. However, ecological and behavioural research of White-winged duck on Sumatra was conducted in early 2000 in Way Kambas National Park, the only detailed study of its kind on this species ever done on Sumatra.

Since 2007, regular biodiversity inventory conducted by APRIL shows the presence of White-winged Ducks within the Acacia plantations of the Kampar Peninsula. The species has been observed to make regular use of access canals in mature Acacia plantations, where human activity is limited. These canals provide long avenues of still water, overhanging branches, shade, and densely overgrown canal banks.

Observations of ducklings confirms that a breeding population of White-winged Ducks exists on the Kampar Peninsula.

Since 2014, RER restoration teams working on closing old drainage canals left by past logging activities are recording the duck along these canals deep in the forest. The regular presence of the ducks in Acacia plantations indicates its adaptability to land cover change and its ability to persist in an integrated production-conservation landscape.

Opportunistic hunting by local villagers is known to occur and may be threatening the duck population. It is essential to increase the awareness of fishing communities using the rivers and canals where the duck is found, about the White-winged Duck's protected status, in order to ensure the duck's future survival.

Big Business & Big Wetlands, Can They Thrive Together?

Lucita Jasmin

Asia Pacific Resources International Ltd (APRIL) - Riau Ecosystem Restoration

The island of Sumatra has one of the largest areas of peatlands in Asia. Over the past 30 years, almost 80 per cent of this area has been deforested or degraded due to forest conversion, illegal logging, and land-clearing fires, drastically reducing the main ecological feature of these peatlands: peat swamp forests. Oil palm estates, fibre plantations, and rubber plantations dominate the landscape today, the remaining forests are fragmented, and the original abundance of wildlife has been dramatically reduced, threatening biodiversity conservation.

The 673,000 ha Kampar peninsula on the east coast of central Sumatra has probably the largest area of contiguous peat-swamp forest remaining on Sumatra, approximately 344,000 ha. The most prominent pulp and paper company on the Kampar peninsula is the APRIL Group, managing some 60% of the peninsula as Acacia plantations (150,000 ha), High Conservation Value Forest (96,000 ha), and Ecosystem Restoration concessions (130,000 ha) in Riau province, Indonesia.

Restorasi Ekosistem Riau (RER) was established by Asia Pacific Resources International Limited (APRIL) in 2013 and is supported by APRIL's US\$ 100 million initial commitment to conservation and restoration. As a not-for-profit partnership between business and civil society organizations, RER's ambitious goal is to protect and restore a very large tropical wetland within a production forest landscape. It aims to manage the peat swamp forest with diverse partners, secure sustainable livelihoods for nearby communities, work closely with government regulators, and demonstrate an integrated landscape model where deforestation is halted, all land is allocated to a responsible management authority, and secure financing is available from responsibly managed production areas to enhance biodiversity and protect natural capital.

The RER project forms part of a response to a 2004 pro-

gramme launched by Indonesia's Ministry of Environment and Forestry to restore 1.7 million hectares of Indonesia's degraded production forest through awarding ecosystem restoration licenses. RER now has the responsibility for managing four ecosystem restoration licenses on the Kampar peninsula for a 60-year period.

The RER project is implemented in collaboration with Fauna & Flora International, The Nature Conservancy, and the local social NGO Bidara. Following what is called the production-protection model; APRIL's fibre plantations form a buffering ring around a large peat dome in the centre of the peninsula. APRIL Group has a unique 1-for-1 commitment of conserving a hectare of natural forest for every hectare of plantation developed. With 400,000 hectares under its protection, including the restoration forests on Kampar Peninsula, APRIL is at 83 per cent of this goal.

The challenges for a large pulp & paper company to achieve such a goal are discussed with respect to governance, community perceptions, land tenure issues in Indonesia, existing protected areas on the Kampar peninsula, and sustainable financing of restoration initiatives in Asia.

Some insights are presented around the opportunities for big business to make significant and long-lasting impacts on large areas of important wetlands. The story of the Kampar peninsula would not be worth telling if it did not involve, and depend upon, big business commitments, building wide-ranging partnerships and ultimately, protecting landscape level wetlands.

Background

The Mai Po and Inner Deep Bay area of the Hong Kong Special Administrative Region (HKSAR), the People's Republic of China, was listed as a Wetland of International Importance (i.e. Ramsar Site) under the Ramsar Convention on 4.9.1995. The Ramsar Site covers an area of approximately 1,500 ha of wetland habitats, including 300 ha of inter-tidal mudflat, 350ha of inter-tidal mangals, 230 ha of gei wai (traditional shrimp ponds), 400 ha of fishponds and about 260 ha of marshes, rivers and channels. The listing is a formal recognition of the international importance of the area and helps promote public awareness of the site.

Ecological Importance

The Inner Deep Bay area regularly supports 50,000 – 80,000 wintering migratory birds, including ducks, gulls and terns, ardeids and spoonbills, shorebirds, cormorant, rails and coots. Over 400 species, including 49 species of globally threatened and near-threatened species according to the IUCN Red List have been recorded, e.g. the Spoon-billed Sandpiper, Black-faced Spoonbill, Nordmann's Greenshank, and Saunders' Gull. The site is also among the network of sites along the East Asian - Australasian Flyway for migratory waterbirds, which helps to promote public awareness, training and information exchange on migratory shorebirds and thus contribute to the long-term conservation of the birds and their habitats along the Flyway.

Conservation Management

The Agriculture, Fisheries and Conservation Department (AFCD) of the HKSAR Government is the administrative authority of the Mai Po Inner Deep Bay Ramsar Site. It formulates and implements the Ramsar Site Management Plan (RSMP) which provides a framework for the conservation management of the Ramsar Site. The work includes law enforcement, ecological monitoring, advising on the wise use of wetland for development proposals, as well as partnership with non-governmental organisations (NGO) to carry out habitat management, public education and bird monitoring programme.

According to the RSMP, the Ramsar Site is divided into four Management Zones with different management objectives based on habitat type, ecological value and land use. The Core Zone (consisting of the inter-tidal mudflat and mangals) and the Biodiversity Management Zone (consisting of gei wai), are primarily designated as a Restricted Area under the Wild Animals Protection Ordinance (Cap. 170), where access is restricted to permit holders only. The Biodiversity Management Zone covers the Mai Po Nature Reserve (MPNR) which is managed by WWF-Hong Kong with advice and financial support from AFCD. The Wise Use Zone and Private Land Zone mainly consist of commercial fishponds.

The traditional practice of pond drain-down in commercial fishponds during harvest provides additional feeding opportunities to waterbirds in the Deep Bay area. Since 2012, the Government's Environment and Conservation Fund has provided funding to the Hong Kong Bird Watching Society to collaborate with the fishpond operators through Management Agreement projects to encourage the operation of the fishponds in an ecologically sustainable manner by continuing the traditional drain-down practice, while conducting a wide range of public education activities to promote local aqua culture and biodiversity conservation in the Deep Bay area. The project has achieved win-win between fisheries and bird conservation and set an example of wise use of wetlands.

In 2016, the Government has formulated the first city-level Biodiversity Strategy and Action Plan (BSAP) for Hong Kong, to step up biodiversity conservation and support sustainable development in the next five years (2016-2021). One of the key actions is to maintain and enhance the management of the Ramsar Site for biodiversity conservation. Continuous effort will also be put in scientific research, promotion of sustainable fisheries and Management Agreement projects.

The return of the smooth-coated otter to Singapore: distribution, growth, public perception and conservation management

Sivasothi N., Meryl Theng, Max Khoo

Department of Biological Sciences, National University of Singapore

Smooth-coated otters (*Lutrogale perspicilata*) are a native species of Singapore but with the rapid development of the modern city state, otters were absent from the mainland in 1970's and 1980's. There have also been heightened efforts to clean waterways, establish protected areas and increase the green cover of the country (including urban greenery such as streetscapes) from 35.7% to 46.5%.

In the late 1990's, smooth-coated otters returned from southern Malaysia to establish residence in the protected north-western mangroves of Sungei Buloh Wetland Reserve. Highly adaptable they spread along natural coastal habitats and also occupied modified inland waterways and reservoirs. They now number some 70 individuals in about 10 families. Primarily fish eaters, they are feeding on a less diverse but abundant diet of mostly exotic cichlids which dominate urban waterways. In mangroves, prawns are part of this piscivores' diet.

Rivers in Singapore are mostly canalised outside of their headwaters in nature reserves. Designed primarily for dispersal of rainwater, there are few sloping banks or riparian vegetation needed by otters. Despite this, smooth-coated otters have adapted to semi-natural and artificial structures along waterways for resting and sprinting sites, and holts for overnight rest and natal dens. Several territorial family groups of 10-13 individuals live in such spaces and consists of parents with up to three litters of cubs.

When individuals or groups of otters seek out new territories, they must survive urban barriers such as highways, roads and construction sites. Their movements are monitored by research-

ers, park managers, naturalists, nature photographers and members of the public who contribute records to the national repository "Mammal Records" and OtterWatch, a dedicated Facebook page enabling photo submissions and information sharing. Private What's App chat groups of dedicated otter followers also provide good spatial information to researchers and managers.

Although urban otters live in proximity with people in the narrow viable spaces adjacent to waterways, they have been reasonably indifferent to or tolerant of people. The public are appreciative although there is some concern about their population number. To address various concerns and promote good observer behaviours, an Otter Working Group comprised of various government and non-government entities and individuals collaborate to produce advisories through physical signs, engage with private property owners, conduct public outreach at otter sites and festivals, and provide support for news and social media sites, as well as documentary makers. This group has also facilitated rescue of individuals, recovered dead otters, and address concerns of the public and policy makers alike.

The smooth-coated otters' close presence has resulted in studies of their diet, home range, activity pattern, reproduction, aspects of behaviour, vocalisation and human-wildlife interaction. It is hoped that both the research and lessons from management since their return to Singapore will contribute to conservation efforts of otters in Asia.

The effect of benthos and fish habitat on the artificial tidal flat restruction in urban canal area

Kana Takeyama¹, Katsuhiko Tanaka², Kota Nakase¹, Katsumi Ishibashi³, Hiroshi Kohno⁴

¹Penta-Ocean Construction Co.,Ltd., ²Tokai University, ³Ota City, ⁴Tokyo University of Marine Science and Technology

Omori Furusato no Hamabe Park is a policy that makes full use of the characteristics of the point of contact between the river and the sea, and has the following four objectives as maintenance objectives. (1) Securing parks and green areas (2) Strengthen disaster prevention function in urban areas (3) Recovery of the point of contact between people and the sea (4) Improvement of water environment. The park is located deep inner part of Tokyo Bay, and it consists of tidal flat area(1.0ha), shallow water area(4.6ha) and sandy beach area(1.2ha). The tidal flat was replaced and developed in Omori Hometown Shore Project in august at 2002. And the sandy beach was developed at 2004. It is necessary to long-term study, manage and evaluate not only the geomorphic change but also the development and succession of fauna, thereby carrying out appropriate evaluation and management.

In most cases, urban canal area is covered by upright seawall and dissolved oxygen concentration in the bottom layer is quite low due to saline wedge and thermocline. In order to understand effect of natural restoration under severe environment in urban canal area, we have been monitoring change of benthos, fish, water quality and sediment since 2002, with universities and research institutions. In addition, we also examined the seasonal occurrence pattern of fishes and water quality at small tide pools in tidal flat to clarify the function of microtopography as a biological habitat.

Result of water survey the canal area around the park was covered by fresh water during summer, making the bottom layer of the canal hypoxic and undesirable condition for benthos. On the other hand, the bottom layer of artificial tidal flat was not hypoxic mainly due to shallow water even in the summer. Result of benthos survey, we could observe appear-

ance of polychaeta and bivalves throughout the year right after the development of tidal flat, and there was seasonal variation. However, we could not confirm appearance of benthos in the canal area throughout the year. Result of fish survey lots of juvenile fishes of benthic fish such as *Acanthogobius flavimanus* and *Gymnogobius breunigii* appeared in tidal flat and sandy beach while the bottom layer of the canal area became hypoxic from spring to summer. After autumn, the oxygen content in the bottom layer was also improved due to the improved oxygenation in the surrounding canal area, and it was speculated that *Acanthogobius flavimanus* was moving to a deeper water area. Moreover, after we developed microtopographic environment such as tide pool in the tidal flat, those fishes which rely on tide pool, such as *Pseudogobius masago* appeared. These results suggested that artificial tide pools have important ecological function for fishes including rare species. And it is necessary to design the tide pool of a variety for fishes.

This result indicates that role of shallow area such as tidal flat and sandy beach in canal is not only expanding habitat of creatures but also offering "evacuation area" for creature from hypoxia during summer. Moreover, the result demonstrates that rich fauna is composed by developing various types of habitat such as tidal flat, sandy beach, shallow area and microtopographic environment. It was suggested that tidal flats created in the urban canal area function as habitat, evacuation site and spawning sites for canal organisms and are important places to maintain the biodiversity of the urban canal area.

High genetic diversity of *Cottus pollux* middle-egg type in Kyushu Island and related river topography

Kazuki Kanno, Norio Onikura
Fishery Research Laboratory, Kyushu University

Cottus pollux (Japanese freshwater sculpin) is a unique freshwater sculpin endemic to Japan. It is widely distributed across the Japanese archipelago where it preferentially inhabits cool, well-oxygenated and clear waters, such as gravel riffles in mountain streams (Ramsar wetland type classification M: permanent rivers/streams/creeks). *Cottus pollux* is considered polytypic and includes three biological species, conveniently named *C. pollux* large-egg (LE) type, *C. pollux* middle-egg (ME) type, and *C. pollux* small-egg (SE) type. These species are collectively called *Cottus pollux* complex. The three types of the *C. pollux* are morphologically similar, but they can be distinguished based on the number of pectoral fin rays with LE individuals having 12–14 (mode 13), ME 13–16 (mode 15), and SE 15–17 (mode 16). In addition, studies have shown that the three *C. pollux* types are genetically divergent, and that *Cottus reinii* from Lake Biwa actually belongs to the SE group.

The population of *C. pollux* complex in Japan is thought to be declining due to the presence of river barriers, such as dams and weirs. In fact, both the SE and ME types have been designated as endangered (EN), and the LE types has been designated as near threatened (NT) according to the Red List published by Japan's Ministry of the Environment in 2015. However, data on the distribution and genetic diversity of this fish in Kyushu Island are sparse. *Cottus pollux* complex species in Kyushu have sometimes been described as *C. pollux* ME and LE (Fukuoka Prefecture, 2014), simply *C. pollux* ME (Nagasaki Prefecture, 2011), amphidromous and fluvial *C. pollux* (Saga Prefecture, 2003), or *C. pollux* and *C. reinii* (Kumamoto Prefecture, 2014; Oita Prefecture, 2011). Therefore, the purpose of the present study was to better characterize the habitat, genetic, and morphological diversity of *C. pollux* complex in Kyushu

Island.

Specimens were collected from 30 rivers in 20 river systems in Kyushu. Based on the number of pectoral fin rays, sculpins were divided into two types: modes 13 (M13) and mode 15 (M15). M13 sculpins were distributed in upstream areas of large river systems, while M15 individuals were distributed in downstream areas of small systems. Mitochondrial DNA analysis showed that both types were in fact *C. pollux* ME. These findings indicated that *C. pollux* inhabiting Kyushu Island belongs to one single genetic group (ME) which can be divided in two groups according to morphological and distributional traits (fluvial M13, amphidromous M15). A more detailed genetic analysis showed that the fluvial M13 group was in fact heterogeneous, with genetic differences detected in specimens from different rivers, whereas the amphidromous M15 group was genetically homogenous. In addition, large differs were observed in terms of genetic diversity within the M13 group between rivers. Next, we used two generalized linear models (GLM) to examine the relationship between river topography and (1) M13 distribution, or (2) population genetic diversity. The dependent variables were presence/absence and number of haplotypes, respectively; while predictor variables included topographical data collected by GIS, such as a mean gradient, percentage of metamorphic rocks, upper stream catchment scales, and area of river systems. The distribution model selected variables on habitat quality in a present condition, while the genetic model selected variables on habitat quality in a long-term perspective.

A Study on the Present Condition and Transition of Habitats of Freshwater Mussels in the Kikuchi River

Kengo Saito¹, Hironori Hayashi¹, Hiroyuki Otubo², Yukihiro Shimatani¹

¹Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University, ²Nippon Koei Co. Ltd.

Unionoida mussels are considered to be an important keystone species in the floodplain environment because they are symbiotic with other species. *Acheilognathus* lay an egg to Unionoida mussels. On the other hand, glochidium birthed from Unionoida mussels adhere to host fish such as *Rhinogobius* and extend their habitats.

However, the flood plain environment is deteriorating due to farmland consolidation and disappearance of the wand. As a result, Unionoida mussels are threatened with extinction, conservation and restoration of their habitats is an urgent task for river environment. In this study, we tried to clarify the distribution of Unionoida mussels and the habitat restriction factors in the middle part of the Kikuchi River, with the aim of obtaining knowledge contributing to conservation and restoration of the habitat of Unionoida mussels.

The distribution of the Unionoida species were surveyed at 371 points in Kikuchi River. The amount of effort in the survey was 3 people × 10 minutes for each survey site. The type and individual value of the captured Unionoida mussels were recorded. In addition, the physical environment such as flow velocity, water depth was measured.

The captured Unionoida mussels were released to the original point. As a result, 2416 individuals of seven species (*Uniono douglasiae nipponensis*, *Pronodularia japonensis*, *Inversiunio yanagawensis*, *Lanceolaria grayana*, *Obovalis omiensis*, *Anodonta japonica*, *Anodonta lauta*) were discovered at 94 sites in Kikuchi River. In the Yamaga basin (Kikuchi River), it was revealed that the distribution of the Unionoida mussels were extremely limited. On the other hand, it became clear that there

are hot spots where many individuals live intensively. The reason why the hot spot existed is thought to be due to the slow gradient, bed material easily accumulates, the flow velocity slows down, and it is located around the village and there is no major renovation from long ago. Statistical analysis by GLM revealed that moderate flow velocity, depth of water and bed material were important factors for the stable distribution of Unionoida mussels.

In the Yamaga basin, it became clear that physical environment of irrigation channel is drastically changing by channel renovation work using concrete structures. Specifically, a remarkable increase in flow and a decrease of water depth are caused. By calculating the flow velocity at the time of water increase at Yamaga basin, it was revealed that there were some points where the habitat of Unionoida species coincided with the point where the increase in flow velocity is small. The GLM analysis was performed again in addition to the flow velocity at the time of water increase, it was revealed that the flow velocity at the time of water increase became a more important factor. It was suggested that there is a relation between the flow velocity at the time of water increase and the distribution of the Unionoida mussels. The flow velocity at the time of water increase is mainly the flow velocity of the waterway in the agricultural season. When the flow velocity is fast at the time of water increase, Unionoida mussels also flow together. It shows that suitable environment for Unionoida mussels are being lost by on going channel renovation works. It is important to conserve the hot spots and to conduct an action toward restoration of deteriorated environmental.

Analyses and counter measures on the severe damages to the ecosystem of the Awase Tideland area of Okinawa Island, southwest Japan by a dredging and reclamation project

Jinen Kita¹, Seiji Maekawa², Norikazu Kameyama³

¹Okinawa Godo Law Office, ²Save-Awasetideland Network, ³University of the Ryukyus

Awase Tideland is located in the east coast of Okinawa City, Okinawa Island, south west Japan. Awase Tideland area has 112 ha sea grass / seaweed bed and 265 ha tidal flat and adjacent shallow sea area, floors of which are made of various sediments such as mud, sand and coral gravel. There are also coral reefs among the tideland. The numbers of shellfish species, sea grass species, RDB species, new species and the population of a migratory bird *Pluvialis fulva* in winter are the highest among the tidelands in Japan.

Awase Tideland area is, no doubt, one of the hotspots of biodiversity in Japan, however, where Japanese government and Okinawa prefectural government are performing island reclamation and harbor dredging works. Local residents, NGO activists and scientists organized Save-Awasetideland Network and made original researches on the impacts against the wetland ecosystem, local economy and public finance by the project, and on the estimated natural disasters on the reclaimed island. The results showed the dredging and reclamation project would have negative effects on both human society and natural ecosystem. Eleven new species of sea animals and plants have been also discovered and described since the reclamation began.

They made a lawsuit claiming local governments not to use tax money to the project and the court affirmed injunction of budgeting in 2009. The national and prefectural governments made a minor change in the reclamation plan and restarted the project. Now the 2nd lawsuit is on trial.

The reclaimed island with 95 ha area is now appearing at the center of Awase Tideland and the surrounding shallow sea area. Changes as follows are observed in Awase Tideland area after the appearance of the island, none of which are expected in the environmental impact assessment report made by the government:

[1] The coral colonies of a branch coral species *Acropora aspera* in the tideland area are in the crisis of extinction.

[2] Seawater repeatedly becomes muddy.

[3] A sandbank, which has long been a breeding site for a tern *Sterna albifrons*, became completely inundated during high tide, and then its ground level fluctuates.

[4] Algae increase explosively, *Ulva clathrata* and another green alga species in 2017 and a brown alga *Hydroclathrus clathratus* in 2016, which respectively resulted in the huge death of shellfish including RDB species. Explosive increase in algae and subsequent shellfish death has also occurred in the Wajiro Tideland, Fukuoka, which also has a reclaimed island.

Such phenomena suggest the accelerating degradation of environmental conditions in Awase Tideland. Okinawa prefectural government stated Save-Awasetideland Network that Awase Tideland would be designated as prefectural wildlife refuge by the autumn 2017, and then as national wildlife refuge. Okinawa prefectural government clearly has the policy to make Awase Tideland registered to Ramsar List of Wetlands of International Importance.

The dredging and reclamation project in Awase Tideland area may be a severely damaging factor to the protection of the wetland ecosystem there as well as the sustainability of the local economy and public finance, as mentioned above. Therefore, the national and prefectural governments are required to alter the dredging and reclamation project policy and to realize the conservation and wise use of wetland environment in Awase Tideland area, which meets Ramsar Convention.

The activities for the protection of Awase Tideland, including two lawsuits, also revealed that the enough involvement of local residents, NGO specialists and scientists to the policy making and administration process by the local/national governments would be the better solution for the protection, restoration and wise use of local natural resources including tideland ecosystem. Japanese legislation is inadequate from this point of view.

As the result of the flood on July 2009, Hii River modification began in 2010 and completed in 2015. In this modification, nature oriented methods such as the slide down dredging which does not change the cross profile and gradient of the river, removal and decentralization of the weirs and returning coarse sediment components to the riverbed after the dredging were adapted. Though some reports showed the positive effects to fish habitats such as more fishes migrated to the upstream through the modified area, the effects of this modification was not assessed enough especially in the downstream and estuarine area. In this study, we focused on the Ice Goby (*Leucopsarion petersii*) which specifically uses the cobble environment of the upper brackish area as its spawning habitat. The effects of the river modification to the spawning habitat for the Ice Goby were investigated.

Field works were carried out on middle to end of April from 2011 to 2016 at the Hii river estuary (1.8km to 4.6km from the river mouth). Numbers of the batches of the eggs, sediment components, salinity and water velocity were recorded at each station.

According to the result of the field work on 2011, a lot of eggs were found in the range of 2.2km to 3.0km from the river mouth. Early stage of the river modification seemed to have little effect on Ice Goby's spawning habitat. During 2012 to 2015; the center stage of the river modification, almost no eggs were found at the investigated area. Due to the slide down dredging and weir removal of 3.3km (the past upstream end of the brackish area), the tidal effect reached to the 3.6km. However the upstream end

of the spawning area reached to the 4.2km. The most remarkable spawning area moved from 2.2km to 2.9km after the river modification. And the spawning area became smaller and localized. This might be related to the change of the sediment components and riverbed salinity. Because of the turbid water formed turbidity maximum around the upstream of the brackish area, accumulation of the finer sediment caused negative impact directly to the spawning habitat. Returned coarse gravels worked as a spawning substrate on the upstream side of the brackish area. However the returned coarse gravels of the middle brackish area had been buried by the sand after several small floods and they did not worked as the spawning substrate. In the upstream area, the slide down dredging would not change tractive force due to the cross-sectional area and river gradient would not change. In the estuarine area, so as the cross-sectional area would increase due to tidal conditions even though the slide down dredging were adapted, tractive force would be reduced and sediment components tend to become finer.

In this river modification, though many adapted nature oriented methods achieved intended effects especially upstream area, some did not especially in the brackish area. Though the tidal effects make the physical environment more complex, we have to examine how the salinity and tractive force change in the river estuary and decide where to restore fish habitats.

The influence of agricultural activities on water chemistry and aquatic biota in the freshwater springs of Uchinada Dune, Japan

Masao Nagasaka¹, Morihiro Takano², Haruo Fukuhara³, Hisashi Takahashi³

¹Kanazawa seiryō University, ²National Institute of Technology, Ishikawa College, ³Kahokugata Lake Institute

Uchinada Dune is one of the largest coastal dunes in Japan. It is located in a catchment area of Lake Kahokugata in Ishikawa prefecture. It has a length of 20 km, a width of 1.5 - 2.0 km and a maximum height of 61.3 m. Some freshwater springs are naturally occurring at the foot of the dune.

Although the local inhabitants used to use both the spring water and the shallow groundwater for their daily life, they stopped using the spring water recently. On the other hand, the farmland and residential land have been constructed on the dune since 1950's. Pump facilities were also built at the coast of Lake Kahokugata to irrigate the farmland on the dune. For these reasons, it is supposed that the water quality of the springs get worse. The purpose of this study is to document the present state of the springs and to find out the way to conserve them. Chemical properties of water, aquatic biota in the springs, the distribution of the farmland on the dune and the variety of crops at the farmland were surveyed from 2015 to 2016. The endangered plants and animals were not found in the springs at this survey. A total of 55 species of plant was found in the springs. The dominant plants were *Carex dispalata*, *Calamagrostis epigeios*, *Persicaria thunbergii*, *Oenanthe javanica* and *Iris pseudacorus*. All of them are common hygrophyte. The aquatic fauna of the springs was composed of 22 species. It was dominated by crustaceans, insects and molluscs. As for crustaceans, *Gnori-mosphaeroma naktongense* and *Jesogammarus hokurikuensis* were found. These are the species typically seen in the spring around the coastal area. The main crops of the farmland on the dune were watermelon, sweet potato, vegetables and Chinese white radish. Chinese white radish was planted in the autumn season, following the harvest of watermelon. Annual utilization rate of the farmland (the ratio of cultivated farmland to all of

farmland including a fallow) was 95%. Annual amount of fertilizer application for each crop was estimated using a cultivation techniques manual for farmers. The average of nitrogen application of the farmland is 166.8 kg ha⁻¹ year⁻¹. It was reported that over 300 kg ha⁻¹ year⁻¹ of nitrogen was applied in other coastal dune farmlands in Japan. The amount of nitrogen application to the farmland in Uchinada Dune is smaller than the other farmland on dune in Japan.

However, high concentration of total nitrogen ranging from 2.7-7.2 mg l⁻¹ was observed at the spring which is located in the northeast foot of the dune. On the contrary, low concentration of total nitrogen ranging from 0.4-4.9 mg l⁻¹ was observed at the spring which is located in the southwest foot of the dune. The catchment area of the spring located at the northeast foot of the dune is mainly occupied by the farmland. On the other hand, there is little farmland in the catchment area of the spring at the southwest foot of the dune. The water quality of the springs would be affected negatively due to the application of fertilizers. Appropriate fertilizer management is required to reduce nitrogen leaching from the farmland.

New fish fauna inventory and survey techniques for marine protected area planning: Environmental DNA metabarcoding

Mitsuhiro Aizu¹, Satoquo Seino², Tetsuya Sado³, Masaki Miya³

¹Research Institute of Environment for Sustainability, Faculty of Engineering, Kyushu University,

²Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University, ³Natural History Museum and Institute, Chiba

A Marine Protected Area (MPA) can be an effective tool for the conservation and sustainable use of marine and estuary biodiversity. In the Japanese legal system, coastal Ramsar sites are regarded as MPAs. A local government has promoted the establishment of MPAs along the coast of Tsushima Island in Nagasaki Prefecture, in response to declining fish catches and the loss of seaweed forests. These areas once had several fine fishing grounds and seaweed forests. The disappearance of seaweed advanced gradually from the south, but reached Waniura Bay in the northern part of the island in 2016. Data on fauna such as fish and zooplankton are necessary to establish and promote MPA designation. Inventory surveys have been implemented at several sites. Previous surveys were conducted not only for scientific purposes but also for environmental assessments. In the case of some environmental assessments, essential data on ecosystems was not collected because the main purpose was for development approvals. The lack of adequate data could result in ecosystem damage by enabling destructive developments. Conventional methods of inventory surveys also involve long time periods, incur significant costs, and require taxonomic expertise. They are based mainly on literature searches and external morphology, the latter requiring a high degree of specialization. Samples for morphological analysis are typically collected from field surveys by cast nets, scoop nets, and other tools. Fish catches are also used to reveal information on coastal and off-shore fish fauna.

However, with these sampling methods it is difficult to collect small fishes, so the results may not accurately reflect ecosystem conditions. New inventory methods are needed to accurately

describe the ecosystems and limit the loss of important environments. Environmental DNA (eDNA) metabarcoding can be useful here. The technique can reveal whole communities from DNA in water samples, can conduct analyses quickly, and require no taxonomic knowledge. Expertise is only required for DNA extraction in the laboratory; almost anyone can collect the eDNA samples from water after receiving basic training. In this study, we applied this technique to an inventory survey to assess the fish fauna along the coast of Waniura Bay. Water samples were collected in August 2016, and total DNA was extracted and metabarcoding was conducted using MiFish primer in MiSeq sequencing in September 2016 at the Natural History Museum and Institute, Chiba. Compared with the 379 species identified in previous studies based on conventional methods in a larger area, this study identified over 70 species from the water samples taken from a small area. The banded blue sprat (*Spratelloides gracilis*) was the most counted species, and this could be explained by a shoal of these fish staying around the sampling area, and also by the area having a sandy bottom (the species favors that environment). This study showed the utility of eDNA metabarcoding for inventory surveys, and the environmental conditions could also be postulated based on fish fauna data. This technique could complement conventional methods and be applied for inventory surveys in other areas to reveal detailed information about marine and estuary ecosystems. Monitoring based on eDNA metabarcoding can be used to quickly reveal changes in ecosystems. Our study demonstrated the potential benefits of these new techniques, including contributions to establish and effectively manage MPAs.

Corn and Cameras: Wildlife Management Issues in Restoring the Migration of Red-Crowned Cranes in Hokkaido, Japan

Takehiro Watanabe, Takeshi Ito
Sophia University

The conservation history of Kushiro Wetland, in Eastern Hokkaido, Japan's northernmost island, is entwined with the history of protecting the red-crowned cranes (*Grus japonensis*). Once thought to be domestically extinct, this charismatic bird has experienced a healthy increase in numbers due to early national-level protection of this species and its habitat, support from local communities, and the prohibitive cost of wetland drainage. The conservation program of this species is regarded as a successful case of community-based initiative and had contributed to the protection of Kushiro Wetland, Japan's first Ramsar site.

The cranes, however, face challenges brought on by this success. The winter feed program has caused a dependency on and familiarity with humans, resulting in traffic accidents and damage to farms. In particular, the crane damage to dairy cows is substantial and has been a major regional issue. Also fueling the farmers' frustration is the increase in the number of tourists and birdwatching enthusiasts, sparked by the crane's iconic status and investment in transportation infrastructure that has made traveling easier. Moreover, the overcrowding at feeding stations has led to international concerns about bird influenza and other diseases.

One goal in Japan's red-crowned crane conservation is the restoration of its original migratory behavior. For conservationists, the ultimate goal would be to restore the migratory patterns so that they visit wetlands in the central and southern portions the Japanese archipelago. But what happens when this bird species, begins to winter in other communities that may be less forgiving to the damage they cause? Would the birds be able to survive wetlands with less protection and feed?

This paper identifies the social obstacles facing efforts to restore the migratory pattern of this crane species, by examin-

ing the relationship with stakeholders in on-going conservation efforts in Hokkaido. Local farmers and fish hatcheries are dealing with damage to their livestock and salmon fries, respectively. Especially problematic is the cranes' wintertime dependency on dent corn, which is also used as feed for dairy cows. The tourism industry is also encouraged to limit human contact with the cranes by educating photographers who disturb crane habitat and propagation. Moreover, the cranes themselves must be re-trained in human-based environments.

Currently, Japan's Ministry of the Environment, with the support of scientists and civic groups, is implementing a feed reduction program, in order to encourage the dispersion of the bird population. Some cities are currently receiving cranes (Mukawa City) or planning to reconstruct wetlands as crane habitat (Naganuma City). Yet it is becoming evident that providing wetland habitat will be insufficient, as wildlife-human conflicts are predicted. This effort must also grapple with how to manage the ecological and social links between wetlands of different levels and styles of wildlife management. This linking of wetlands via birds, a key guiding principle of the Ramsar Convention, may also require distant human communities to share information and coordinate programs with local managers who are at the frontline of the conservation efforts.

The conservation efforts for the red-crowned cranes in Eastern Hokkaido exhibits a wider problem for wetland restoration as it highlights the continuing problem with Japan's land-use policy. Problems of human-animal conflict, a major issue in wildlife management programs worldwide, will be addressed. The presentation will explore the question of whether the concept of "wise use" can be expanded to wildlife as a beneficiary of wetlands.

The environmental conservation in Yatsu wildlife protection area

Kiwamu Kawaguchi¹, Sohei Ikeda¹, Shuji Kanda¹, Aya Genseki², Yoshihiro Natori³

¹IDEA Consultants, ²Ministry of The Environment, ³Wetlands International Japan

Yatsu Higata (Yatsu Tidal Flat) is a muddy/sandy tidal flat with the area of 40 hectares located at 2 kilometer inland of Tokyo Bay. Two canals with 6 meter width connect Yatsu Higata with Tokyo Bay, and the sea water comes in and flows out through the canals along with the ebb and flow of the sea. Because of the various and large number of migratory shorebirds and waterfowls hosted by Yatsu Higata, it was designated as an official site of Ramsar Convention in 1993.

More than 110 species of birds are able to be observed in a year including about 70 shorebird and waterfowl species. Since Yatsu Higata is a major stopover for migratory birds, we can observe large number of shorebird corresponding to 10% of entire shorebirds coming to Japan.

In addition to the bird species, Yatsu Higata hosts many kinds of aquatic creatures such as fishes, worms, crabs, bivalves and so on. Abundance of the benthic species makes Yatsu Higata good place for feeding and resting for migratory birds.

The Ministry of Environment designated Yatsu Higata as a wildlife protection area aiming to protect the environment for birds. Number of shorebirds migrating to Japan is decreasing recently. Comparing to 1993 when Yatsu Higata was designated as an official site of Ramsar Site Convention, the numbers of shorebirds decreased to be 1/4. The Ministry of Environment started conservation project in 2010 to improve habitat condition of Yatsu Higata to restore the number of the migrate birds.

The feature of this conservation project's approach is that based on scientific data, the project was carried out with emphasis on the current status grasping → factor analysis → countermeasure examination → effectiveness verification flow. Also, in order to deal with the uncertainty of countermeasures, we carefully examined the adequacy of countermeasures based on small-scale demonstration tests. Furthermore, in order to

promote efforts, it is necessary to obtain understanding and cooperation not only by the business operator, the Ministry of the Environment, but also related organizations in the area, residents, etc., in order to form consensus and share information with the region, Opening a website, holding local briefing sessions and events, and building monitoring systems that local residents can participate.

As a result of these efforts, by the year 2014, we confirmed the change of benthic organisms by improving bottom sediments, the effect of removal of sediments in rivers connecting tideland and sea, etc. for improving the habitats of waterfowl species, And devised an effective countermeasure method. In addition, by raising the ground and installing piles at the sedimentary spot of Aoshu, the frequency of spoilage odor was reduced to about 1/6 of that of the comparison area, and the living environment of the surrounding residents was improved. Approximately 9,000 people visited the website, about 260 people participated, 6 events, stated about 500 people participated, about 50 participants to participate in the citizen participation monitoring There are 320 postings since then, many local residents are interested in Yatsu Higata, and participation and cooperation in conservation project efforts are obtained.

Sustainable Forest Management for Soil and Water Resource under SGEC Certification

Yuuko Iizuka

Sumitomo Forestry Co. Ltd.

Sumitomo Forestry can trace its beginnings to the use of wood harvesting operations in neighboring forests to fortify the Besshi Copper Mine opened in Ehime Prefecture in 1691. Timber was crucial for the mining operation, as it was needed in construction, for the mine posts, and for the fuelwood to refine copper. However, by the end of the 19th century, the forests around the Besshi Copper Mine were facing severe degradation due to long periods of excessive harvesting and smoke pollution. The then principal of the mine, Teigo Iba, believed that "allowing this land to be degraded while moving forward with business made possible by its fruits runs counter to the proper course of our relationship with nature. We must return all the mountains of Besshi to their verdant state." With this belief, he launched the Great Reforestation Plan in 1894 to restore the forests that had been lost. Through a process of trial and error, and by implementing large-scale planting efforts of up to more than one million trees per year, the mountains were eventually returned to a state of rich greenery. It is the sustainable forest management based on this spirit of repaying what has been reaped from the land that serves as the starting point for Sumitomo Forestry's business activities and for its corporate social responsibility (CSR) efforts.

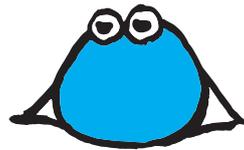
Currently, Sumitomo Forestry owns forests in Hokkaido, Shikoku, Wakayama and Kyushu, corresponding to a total area of over 46,000 hectares, or about 1/900 of the land area of Japan. These company-owned forest is managed based on this principle of sustainable forest with the cycle of planting and carefully cultivating trees before harvesting them, according to the forest management plan established by the Company every five years. They are also 100% certified under SGEC (Sustainable Green Ecosystem Council).

The SGEC certification requires forest management with seven criteria that include preservation of biodiversity and the conser-

vation and maintenance of soil and water resources. While Sumitomo Forestry has gobs of expertise in forest management with its long history of experience, acquiring the third party certification is a way to show its commitment to sustainability and high quality of operation to the interested stakeholders. Prior to acquiring the SGEC certification in 2006, the Company created an operation manual for the riparian forest and set the policy to conserve 15m wide area alongside rivers. By adding this riparian information to our proprietary Forestry Management Data Mapping System, which amalgamates tree species, ages and other information with map data, it can secure forestry operation in a sustainable manner.

Production of timber has been the major focus of the forest management. However, Sumitomo Forestry strives to expand the functions and roles of forest, such as water resource cultivation and landslide prevention, through its sustainable forest management. We also wish to provide opportunities for stakeholders to understand the close link with forests and wetland as one of water resources.





AWS Saga 2017

