Conference Report

International Conference on Sustainable Mangrove Ecosystems:

Managing a Vital Resource for Achieving the Sustainable Development Goals and the Paris Agreement

18-21 April 2017, Bali, Indonesia









International Tropical Timber Organization
Ministry of Environment and Forestry of Indonesia
International Society for Mangrove Ecosystems

International Conference on Sustainable Mangrove Ecosystems:

Managing a Vital Resource for Achieving the Sustainable Development Goals and the Paris Agreement

Conference Report

Prepared for International Tropical Timber Organization

by

Natural Resources Development Centre (NRDC)

Ministry of Environment and Forestry of Indonesia
International Tropical Timber Organization
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The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. Its members represent the bulk of the world's tropical forests and of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances and to implement them in the field through projects. In addition, ITTO collects, analyses and disseminates data on the production and trade of tropical timber and funds projects and other actions aimed at developing sustainable forest industries at both the community and industrial scales. Since it became operational in 1987, ITTO has funded more than 1000 projects, pre-projects and activities valued at more than US$400 million. All projects are funded by voluntary contributions, the major donors to date being the governments of Japan and the United States of America.

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Although every effort has been made to ensure objectivity and balance, the publication of this summary report does not imply endorsement or agreement with its conclusions by ITTO or the conference's donors.

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Contents

Acronyms and abbreviations

ASEAN	Association of South East Asian Nations
CIFOR	Center for International Forestry Research
FAO	Food and Agriculture Organization of the United Nations
ISME	International Society for Mangrove Ecosystems
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
MoEF	Ministry of Environment and Forestry (Indonesia)
PES	Payments for environmental services
SDG	Sustainable Development Goal
SFD	Sabah Forest Department
US$	United States dollar(s)

The event

Mangroves are among the Earth's most productive ecosystems, producing a wide range of goods and environmental services. When sustainably managed, mangrove ecosystems can support the livelihoods of millions of coastal people while storing globally significant quantities of carbon and reducing the vulnerability of coastal regions to storm surges and other threats.

The area of mangrove forests is decreasing rapidly in many tropical countries, however, due to poor management and increasing demand for coastal lands for development. A high priority for the global community, therefore, is arresting the loss of mangroves and restoring degraded mangrove ecosystems.

The International Conference on Sustainable Mangrove Ecosystems was convened to promote the conservation, restoration and sustainable management of mangrove forest resources in the tropics. An important objective was to identify ways in which mangrove restoration and sustainable management could contribute to the achievement of Sustainable Development Goals 13, 14 and 15 and the Paris Agreement on climate change.

At its conclusion, the conference adopted the Bali Call to Action for Sustainable Mangrove Ecosystems, in which participants urge policymakers, land-use planners, mangrove practitioners and scientists, international organizations, the private sector, donors and coastal communities to redouble their work to ensure the conservation, restoration, protection and sustainable management and use of the world's remaining mangrove forest ecosystems.

Date	18–21 April 2017
Venue	Inna Grand Bali Beach Hotel, Bali, Indonesia
Organizers	International Tropical Timber Organization Ministry of Environment and Forestry of Indonesia International Society for Mangrove Ecosystems
Collaborators	Center for International Forestry Research Food and Agriculture Organization of the United Nations United States Forest Service Asian Forest Cooperation Organization
Supporters	Mangrove related civil society groups and several private companies in Indonesia and Green Forest Product and Tech. Pte Ltd., Singapore
Drafting/editing	Mr Yus Rusila Noor, Dr Shigeyuki Baba, Dr Hung Tuck Chan, Ms Nozomi Oshiro, Dr Mami Kainuma, Ms Karin Baba, Dr Norimi Kimura, Dr Tomomi Inoue, Dr Hiras Sidabutar, Dr Hwan-ok Ma, Dr Promode Kant and Mr Alastair Sarre

Opening session

Welcoming remarks

His Excellency I Ketut Sudikerta, Vice Governor of Bali Province, speaking on behalf of the Governor of Bali Province, welcomed participants to beautiful Bali. He gave a brief introduction on the island's mangrove forests and the steps the government and people of Bali have taken to restore and manage them. Mr Sudikerta recalled the 2030 Agenda for Sustainable Development, stating that a major challenge for the world was to speedily achieve the targets set under the Sustainable Development Goals (SDGs). The deliberations of the conference would help guide his province in making its contributions.

Professor Sanit Aksornkoae, President of the International Society for Mangrove Ecosystems (ISME) and Senator in the National Assembly of Thailand, welcomed participants and introduced them to the objectives of ISME and its recent achievements in pursuing its goals. Professor Aksornkoae spoke of the tremendous importance of mangroves in protecting coastlines against the increasing threat posed by tropical storms, and their crucial role in the fishing economy. He hoped that the papers presented at the conference would enrich the scientific literature on mangroves.

Dr Manoel Sobral Filho, Director of the United Nations Forum on Forests, recalled his long association with the island of Bali and its ethos of nature conservation. He said it was appropriate that such a major international conference on mangroves was being held here. He hoped that discussions at the conference would enlighten the global community on the role that these highly productive tropical ecosystems could play in achieving the SDGs and the Paris Agreement on climate change.

Speaking on behalf of the International Tropical Timber Organization (ITTO), **Dr Steven Johnson** spoke of the need for the conference and the long preparation that had gone into making it possible. ITTO recognized the benefits of mangroves for humanity and the ongoing threats to the resource, and the Organization had provided more than US$10 million in grants for the sustainable management and use of tropical mangrove ecosystems over the last three decades. Dr Johnson emphasized the importance of large-scale collaboration among governments and research and development organizations in achieving the objectives for which the conference had been organized.

Opening speech

Dr Ir Hilman Nugroho, Director-General of Watershed Control and Management, Government of Indonesia, delivered the opening speech on behalf of Her Excellency Dr Siti Nurbaya, Indonesia's Minister of Environment and Forestry. Dr Nugroho gave a brief overview of Indonesia's mangrove resources and the role they could play, with adequate investment, in implementing the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change. He proposed seven activities for ensuring sustainable mangrove management:

1) establish policies and regulatory frameworks on mangrove ecosystem management in accordance with each country's condition and local wisdom;
2) promote mangroves as a way of improving livelihoods in local communities, in terms of their non-timber products and environmental services;
3) increase awareness and community engagement in mangrove management and use to maximize their economic, social and environmental benefits;
4) provide clear specifications and silvicultural prescriptions for mangrove timber logging;
5) improve mangrove productivity through technological development;
6) establish, improve and strengthen collaboration in mangrove rehabilitation—both nationally and internationally; and
7) improve fair and transparent law enforcement.

Rapporteur

Dr Hiras Sidabutar, Indonesia

Summary of opening keynote addresses

Four leading thinkers on mangroves articulated their thoughts on the conference theme.

Professor Sanit Aksornkoae, ISME president and Senator in the National Assembly of Thailand, said palm-oil production was a serious emerging threat to mangroves. Mangroves can survive sea-level rise if properly conserved, and an effective way of doing this would be to declare them as protected forest reserves. Another sound strategy would be to capitalize on non-wood benefits such as ecotourism, the increase in marine catch due to mangroves, and the "blue carbon" value of these assets. Good mangrove governance is underpinned by responsive policies, strategic planning, the active restoration of degraded sites, the zoning of production and protection areas, curtailing the conversion of mangrove areas for other uses, and active local participation and capacity building.

Dr Chandra Giri, Chief of Sensing and Spatial Analysis Branch, US Environmental Protection Agency, spoke of the crucial need to update databases on the global status of mangrove forests to enable high-quality change detection analysis and responsive governance of this precious resource. Instruments and expertise for remote sensing and mapping have improved greatly in recent years, as reflected in the number of earth observation satellites, the resolution and quality of images, easier access to LIDAR ("light detection and ranging"), and the availability of drones for ground-truthing. Challenges in image classification remain, however, such as accounting for dead standing trees and small patches of mangroves.

Professor Daniel Murdiyarso, Principal Scientist, Center for International Forestry Research, stated that blue-carbon partnerships can contribute to the achievement of both the Paris Agreement on climate change and the SDGs. This requires mainstreaming blue carbon into global and national policy processes and implementation and the appropriate realignment of government policies at the central and provincial levels to favour mangrove restoration and conservation. The non-consumptive economic use of mangroves on a significant scale would also help reduce pressure.

Dr Antung Deddy, Director of Essential Ecosystem Management, Director General of Natural Resources and Ecosystem Conservation, Ministry of Environment and Forestry, Indonesia, spoke of the status of mangrove forests in Indonesia. Mangrove conservation fits well into the global pursuit of the SDGs and the Paris Agreement on climate change, he said. Achieving mangrove conservation requires placing it at the forefront of governmental conservation priorities and carrying out sustained awareness-raising campaigns to convince people of the seriousness of the situation and the need for urgent action. Non-consumptive economic uses of mangroves on a significant scale would help reduce pressure.

Key messages

- Mangroves could play a crucial role in implementing the Paris Agreement on climate change by reducing the vulnerability of coastal regions to the changing climate and because of their high potential to remove carbon from the atmosphere and thereby contribute to mitigation.
- Mangroves can help poorer coastal regions in the tropics realize the SDGs through their capacity to increase the marine fisheries catch and by protecting communities from weather-linked disasters.
- Good mangrove governance is underpinned by responsive policies, strategic planning, the active restoration of degraded sites, reducing the diversion of mangrove lands for other economic activities, and enhancing active local participation and capacity building.
- Remote sensing technologies for detecting change have greatly improved, and they have an important role to play in the effective management of mangroves.

Rapporteur: Dr Dixon T Gevaña

Thematic Areas

ITTO's **Dr. Hwan Ok Ma** introduced participants to the structure of the conference. He said that its thematic areas were designed to maximize learning from the implementation of a range of mangrove initiatives and projects in the tropics in recent years. The seven thematic areas were:

1. Promoting the sustainable management of mangrove forests and ecosystems

2. Addressing climate-change adaptation and mitigation

3. Sustainable livelihoods for mangrove-dependent communities

4. Restoration of degraded mangrove forests and ecosystems

5. Strengthening good governance, law enforcement and monitoring systems

6. Scaling up payments for environmental services in mangrove forests

7. Increasing research, education and awareness

Themes comprised keynote presentations followed by short presentations by panellists featuring case studies on the protection and sustainable management of mangrove forests and the restoration of degraded mangrove ecosystems. The presentations made by panellists were analytical in nature, focusing on issues, challenges and lessons learned, and they were followed by facilitated discussions to which all participants had the opportunity to contribute.

Theme 1: Promoting the sustainable management of mangrove forests and ecosystems
This theme discussed lessons learned and challenges in promoting the sustainable management and use of mangrove forests, including silvicultural systems and forest conservation, in the context of socioecologically productive landscapes and seascape management. Presentations addressed national mangrove strategies, mangrove land-use zoning (e.g. conservation, management and conversion), integrated costal management systems, and initiatives to support the achievement of targets 14.2 and 15.2 of the Sustainable Development Goals (Target 14.2: By 2020, sustainably manage and protect marine and costal ecosystems; Target 15.2: By 2020, promote the implementation of sustainable management of all types of forests).

Theme 2: Addressing climate-change adaptation and mitigation
Discussions on this theme addressed opportunities for, and challenges in, addressing climate-change adaptation and mitigation through sustainable mangrove management and use. The Blue Carbon Initiative was discussed as a way of capturing opportunities for climate financing. Case studies were presented on carbon sequestration in mangrove forests, mangrove adaptation to climate change, and the ecological and environmental values of mangrove ecosystems. Presentations were made on the

economic valuation of mangrove ecosystems, payment schemes for mangrove environmental services, and engaging the business community.

Theme 3: Sustainable livelihoods for mangrove-dependent communities

Discussions on this theme addressed tenure security; ensuring the effective participation of communities, women, civil-society organizations and other local stakeholders; developing effective benefit-sharing and distribution models; and traditional knowledge. Experiences with community-based management approaches and livelihood improvements, including ecotourism and integrated shrimp aquaculture and mangrove protection, had been presented with the aim of increasing the potential to diversity income sources of mangrove-dependent communities while enhancing their contribution to mangrove protection.

Theme 4: Restoration of degraded mangrove forests and ecosystems

The restoration of degraded mangrove forests should be pursued in ways that incorporate both scientific silvicultural principles and traditional knowledge, adapted to local conditions to assist the recovery of resilience of mangrove ecosystems at the disturbed site. Discussions on this theme addressed best practices in mangrove restoration to increase a success rate for restoring degraded mangrove forests, including the design of a restoration programme by assessing the ecology of mangrove species at the site as well as supporting mechanisms and positive incentives to replant on devastated shrimp ponds.

Theme 5: Strengthening good governance, law enforcement and monitoring systems

Various governmental agencies, such as fisheries, forestry, coastal planning, agriculture and environment, have jurisdiction over coastal resources, and their policies are often in conflict. It is important, therefore, that relevant government agencies and stakeholders work together to establish sound policies and legislation. This theme addressed lessons learned from mangrove governance and the challenges encountered. Experiences with strengthening law enforcement against illegal activities will be presented, along with improved monitoring systems in order to better assess progress towards sustainable mangrove management.

Theme 6: Scaling up payments for environmental services in mangrove forests

Initiatives such as the International Partnership for Blue Carbon and the Mangroves for the Future (MFF) Initiative are helping raise awareness of the important environmental services provided by mangrove forests, such as climate-change mitigation, and the need to pay for these. Mangrove-based ecotourism operated by local communities and the private sector is increasing in many tropical countries, and, in Indonesia, the certification of mangrove forests is showing promise. Presentations and discussions on this theme addressed the valuation of mangrove-related environmental services, experiences in developing payment schemes for environmental services, and policies and legal frameworks for increasing demand for the environmental services provided by mangrove forests.

Theme 7: Increasing research, education and awareness

There is an urgent need for more research and public education and awareness on many aspects of mangrove restoration, conservation and sustainable use. Presentations on this theme addressed

innovative research on ecological resilience, silvicultural interventions for sustainable mangrove management, and the use of mangrove forests as renewable sources of bioenergy. Discussions also covered education and awareness-raising among the public, including local communities, on the restoration, conservation and sustainable use of mangrove ecosystems.

Theme 1:
Promoting the sustainable management of mangrove forests and ecosystems

This theme was addressed in the plenary session on day 1, focusing on the challenges and lessons learned in the sustainable management and use of mangrove forests across the tropics. Presentations addressed national mangrove strategies; the zoning of mangrove land for conservation, use and diversion to other uses; silvicultural systems suited to mangrove forests; and integrated coastal management systems. Almost all speakers spoke of the important role mangroves could play in achieving the Paris Agreement on climate change and the SDGs. SDG 14.2 aims to sustainably manage and protect marine and coastal ecosystems, and SDG 15.2 aims to achieve sustainable management in all types of forest by 2020.

[Speakers]

- Mr Agung Kuswandono, Deputy Minister, Coordinating Ministry of Maritime, Indonesia
- Mr Roslan bin Rani, Principal Assistant Director, Forestry Department, Peninsular Malaysia, and Dr Samsudin Musa, Forest Research Institute, Malaysia
- Dr Toe Toe Aung, Forest Department, Ministry of Natural Resources and Environmental Conservation, Myanmar
- Professor Luiz Drude de Lacerda, Marine Sciences of Universidade Federal do Cearaá, Brazil
- Mr Jacinto Samuel García Carreón, National Forestry Commission, Mexico
- Ms Fatima Kanji Bonete, National Directorate of Forests, Ministry of Land, Environment and Rural Development, Mozambique
- Ms Rakotoaridera Rantonirina, Director of Protected Area Systems, Ministry of Environment, Ecology and Forestry, Madagascar

Summary of the presentations

Presenting “Overview of the Management of Mangrove Forests and Ecosystems in Indonesia”**, Mr Agung Kuswandono** said that Indonesia has a mangrove forest estate of 3 million hectares, which is 23% of global mangrove assets, and it plays an important role in human lives and the environment. Indonesia's mangroves face many problems, such as land-use change; a low level of knowledge of their importance; pollution; illegal logging; and natural disasters in the form of tsunamis and sea level rise. Several programmes and actions have been initiated to overcome these problems, including planting, sustainable harvesting, and community involvement in mangrove management. Under the Indonesian National Strategic Program 2015–2019 the Coordinating Ministry of Maritime Affairs is supporting the sustainable management of Indonesia's mangrove ecosystems as a way of accelerating the rehabilitation of coastal and sea damage. Key stakeholders in the programme are ministries, companies, non-governmental organizations and local communities.

In their presentation, "Sustainable management of Matang mangrove ecosystem: issues, challenges and way forward" ,**Mr Roslan bin Rami** and **Dr Samsudin Musa** said that mangrove forests are among the world's most productive terrestrial ecosystems, constituting a renewable resource for fuel, energy and wood and non-wood products, supporting forest-based eco-tourism, and providing food, shelter, education opportunities and income for local communities. Malaysia's Matang mangroves forest, which covers more than 40,000 hectares, has been

[Moderator]

- Dr. Tachrir Fathoni,
  Country Indonesian Director,
  USAID

managed since 1904 for sustainable timber production while maintaining the richness and diversity of its ecosystem. The objectives of management are the production of fuelwood, charcoal and poles; the conservation of wildlife and marine flora and fauna and the provision of recreation, eco-tourism, education and research. There are four distinct management zones: the productive zone, the restricted productive zone, the unproductive zone and the protective zone. The main challenges are adequate timber production in view of a timber supply shortage; competing land use; competing resource use and diversification; maintaining healthy mangrove ecosystems; boundary disputes; and natural hazards. The way forward is through government initiatives such as replanting programmes, integrated planning and management, product development through research and development, local community involvement, and awareness campaigns. The Matang mangroves have been managed systematically and sustainably for over a century. They provide an excellent learning experience in sustainable forest management demonstrating good planning, the conservation and protection of forests, sound management, and fair and just administration.

Dr Toe Toe Aung, speaking on "Myanmar's Efforts on Conservation and Management of Mangrove Ecosystems", said that Myanmar has about around half a million hectares of mangrove forests. This resource is under management by the government in accordance with the principles laid down in the forest policy, which calls for the management of forest resources for the conservation of soil, water, wildlife and biodiversity and the protection of the environment while fulfilling people's basic needs for fuel, shelter, food and recreation. An important aspect of this policy is the participation of people in forest conservation and use. Myanmar has its National Biodiversity Strategy and Action Plan, spanning 2015–2020 and the Myanmar Agenda 21, which addresses the sustainable management of coastal, marine and island ecosystems. Myanmar's mangrove forests have been placed under protection in order to meet the commitments made in the Paris Agreement on climate change. The national target for community forestry is 0.92 million hectares, which includes mangrove plantations. The Myanmar Reforestation and Rehabilitation Program 2017–2026 provides for the rehabilitation of mangroves. There is increasing awareness among people about the value of mangroves. Major issues in mangrove conservation and management include village settlement and demands on mangrove forests for rice cultivation, shrimp ponds, fuelwood and charcoal production. Five priorities in the National Strategy and Action Plan are environmental profiling, capacity building, policy and strategy development, civil-society involvement and the establishment of marine protected areas. In view of the importance of mangroves, their management is often led by relatively more experienced and higher-ranking officials.

Professor Luiz Drude de Lacerda presented a paper titled "Neotropical mangroves: Conservation and Sustainable Use in A Scenario of Global Climate Changes". He said there are 4.06 million hectares of mangrove in Latin America and the Caribbean, which is 26% of the world's mangroves resource. Major drivers of change in mangroves in the region are urbanization, industrialization, agriculture, and aquaculture as well as the construction of dams, which has affected the sediment and salt balance and nutrient fluxes. Replanting and rehabilitation are major positive drivers. Mangroves act as filters to protect adjacent coastal areas because the mangrove rhizosphere traps metals, thus avoiding the contamination of adjacent coastal waters. The highest proportion of threatened mangrove species is on the Atlantic and Pacific coasts of Central America. Major constraints to a strong societal response to the threats posed to the mangroves are weak laws on mangrove protection, the large capital investment required for mangrove rehabilitation, and an inability to add value to mangrove wood and non-wood products, all of which acts as

deterrents to community-based management. Professor Drude de Lacerda concluded his address by stating that the drivers of impacts on mangroves have changed drastically in recent years, reducing the effectiveness of important pre-existing societal responses to conservation and sustainable management in parts of Latin America. He recommended that the rehabilitation strategies, conservation, laws and practices employed in mangrove forests should take into consideration not only local anthropogenic drivers but also climate change.

In his presentation, titled "scheme of Restoration and Mangrove Management in Mexico with Funds from Environmental Compensation for Land-Use Change in Forest Lands",**Mr. Jacinto Samuel García Carreón** said that Mexico ranks fourth in the world in total mangrove area; major threats to these ecosystems are illegal logging and land-use changes. Among the important consequences of mangrove degradation are changes in hydrological flows, water chemistry and soil changes, resulting in the depletion of soil carbon. Lessons learned in mangrove restoration include the selection of appropriate restoration sites, the identification of flow direction and soil parameters, the restoration of hydrological flows by channels, and revegetation or reforestation.

Ms Fatima Kanji Bonete, in her address “Mangroves in Mozambique”, said that Mozambique loses about 800 hectares of its 300 000 hectares of mangroves each year, and losses have increased in recent years. The main drivers of these losses are the high demand for wood for energy and land for the salt industry, as well as urbanization, erosion, aquaculture, pollution, climate change, and land for development programmes. There is increasing realization of the importance of mangroves for the welfare of coastal people, however; mangroves are among the world's most productive and biologically important ecosystems, providing ecosystem goods and services important for human society and for coastal and marine systems. Major activities initiated by the government to reduce threats to mangroves include mangrove planting, biodiversity projects, and other ecosystem-

restoration efforts. Medium-term and long-term strategies include capacity building, the promotion of sustainable mangrove management, improved research, protection and rehabilitation and raising public awareness. The way forward involves reviewing achievements and gaps, the close monitoring of rehabilitation efforts, and renewed emphasis on involving communities.

Ms Rakotoaridera Rantonirina, in her presentation titled "Towards sustainable management of mangroves in Madagascar", said that, in her country, mangrove forests constitute an important part of the local subsistence economy, being a main source of woodfuel, timber and non-timber forest products for local communities. The main threats to mangroves are overexploitation and illegal logging due primarily to population pressure. A policy was laid out in 2014 to encourage community management and prohibit the overuse of mangroves; a national committee established to enforce the policy has proved ineffective, however. The community management approach is not enough to stop the loss of mangroves, said Ms Rantonirina. Plans for mangrove management exist, but they need updating and revision. Integrated management should be promoted while improving the legislative and regulatory framework to better manage and use mangroves in Madagascar

Key Messages and Recommendations

- Mangroves play multiple valuable economic, social and environmental roles and are, often of vital importance to sections of society in the coastal tropics. Mangroves reduce the vulnerability of coasts and coastal communities to weather-related risks, and they also increase earnings from the marine catch and make it sustainable over the long term. Mangroves produce wood and other biomass for sustenance, and help mitigate climate change through relatively rapid rates of carbon sequestration.
- Mangroves are under serious threats worldwide due to over-exploitation and poor resource management, conversion for infrastructural uses such as ports, resorts and roads as well as for aquaculture and rice cultivation, and marine pollution.
- A lack of clarity on tenure rights has contributed to the weakening of community role in mangroves protection.
- There is an urgent need to protect and conserve remaining pristine and primary mangroves worldwide and to enhance the sustainable management of mangroves through the formulation of appropriate policies, laws and regulations at all levels and by building capacities within implementing organizations and local communities.
- Drivers of mangrove losses and degradation have changed in recent years, with rapidly developing economies requiring large investments in coastal infrastructure. This has reduced the effectiveness of some important societal responses towards conservation and sustainable management.
- Community-based mangrove management, which has traditionally been confined to providing organizational inputs and labour, is unable to cope with the requirements of capital investments while mangroves managed for forest products lack the forward economic planning needed to expand product value and be competitive in global markets.
- The management of mangrove forests requires integrated multi-sectoral and multi-disciplinary approaches, as well as better coordination and networking. Societal and governmental responses to the fast-deteriorating situation of mangroves have been in adequate.
- Ecotourism can be integrated with mangrove rehabilitation and reforestation programmes to obtain multiple benefits from mangrove ecosystems.
- High levels of human and financial investments are needed for research and development into the sustainable production of the multiple goods and functions of mangrove ecosystems.
- Plans should be formulated for priority actions, such as assessing drivers, mapping degraded mangroves, developing methodologies to restore and monitor mangroves, and selecting species best suited for planting. Rehabilitation strategies should take into account not only local anthropogenic drivers but also future climate-change scenarios in moving towards the achievement of the SDGs and the Paris Agreement.

Rapporteurs: Dr Aulia Aruan, Indonesia and **Dr Antonio Villa-Lopera**, Colombia

Theme 2:
Addressing climate-change adaptation and mitigation

Mangrove forests are among the most carbon-rich biomes; they form highly productive ecotones between terrestrial and marine ecosystems, with carbon production rates equalling those of tropical humid forests. Mangrove forests allocate more carbon below ground than above ground, creating large carbon pools in soils and dead roots that ultimately reach ocean bottoms, away from the atmosphere. Mangrove deposits also enhances the nutritional value of the coastal waters, which become breeding grounds for marine life. Discussions on this theme centered on opportunities offered by mangroves for mitigating and adapting to climate change. The presentations also covered payment for environmental services (PES) and the Blue Carbon Initiative, which is a global effort to conserve and restore coastal and marine ecosystems.

[Keynote speaker]
- Dr Nur Masripatin, Director General, Climate Change, Ministry of Environment and Forestry, Indonesia

Speakers
- Professor Dedi Hadrianto, Mulawarman University, Indonesia
- Dr. Ong Jin Eong, Honorary Chief Technical Advisor to ISME and Mangrove Specialist Group of the IUCN Species Survival Commission
- Dr. Tomomi Inoue, Senior Researcher, Center for Environmental Biology and Ecosystem Studies, National Institute for Environmental Studies, Japan
- Dr. Kangkuso Analuddin, Department of Biology, Halu Oleo University, Southeast Sulawesi, Indonesia
- Mr. Barakalla, Blue Carbon Coordinator, Conservation International, Indonesia

[Moderator]
- Dr Daniel Murdiyarso, Principal Scientist, Center for International Forestry Research, Indonesia

Summary of the presentations

In her key note speech, titled “Addressing climate-change mitigation and adaptation in Indonesia and role of mangrove ecosystems”, **Dr Nur Masripatin** said that the Paris Agreement on climate change seeks to guide the global community in a long-term global response to climate change through cooperation, and it underlines the importance of ensuring the integrity of all ecosystems in the face of increasing vulnerability to the impacts of climate change. Indonesian commitment under the Paris Agreement emphasizes the country's large coastal population and resultant vulnerability to climate change. Mangroves play an important role in both mitigation and adaptation in Indonesia’s nationally determined contributions with mangrove conservation and restoration integral to the country’s push to promote climate resilience in food, water and energy. Nevertheless, said Dr Nur, there is widespread mangrove degradation in Indonesia due to overharvesting, which is sometimes the first step towards land-use change.

Planned land-use change for other economic activities is another major cause of mangrove loss, and a lack of awareness of the true value of mangroves and a lack of coordination among various authorities also places serious stresses on this precious resource. Things are changing for the better, however, with the 2015-2019 plan

to develop enabling conditions for sustainable mangrove management; this involves coherent actions at the national level, including research into the causes of depletion and possible solutions, and resource mobilization for large-scale ameliorative action through partnerships and international cooperation. Specific procedural criteria for mangrove forest management need to be developed, as has been done for other specialized ecosystem types.

Professor Dedi Hadrianto, presenting his paper titled "Toward Future Management of Mangrove in Mahakam Delta Forest Management Unit, East Kalimantan", said that oil and natural gas exploration and aquaculture are dominant land uses and the primary causes of deforestation in the Mahakam Delta , which was about 500 hactares annually in the 1980s and has been increasing; perhaps 85000 hactares have been lost. There are about 61 500 aquaculture ponds in the delta, none of which has a legal permit. Mangrove management activities under implementation include land rezoning, rehabilitation, social forestry, ecological pond management, and collaborative management. Nurseries and planting activities are being undertaken to restore mangroves, but new approaches are needed to rehabilitate degraded mangrove forests. Natural revegetation in disused aquaculture ponds is prevalent, and this can be speeded up with appropriate interventions. Environmentally benign, small-sized "green" aquaculture ponds have been started as pilot projects.

Dr Ong Jin Eong spoke on "measuring Mangrove Blue Carbon Fluxes". He said that carbon fluxes in mangrove forests have only a limited similarity with those in other forest ecosystems because a significant part of the primary production from photosynthesis is leached into the sea by tides twice a day. Studies have indicated that the peak productivity is at around ten years of age in plantations. The carbon dioxide exchanges during photosynthesis and respiration can be measured using flux towers, and assessments of aboveground and belowground biomass are made using allometric equations, the appropriateness of which determines the accuracy of estimation. As in other forest ecosystems, soil carbon measurements are made by taking soils samples at different depths. For carbon trading to be sustainablek, the measurements of carbon fluxes must be underpinned by science, requiring further research. A small part of the revenue from carbon trading could be used to fund research.

Dr Tomomi Inoue, presenting his paper titled "Carbon storage of mangrove ecosystems: global maps of reported data and estimated models", said that mangrove forests store more carbon than any other forest type per unit area. There is relatively higher belowground carbon in estuaries and higher aboveground carbon in oceanic mangroves. The estimated annual release of carbon from mangroves is in the range of 900–4500 tonnes per hactares. Of about 250 data sets of aboveground and belowground carbon in biomass in mangrove ecosystems around the world, the highest is 2203 tonnes per hactares in Sondaken, North Sulawesi, Indonesia. Tidal range, wind and temperature are correlated with above ground biomass; tidal range, swell and temperature correlate with the underground necromass. The stored static necromass carbon can sometimes be thousands of years old.

Dr Kangkuso Analuddin presented a paper titled "Mangrove forests and conservation of their services in the Coral Triangle Eco-region, Southeast Sulawesi, Indonesia". There are significant areas of mangroves in Rawa Aopa, Tiworo Archipelago, the North Buton wildlife conservation area, and Wakatobi Marine National Park in Southeast Sulawesi. The main threat to mangroves in the Coral Triangle is conversion to other land uses. By 2007, when these areas were brought under conservation, about 23,700 hactares had already been converted to aquaculture. Sedimentation and pollution from mining and upland deforestation also have adverse impacts on mangrove ecosystems. A good strategy for restoration would include the reintroduction of mangroves to abandoned aquaculture ponds and other unproductive aquaculture areas, the management of natural revegetation by reducing large woody debris to promote growth, the more effective conservation of mangrove floral and faunal species, and the development of mangrove-based non-Timber forest product value chains.

Mr. Barakalla presented a paper titled "Conservation International's Blue Carbon Approach in Kaimana, West Papua, Indonesia" and said that mangroves cover 81 169 hactares in Kaimana, West Papua. The resource is facing severe deforestation, however, moving rapidly from west to east, with logging concessions already sitting atop mangrove areas. Focused conservation efforts and advocacy have proved fruitful, with as many as 22 oil-palm projects denied permission in Kaimana in 2016. Long-term solutions cannot be exclusively prohibition-based, however, and local people need to be engaged in mangrove management in such a way that their incomes do not decline as a result of mangrove conservation. Potential strategies include the alignment of overarching and sometimes conflicting policies from ministries; investment in sustainable fisheries catch enhancement; addressing supply-chain bottlenecks in high-value products like mangrove crabs; and mangrove-based carbon credits. In villages with homogenous communities, the traditional Sasi system of rules on temporary prohibitions on the use of a particular resources or territories may also work.

Moderator's summary of discussions

- Climate change adaptation is defined as a set of measures aim at responding to the impacts of climate change, whereas mitigation involves addressing the causes of climate change by reducing sources and enhancing sinks of greenhouse gases.
- Mangroves ecosystems can play significant roles in nationally determined contributions under the Paris Agreement on climate change, including measures to reduce greenhouse-gas emissions and actions to adapt to climate change.
- Managing mangrove ecosystems needs strong governance systems with clear objectives in addressing tenure-related issues.
- High-tier carbon metrics, including allometric equations, carbon stocks and cycling, are key crucial for reducing uncertainties and enhancing the credibility of reporting.
- The rehabilitation and restoration of degraded mangroves should be done in tandem with efforts to protect existing mangroves and to enhance value chains for mangrove-based non-timber products.
- Involving local communities and adopting local agendas would be beneficial not only for ecological sustainability but also the well-being of communities that depend on coastal resources.

Key messages and recommendations

- To motivate the global community to act quickly to conserve and restore mangrove ecosystems, it is necessary to acknowledge the significant role these ecosystems play in sequestering carbon dioxide and storing carbon. Both the above-ground and below-ground biomass of mangroves in the Indo-Pacific region stores more carbon (per unit area) than boreal, temperate and tropical forests.
- Countries with tropical coastlines should be encouraged to specifically include the conservation and restoration of mangroves in their nationally determined contributions as a way of ensuring that mangroves receive due attention from national leaderships and to facilitate adequate financial allocations and sound monitoring.
- Adequate investments in research on carbon sequestration, transpiration and deposition processes in mangroves is required to reduce uncertainties around estimates of carbon stock and sequestration in various kinds of mangrove ecosystems. Such research would enhance the credibility of reporting by countries to the United Nations Framework Convention on Climate Change.
- Managing mangrove ecosystems needs strong governance with clear objectives, especially in addressing tenure-related issues. Degraded mangroves should be restored by engaging local communities to the greatest extent possible while also achieving the primary objectives, by adopting local agendas.
- Taxation on economic activities with a bearing on coastal ecosystems should be considered under the Blue Carbon Initiative, part of the revenues could be used as a global fund for mangrove research and restoration.

Rapporteurs: Ms. Yani Septiani, Indonesia and **Mr. Ben Brown**, Australia

Theme 3:
Sustainable livelihoods for mangrove-dependent communities

The effective participation of communities, tenure security, traditional knowledge, gender equity and benefit sharing were among the topics discussed under this theme. Speakers and participants shared their experiences with community-based management approaches and livelihood improvement efforts in community forestry involving predominantly mangrove species; a bio-rights approach involving conditional loans as incentives for community participation in restoration in Indonesia; and community management in Fiji's Rewa Delta. The focus was on diversifying income sources for mangrove-dependent communities while enhancing their contributions to mangrove protection.

[Keynote speaker]

- Ms Cecile Ndjebet, African Women's Network for Community Management of Forest

[Speakers]

- Mr Wiratno, Director of Area Preparation for Social Forestry, Director General of Social Forestry and Environment Partnership. Ministry of Environment and Forestry, Indonesia
- Dr. Mohammad Basyuni, Department of Forestry, University of Sumatera Utara, Indonesia
- Professor. Kithsiri Ranawana, University of Paradeniya-Kandy, Sri Lanka
- Dr Pham Duc Chien, Deputy Director Research Institute for Forest Ecology and Environment, Vietnamese Academy of Forest Sciences, Viet Nam
- Dr Kenichi Shono, Forest Resources Officer, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand

Summary of the presentations

Presenting her keynote address titled "Women's response activities in the restoration and management of mangroves in Cameroon", **Ms. Cecile Ndjebet** said that the key drivers of mangrove deforestation in her country are population growth; infrastructure development; wood-fuel demand; unregulated fishing; the diversion of land for oil-palm plantations; oil gas exploitation; pollution from industries; and a lack of legal and institutional frameworks to address these problems. Mangroves are important for women for their livelihood and as sources of food, medicines and drinking water, as sacred sites, and for incomes from marine catch. The disappearance of mangroves is a threat to families and to society as well. Women are engaged in nursery establishment, agroforestry, cook-stove improvement, and developing alternative income activities such as bee keeping. Women need to be empowered by building their capacities, increasing their access to funding, and removing legal and policy hurdles that stand in the way of their empowerment.

Mr Wiratno, speaking on the topic of "social forestry in Indonesia", said forestry is about people, not trees, and there is a need to

[Moderator]

- Dr Victor Agyeman,
  Director General and Chief Research Scientist, Council for Scientific and Industrial Research, Ghana

promote social forestry across all management types and the management spectrum. The government has given access rights to forest farmer groups in 9800 villages, with a target of reforesting 12.7 million hectares of forestlands in the period 2015-2019. The key factors for success in social forestry are public-private partnerships and adherence to the four principles of governance, namely, transparency, participation, accountability and collective responsibility.

Dr Mohammad Basyuni speaking on "community-based ecotourism in North Sumatra, Indonesia" said that, owing to their position on the land-sea interface, mangroves have high potential for promoting ecotourism in North Sumatera Mangrove ecotourism is a sustainable form of land use, contributing to environmental conservation while also providing socio-economic benefits for local people by creating a market for the indirect values of the resource. In order to develop and promote mangrove ecotourism, important parameters like community profile, the nature of mangrove ecosystems, ecological suitability and carrying capacity should be considered. Non-consumptive uses of mangroves, such as ecotourism, will help reduce resource dependency.

Professor Kithsiri Ranawana spoke on the topic of "community development in the mangrove conservation programme of the Small Fishers Federation, Sri Lanka". He said that, in his country, over 6000 hectares of mangroves have been cleared in the last three decades for shrimp farming and other commercial purposes. With financial support from Seacology, the Small Fishers Federation of Sri Lanka has launched a mangrove conservation drive with communities throughout the coastal belt of Sri Lanka. Given the women's groups are the most dynamic mangrove conservation forces, the federation provides such groups with legal and scientific knowhow to identify, conserve and replant mangroves. Village-based community mangrove nurseries have been established, and each family produces at least 100 mangrove seedlings in their home gardens near the lagoon. Micro credit, skills training, and facilitating job opportunities for women are possible ways to alleviate poverty and contribute to mangrove conservation. A small amount of financial assistance can offer a path out of poverty for some of the country's most

vulnerable inhabitants, who are key partners in efforts to protect remaining mangrove forests. There is a realization that women are a major source of power for conservation and that mangrove conservation can only be effective by raising awareness among people and tapping into community organizations.

Dr Pham Duc Chien spoke on the topic of "sustainable development of mangrove forest ecosystems in Thai Binh, Viet Nam". He said that mangrove forests in Thai Binh are severely degraded by aquaculture activities and other land-use changes, inadequate management and damages caused by extreme weather events. A ten-year project on mangrove rehabilitation was launched in 2015 with the support of local communities. Communes are provided with budgetary support at the rate of US$20 per hectare per year, of which 90% goes directly to the group of people within the commune responsible for mangrove protection and management; the commune uses the rest for monitoring, organizing meetings and communications. The project is also helping to develop and operate community regulations on the management and protection of mangrove forests in communes. It is proposed that people who harvest sea food products from mangroves should be required to pay a fee, which would be used to fund the operations of management and protection groups and also to re-invested in the development of mangrove ecosystems.

Dr Kenichi Shono spoke about the project "Income for coastal communities for mangrove protection", which is being implemented in Pakistan, Thailand and Viet Nam with the aim of conserving and restoring mangroves by introducing sustainable financing for coastal communities. The project is developing low-cost mechanisms that enable investors to promote mangrove conservation, carbon emission reductions and sustainable development by helping local communities diversify their livelihood options while enriching mangrove resources and protecting coastal assets. Under the project, the financing agency provides local communities with financial or in-kind incentives in return for mangrove protection and restoration. The incentives provided are also expected to cover the costs of most project activities, including mangrove restoration, patrolling and monitoring, implemented by the local community. A key consideration is the right of local communities to manage mangroves to the exclusion of others, which necessitates clear tenure rights in favour of communities. The project has a better chances of success when tenure rights are clear, the responsibilities of each party to the agreement are well defined, financial incentives are adequate for providing alternate livelihoods, and there is an effective financial management system.

Key messages and recommendations

- Mangroves provide key livelihood support for women and, therefore, the empowerment of women by way of small loans, skills training and facilitated job opportunities should be central to restoration and conservation efforts.
- Community-based forest management can succeed when there is clarity on tenure; attractive immediate and long-term incentives exist; capacity is developed; and there is good local awareness of the role of mangroves and sound knowledge on appropriate restoration techniques. Incentives for mangrove restoration should be linked to measurable indicators such as survival and growth rates.
- To ensure that communities extend their consent for restoration over all restoration sites, they should be provided with appropriately thought-out exit strategies that limit damage to the restored ecosystems.
- In places where local people profit commercially from mangroves, user fees could be incorporated for financing the management, rehabilitation and conservation of mangroves.
- Non-consumptive uses of mangroves for ecotourism and nature education can help reduce resource dependency and should be promoted. Even with good investment in capacity building, however, it takes time to develop areas for ecotourism because it is not easy to change the attitudes of local communities. Being an entrepreneurial activity, ecotourism involves risks that local communities need to understand.
- Mangrove conservation can be encouraged by inculcating a love of nature, especially among the young, and it can be made more effective by strengthening awareness in community organizations.

Rapporteurs: Ms Retno Surati, Indonesia and **Dr Leni D. Camacho**, Philippines

Theme 4:
Restoration of degraded mangrove forests and ecosystems

The restoration of degraded mangroves needs to be pursued in ways that incorporate both scientific principles of silviculture and traditional knowledge adapted to local conditions to build resilience at disturbed sites. Discussions on this theme centred around best practices in mangrove restoration to increase the chances of success through the proper design of restoration programmes that take into consideration the dynamics of mangrove ecosystems at particular sites.

[Keynote speaker]
Dr Richard A. MacKenzie, Acting Watershed National Program Leader, US Forest Service, Institute of Pacific Islands Forestry, United States of America

[Speakers]
- Dr M. Firman, DG Watershed, Forest and Environment, Ministry of Environment and Forestry, Indonesia
- Mr Nyoman Suryadiputra, Director of Wetlands International, Indonesia
- Ms Benjamas Chotthong, Thailand Environment Institute, Thailand
- Mr Joseph Tangah, Sabah Forestry Department, Malaysia
- Mr Lokossou Achille Orphée, Management of Forests and Natural Resources, Ministry of Environment, Benin

[Moderator]
Dr Luiz Drude de Lacerda, Brazil

Summary of the presentations

In his keynote address, **Dr Richard A. MacKenzie** spoke on the subject of "mitigation of climate change through more effective rehabilitation of degraded and deforested mangroves". He said that mangroves and tropical wetlands store 3-5 times more carbon than any other tropical or temperate ecosystem. Mangrove restoration requires ecological and hydrological assessments of plantation sites and the implementation of appropriate planting techniques to ensure success. Successful restoration also requires the involvement of local communities and a true understanding and accommodation of land tenure. Mangroves restored through planting will develop carbon stocks comparable with naturally regenerated intact mangrove ecosystems over a period of 30-40 years and offer similar ecosystem services. The Institution of Pacific Islands Forestry, USA, has developed a mangrove restoration support that shows flow charts of activities and stakeholder involvement. The tool currently looks only at carbon stocks, and other ecosystem services such as biodiversity will be added as more knowledge is gathered through research.

Dr M. Firman, presenting his paper titled "Mangrove ecosystem management policy in Indonesia", said that more than half Indonesia's mangroves are partially or severely degraded. Mangrove ecosystems face threats from human activities and from natural causes such as tsunamis. Shrimp farming is one of the major drivers of mangrove degradation. The central thrust of Indonesia's approach is to maintain existing mangroves that are in good condition and to restore and rehabilitate degraded mangroves. A number of regulations have been put in place to ensure good mangrove management. Mangrove maps showing the status of degradation are being generated to assist in national-level planning for the rehabilitation of degraded mangroves. Mangrove working groups have been established at the national, provincial and district levels to assist in the implementation of the rehabilitation strategy, and a number of programmes have been developed by the Ministry of Environment and Forestry. The ASEAN Mangrove Network, which was established in 2012 with support from the Japan International Cooperation Agency, encourages cooperation among ASEAN countries on the sustainable management of mangroves.

Mr Nyoman Suryadiputra spoke on the subject of "restoring degraded coastal mangrove areas in Banten Bay Indonesia using sediment traps". He said that Indonesia has 3.2 million hectares of mangroves, which is 23% of mangroves worldwide, with an estimated carbon stocks of 3.14 billion tonnes. The concept of "silvo-fishery ponds" has been developed in Banten Bay to create environmentally friendly ponds. Sediment is trapped step by step using old fish nets, sand bags and bamboo poles, starting close to the eroded coast line and then extended further as earlier trapped sediments become more stable. These stable sediments act as new mangrove habitats, which can be colonized naturally if mature mangrove trees are available in the vicinity. Local communities can easily implement this simple technology, provided there is capacity building and a certain level of technical supervision.

In her presentation titled "Secure coastal ecosystems, secure communities in tsunami-affected areas", **Ms Benjamas Chotthong** spoke about the rehabilitation of mangroves damaged by the 2006 tsunami through community-based coastal resource management approaches under an ITTO project on mangrove rehabilitation. The project involves the integrated coastal resource management of 3688 hectares, focusing on capacity development, training local government officers and community leaders, and socio-economic incentives through the development of high-value biological products from mangroves. Increasing the awareness and involvement of local communities is crucial for mangrove rehabilitation.

Mr Joseph Tangah presented his paper titled, "The SFD & ISME collaboration on rehabilitation of degraded mangroves in Sabah: a success story towards sustainable forest management". He said that about 58% of mangroves in Malaysia are in Sabah, covering an area of 281 375 hectares, of which about 3300 hectares have been illegally encroached and occupied. Mangroves in Sabah are designated as forest reserves and zoned in protection classes. A mangrove restoration programme, based on an assessment of forest cover began in Sabah in 2005. The private sector provides support for rehabilitation projects in Sabah, and local communities and other members of the public are encouraged to participate in the planting programme. The main drivers mangrove of loss and degradation are encroachment, human settlement and agriculture, including oil palm. Rehabilitation projects have been successful due to the support of local governments, civil society, ISME and other stakeholders. Most large shrimp farms established in the past involves legally alienated lands; they are outside forest reserves and are thus not included in rehabilitation efforts. The rehabilitated mangrove forests will prevent further erosion along the waterways and create an environment conducive to mangrove establishment. In the long run, this collaborative project will prove beneficial to all stakeholders in mangrove ecosystems and restore valuable mangrove forests throughout Sabah's wetlands.

Mr Lokossou Achille Orphée spoke on the "restoration and sustainable management of mangroves in Benin", most of which have been severely degraded in recent decades due to overexploitation for timber and fuelwood and their extent reduced by more than 60% through diversion for agriculture, salt production and urban and transport infrastructure. The management of mangrove ecosystems requires a decentralized governance approach with the active participation of local communities. National synergy in the implementation of various multilateral environmental agreements is required for the restoration and sustainable management of mangroves by way of integrating sustainable mangrove management into national policies, action plans and development strategies. National strategies for restoring mangrove ecosystems in Benin include the creation of marine and coastal protected areas, the restoration of degraded mangroves and the integration of mangrove rehabilitation and sustainable management into national development efforts. The Benin government is also promoting eco-tourism as one of its flagship programmes, involving the development of seaside resorts in managed mangrove ecosystems.

Key messages and recommendations

- The starting point for restoring degraded mangrove areas should be the preparation of integrated management plans based on an area's bio-geophysical background and environmental history. These plans should be prepared by qualified mangrove professionals with the full collaboration of local communities and local governments, and they should incorporate the development of viable alternative livelihoods for mangrove-dependent families.
- Abandoned shrimp ponds form an important potential restoration site for mangroves and incentives are needed that are attractive to the owners of these ponds and yet are financially sustainable.
- Many restoration projects have failed due to a lack of ecological assessment of the selected sites. Proper techniques should be employed based on the ecological characteristics of the sites to ensure their success. Local knowledge should be used to enhance the effectiveness of new innovative techniques for restoring mangroves areas.
- The empowerment of women and their participation in the preparation, execution, monitoring and governance of restoration initiatives, will increase the chances of success.
- Enhancing the capacity of local participants is important for ensuring the sustainability of projects when funding and the involvement of external technical expertise cease.
- Wherever feasible, the well-recognized role of mangroves in mitigating and adapting to climate change should be used to attract funding for mangrove restoration.

Rapporteurs: Dr Aulia A. Aruan, Indonesia and **Dr Samsudin Musa**, Malaysia

Theme 5:
Strengthening good governance, law enforcement and monitoring systems

Governmental agencies, such as departments of forestry, fisheries, coastal planning, agriculture, environment and marine parks, have overlapping jurisdictions over coastal resources, and their policies often conflict. This session addressed lessons learned in mangrove governance and the experiences gained and challenges encountered. There is often a need to strengthen law enforcement against illegal activities, as well as to improve monitoring systems for assessing progress in the sustainable management of mangrove ecosystems.

[Keynote speaker]
- Mr Istanto

[Speakers]
- Dr Dan Friess, Department of Geography, National University of Singapore
- Dr Monika Ruwaimana, Universitas Atma Jaya Yogyakarta, Indonesia
- Mr Ruhuddien Pandu Yudha, PT Bintuni Utama Murni Wood Industries, Indonesia
- Dr Dixon T. Gevana, University of the Philippines, Los Banos, Philippines
- Dr Victor Kwame Agyeman, Director General, Council for Scientific and Industrial Research, Ghana

[Moderator]
Dr Hadi S. Pasaribu,
- Chairman, Forest for Life-Indonesia Foundation, Indonesia

Summary of the presentations

In his keynote address on the importance of good governance, judicious law enforcement, and the need for high-quality monitoring, **Dr Hadi S. Pasaribu** said that, with as many as 1.3 million hectares of degraded mangroves, mostly due to illegal logging and encroachment, environmental law enforcement including forest laws and regulations is a top priority for the Indonesian government. Three strategic steps have been taken: good environmental governance, affirmative actions, and environmental political leadership. A special task force is being developed to improve law enforcement in the environment and forest sectors. Affirmative actions imply that law enforcement must be conducted consistently and equitably to create a deterrent effect. Another important initiative is capacity building in the judiciary through the introduction of an environmental certification programme by the Supreme Court, and ramping up the commitment and quality of the verdicts by applying the principle of *in dubio pro natura* ("When in doubt, in favour of nature") for environmental justice. It is necessary to actively involve public participation in law enforcement to strengthen the supremacy of law. Ultimately, the analysis indicated that a sound and judicious enforcement of good laws should be able to change people's behaviour.

Dr Dan Friess presented his paper titled, "Rates and causes of mangrove deforestation in Southeast Asia from 2000 to 2012". He said that, although it is often claimed that the mangroves of Southeast Asia are being lost at the rate of 1-3% annually, two recent studies in the region have suggested that the rate between 2000 and 2012 was about 0.2% per year. The main drivers of mangrove loss vary between countries, but aquaculture is still the leading cause in many countries, followed by rice and oil-palm cultivation. Although mangrove deforestation may have declined recently, mangroves are still under threat because governments have set ambitious targets to produce more palm oil and aquacultural and agricultural products. The good thing is that the world is now more prepared to make informed management and policy decisions to better protect mangroves.

Dr Monika Ruwaimana spoke on the "comparison of satellite and drone imagery for mangrove mapping". She said drone photography has both advantages and disadvantages over satellite imagery, and she made comparisons of total costs, image clarity and the ability to work in different weather conditions. Drones have huge potential as a new research and monitoring tool, especially for areas less than 100 hectares in size, which are often most vulnerable to both deforestation and degradation.

Mr Ruhuddien Pandu Yudha, speaking on the subject of "FSC-certified sustainable mangrove forest management best practices", presented his experiences of best practices in the sustainable management of mangrove forests in West Papua involving local communities. He said that mangrove forests can be used sustainably, as shown in a Forest Stewardship Council-certified operation by a company in Indonesia, which is producing 2.9 million m^3 of wood chips per year. The company has adopted five pillars to ensure sustainability: 1) compliance with laws and regulations; 2) the adoption of a sustainable silvicultural system; 3) sustained economic development of the area; 4) environmental management backed by sound monitoring and research; and 5) genuine community and stakeholder engagement. Economic value is the key driver of sustainability because it enables social and environmental improvement. However, government policies on mangroves make products costlier to produce compared with competing monoculture plantation forests.

Dr Dixon Gevana presented a paper titled "Community-based mangrove management in the Philippines: Experience and Challenges of Forest Governance in the context of Climate Change". He said major issues with community-based mangroves management are elusive tenure rights, insufficient alternative livelihoods, a lack of motivations for participation in reforestation, poor ecological considerations when doing reforestation, and deficient coastal land-use-zone planning and management. Community-based mangrove will only be successful, he said, if the community understands that mangrove management can provide goods and services now and well into the future.

There are often overlaps in policies on mangrove use rights, leading to conflicts and a loss of faith in the intentions of government; therefore, this needs to be reviewed as a priority. A national policy forum to discuss important technical, legal and socio-economic issues in sustainably managing mangrove forests would be helpful.

In presenting his paper titled "Community-based mangrove management as inspiration for effective national policy development", **Dr Victor Agyeman** argued that national policies on mangroves should be formulated based on integrated public consultation processes with strong stakeholder engagement. Institutions involved in managing mangroves should be more transparent and accountable. Laws that prohibit mangrove use may not be effective conservation tools on their own, and they should be complemented by policies that increase the benefits local communities obtain from the resources. Strong civil-society and media advocacy and scrutiny of policy development and implementation are essential for conservation success.

Key messages and recommendations

- Relevant government agencies and stakeholders should work together to establish sound policies and laws. This may require co-ordination by a single authority of the activities of diverse actors.
- Law enforcement must be conducted consistently and equitably to create a deterrent effect. Intense efforts to build capacity are required, not only for law enforcement personnel but also for members of the judiciary through environmental certification programmes.
- The judicious application of the precautionary principle of *in dubio pro natura* will help improve the quality of environmental justice.
- Enforcement officers from relevant government departments usually have the mandate and authority to halt the illegal harvesting of forest products and illegal fishing. Audits should be undertaken to assess their effectiveness and to make recommendations for improvements to be incorporated in management plans.
- A lack of clarity on mangrove use rights leads to conflicts and a loss of faith in the intentions of government and. Use rights, therefore, need to be reviewed as a priority.
- More precise data are needed to accurately monitor mangrove deforestation. Drone technology offers a promising new research and monitoring tool.
- Mangrove conservation does not exclude harvesting, and mangroves can be used sustainably through strict adherence to good forest practices. Appropriate silvicultural systems need to be developed for mangrove ecosystems.

Rapporteurs: Ms Yani Septiani, Indonesia and **Mr Barney Chan**, Malaysia

Theme 6:
Scaling up payment for environmental services in mangrove forests

Various initiatives are helping to raise awareness of the important environmental services provided by mangrove forests and the need to pay for these services. Mangrove-based ecotourism operated by local communities and the private sector is increasing in many tropical countries; in Indonesia, the certification of mangrove forests has shown promise in recent years. The many environmental values of mangrove ecosystems, methodologies for their valuation, experiences in developing PES schemes, and policies and legal frameworks for increasing demand for the environmental services provided by mangrove forests were the focus of discussions under this theme.

[Keynote speaker]
Dr Patricia Moreno-Casasola, Institute of Ecology, Mexico

[Speakers]
- Mr Ben Brown, Charles Darwin University, Australia
- Dr Leni D. Camacho, University of the Philippines Los Baños, Philippines
- Dr Vien Ngoc Nam, Faculty of Forestry, Nong Lam University, Viet Nam
- Mr Daniel Coronel, Alternate Development Mechanisms, Lima, Peru
- Ms Leah Glass, Blue Ventures, Blue Carbon and Coastal Communities, Madagascar

[Moderator]
Ms Akiko Nakano, Deputy Director, Biodiversity Policy Division, Ministry of Environment, Japan

Summary of the presentations

In her keynote address, **Dr Patricia Moreno Casasola** spoke on "mangroves and freshwater flooded forests, their value to society" in the context of Mexico. She said that mangroves and other wetland ecosystems such as swamps and marshes are of crucial importance in regulating the impact of floods. Mapping the economic values of services provided by these wetlands is a helpful tool in decision-making and policy making. Considerable work has been done to establish PES schemes in Mexico and elsewhere, but much ground is yet to be covered. PES schemes need greater clarity on the quantity and quality of services on offer over what period. There is also a need to identity the real producers of these services, distinguishing those who actively work (or otherwise make economic and other sacrifices) to maintain these services from those who merely own rights to the wetlands. Research on PES schemes must relate to real programmes that bring incomes to poor communities.

Mr Ben Brown, presenting his paper "Building consensus for climate compatible development in the Lorentz Lowlands, the world's most productive mangrove and tropical lowland swamp forest landscape", said that, in several communities, there are strong cultural links to mangroves as homes of their ancestors. Conflicting interests between the cultural preferences of communities and the need for economic production, therefore, need to be addressed with empathy. Mangrove benefits, if properly managed, can offer local communities with many economic opportunities. By one estimate, 1 hectare of mangrove forests provides US$ 2240 worth of ecosystem services every year by way of food, wood and carbon to local communities. Capacity building for more effective mangrove management is needed to fully harness these benefits, and social forestry through co-management between government and local communities offers a good approach for sustainable mangrove management.

Dr Leni D. Camacho gave a presentation on the "economic valuation for sustainable mangrove ecosystems management in the Philippines". She said that, as of now, only limited science-based tools and initiatives are available for in accounting for the values of mangrove ecosystems. The economic valuation of mangroves should include both extractive and non-extractive uses. Mangrove tourism could give significant additional income to local communities who would be incentivized to sustain ecosystem services. Government policies should encourage mangrove conservation by promoting non-wood-based livelihoods, and policies that constrain the use rights of local people over the mangroves they planted should be reviewed. Dr Camacho estimated that the total economic value of mangroves from recreation, biodiversity, woodfuel and marine catch could be more than US$1000 per hectare annually.

Dr Vien Ngoc Nam, presenting a paper titled "Mangrove payment forest ecosystem services in Ca Mau Province, Viet Nam", said that PES was an effective approach for conserving mangroves. PES revenues could serve to reduce the burden on the exchequer in managing this resource while also increasing household income. Designing an effective and judicious PES scheme is a difficult task, however, because it needs a lot of negotiations between government, local communities and private entities in the face of many uncertainties about valuation processes. In the case of a PES pilot in Ca Mau in Viet Nam, private companies benefiting from ecosystem services provided by mangroves are required to pay US$200 per year to communities in return for protecting mangroves. This pilot is expected to provide the basis for developing a national PES policy framework on mangroves in Viet Nam.

Ms Leah Glass, presenting her paper titled "Blue carbon and coastal communities: lessons learned from the implementation of mangrove carbon projects in Madagascar", said that the biggest cause of mangrove deforestation in Madagascar was increasing local and regional charcoal demand. A clear understanding of tenure arrangements is crucial for setting up blue-carbon projects in poor communities wary of losing what little they have. Early economic returns are also essential for attracting these communities. Project modelling and forecasting, including benefit-sharing scenarios, opportunity costs, and the challenges of dealing with volatile markets, are crucial for the success of projects. Project designs should consider project size, leakage, alternative livelihoods and integration with sustainable fisheries management.

Key messages and recommendations

- Mangrove ecosystems have huge economic value that is usually underestimated because the many indirect benefits and co-benefits are rarely taken into account.
- Payments schemes for ecosystem services face many challenges, including in the methodologies for, and policies on valuation; tenure; uncertainty on carbon price; the willingness of beneficiaries to pay; equity considerations; certification requirements; and funding.
- PES schemes must take into account the social, cultural and ethnic diversity of local communities dwelling inside and adjacent to mangrove forests.
- PES schemes should provide clarity on the quantity and quality of services on offer, as well as their timespan. There is a need to identity the real producers of these services, distinguishing those who make sacrifices to maintain the services from those who own rights over lands containing mangroves.
- Capacity building is needed among relevant government staff and in communities to increase the effectiveness of mangrove management in providing ecosystem services.
- The role of mangroves in coastal protection deserves more attention in the preparation of climate-change adaptation plans. The use of natural coastal protection should be encouraged, and this can form part of the funding mechanism for PES schemes.
- There is an urgent need to take the initiative to move forward. Piloting PES schemes will generate useful lessons, which can be conveyed to other countries.

Rapporteurs: Ms Retno Suratri, Indonesia and **Dr Dixon T. Gevaña,** Philippines

Theme 7:
Increasing research, education and awareness

Speakers, and other conference participants highlighted the need for intensive research to enhance understanding of all aspects of mangrove ecosystems, such as the carbon cycle, the impact of various silvicultural techniques on productivity and sustainability, and regeneration techniques. Research is a powerful tool, but it requires considerable investments of money and human resources, and often considerable time, to yield results. Presentations on the theme covered innovative research on ecological resilience, silvicultural interventions for sustainable mangrove management, and the various uses of wood and non-wood mangrove products.

Summary of presentations

[Keynote speaker]
- Dr Jurgenne Primavera, Chief Mangrove Scientific Advisor of the Zoological Society of London, the Philippines

[Speakers]
- Dr Promode Kant, Director, Institute of Green Economy, India
- Mr Muljadi Tantra, Green Forest Product and Tech. Pte Ltd, Singapore
- Dr Adji Sapta, TOYOTA-Indonesia
- Dr Noriaki Sakaguchi, JICA, Japan
- Dr Antonio Villa-Lopera, biologist, Colombia

[Moderator]
Dr Mami Kainuma, ISME

In her keynote speech, "Mangrove rehabilitation in the Philippines: science vs quotas", **Dr Jurgenne Primavera** said that mangrove rehabilitation and conservation should be science-based and not driven by quotas or budgets. Highest priority should be given to the reversion of abandoned fish and shrimp ponds. When planting on seafronts, it is important to choose the right sites and to plant resilient species such as *Avicenna marina* and *Sonneratia alba*. Rehabilitation success should be rated by the area restored rather than the number of seedlings planted. Dr Primavera stressed the importance of engaging local communities, including youth and school children, in the rehabilitation process

Dr Promode Kant presented a paper titled "Development of a new marine silvicultural system in India for short rotation marketable biomass production and uninterrupted ecosystem services". He said that pertinent questions in this regard are: Is harvesting possible without affecting ecological services? Will it help increase productivity? Can it be done without increasing the vulnerability of ecosystems and communities? Younger trees are more resilient to climate change and less vulnerable to insects and disease, and the policy of no harvesting in mangroves would render them old and more vulnerable to global warming. Appropriate site-specific silvicultural approaches are needed to keep mangroves in a vigorous condition while also meeting timber and fuel demands.

Mr Muljadi Tantra, speaking on the topic of "value development of mangrove forest in Southeast Asia", said that mangroves can be sustainably harvested and developed for value-added wood products such as charcoal and woodchips within the regulatory framework. Mangroves have shown sustainability under a 30-year rotation; with good management, a mean annual increment upward of 9 tonnes per hectare per year can be achieved. With low moisture content of about 35% and high specific gravity, the cost of drying per unit weight is low. Mangrove harvesting also has a small environmental foot-print, with a harvest yield of over 200 tonnes per hectare, a gross calorific value of 4630 kilocalories per kilogram when air-dried, and a net calorific value of 3800 kilocalories per kilogram. Because most mangrove ecosystems are naturally homogeneous, they can be "selectively" harvested while maintaining bio-diversity.

Dr Adji Sapta spoke on "the implementation of the Toyota Forest Program, Mangrove for Life, in North Java Island". He said that mangrove planting in West Java, Central Java, East Java and Bali has been undertaken under Toyota's "one car one tree" programme, and more than 1 million mangrove trees have already been planted. This successful rehabilitation project funded by Toyota through its corporate social responsibility programme has been ongoing since 2001.

Dr Noriaki Sakaguchi, speaking on "JICA's cooperation for the conservation and sustainable use of mangroves", said that the overall goal of JICA's Strategic Themes in Nature Conservation over the period 2015-2020 is harmonization between nature conservation and human activities. The three strategic themes address climate change through sustainable forest management, the enhancement of livelihoods in vulnerable communities through sustainable natural resource use, and biodiversity conservation through the management of protected areas and their buffer zones. The rehabilitation of mangrove ecosystems falls primarily under the first two strategic themes and, to a limited extent, also the third theme. The goal of the JICA project, "Mangrove ecosystem conservation and sustainable use in the ASEAN region", is to establish a cooperation mechanism to share good practices and lessons learned in the ASEAN region.

Mr Antonio Villa-Lopera spoke on "the need for a formal, funded and long-term action plan on mangroves". He said that the world needs to act quickly and more effectively and in a coordinated manner because mangroves are being lost at a rete of about 150 000 hectares per year, resulting in the loss of 225 000 tonnes of potential carbon sequestration, at the rate of 1.5 tonnes of carbon per hectare per year. Further, disturbed mangrove soils release an additional 11 million metric tonnes of carbon annually. Mr Villa-Lopera said that, for the necessary actions to happen, leadership is needed at the global and regional levels to inspire greater cooperation and coordination in the execution of agreed short-term, medium-term and long-term action plans with the desired objectives.

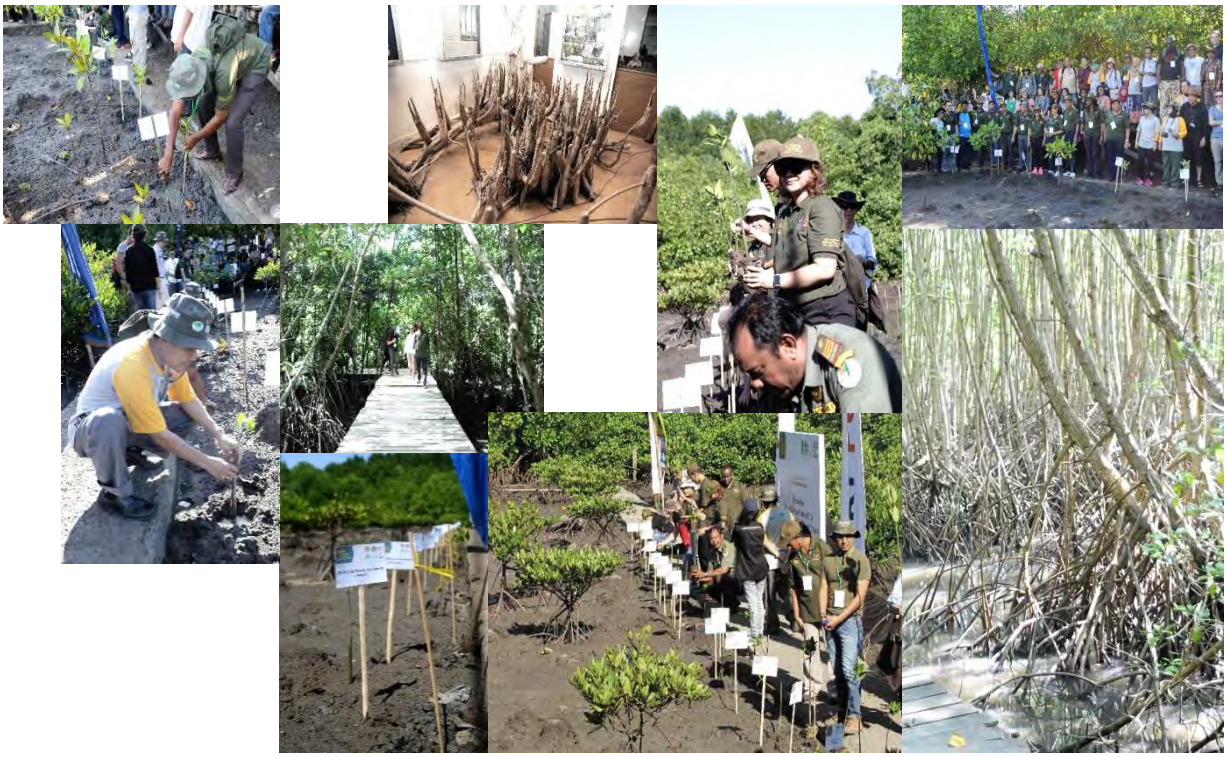
Key messages and recommendations

- Mangrove rehabilitation and conservation should be science-based and not quota- or budget-driven. Assessments of restoration success should be based on area restored rather than the number of mangrove propagules or other planting materials planted.
- The reversion of abandoned fish and shrimp ponds in mangroves should be prioritized over seafront planting.
- Mangroves should be sustainably harvested within a regulatory framework so as not to diminish the ecological services offered by them. To the extent possible, harvested mangrove wood should be used for making value-added products such as charcoal and woodchips that bring substantial incomes to local communities.
- Long-term monitoring of mangroves and systematic collection, publication and dissemination of data are important prerequisites for effective global action to rehabilitate mangroves in all suitable coastal areas in the tropics.
- It is important to engage local communities, including youth and school children, in the rehabilitation process. This is best done for youth and children by raising awareness about the crucial role of mangrove ecosystems in the welfare of human societies and by providing adequate financial and other incentives.
- The private sector should be encouraged to provide funds for mangrove rehabilitation under their corporate social responsibility programmes.
- The conference recommends that, as priorities, research is undertaken on the use of drones in mapping and monitoring mangrove forests and restoration areas, determining fish diversity in pristine and disturbed mangrove ecosystems, the valuation of the full range of mangrove ecosystem services, and mangrove carbon stock assessment. Mangrove restoration using sediment traps and high-density plantings of mangroves are useful projects that should be encouraged and supported.

Rapporteurs: Mr Yus Rusila Noor, Indonesia and **Dr Maung Maung Than,** Myanmar

FIELD VISIT

Conference participants took part in a field trip to the Mangrove Information Center in the Ngurah Rai Grand Forest Park, Bali, on the afternoon of 20 April. The centre was established with financial support from JICA in 2003 for the study and preservation of the region's mangrove forests. Participants then visited a nearby mangrove forest that was rehabilitated on the site of abandoned shrimp ponds in 1992–1996 as part of a JICA project titled "Establishing appropriate silvicultural techniques and sustainable models for mangrove ecosystem management in Indonesia". The project received technical guidance from ISME's Professor Shigeyuki Baba.



Rapporteurs: Mr Yus Rusila Noor, Indonesia


INTERNATIONAL CONFERENCE
ON SUSTAINABLE MANGROVE ECOSYSTEMS
18 - 21 April 2017
Bali, Indonesia

PANEL DISCUSSION

Eight panellists-**Agus Justianto, Daniel Murdiyarso, Sanjana Lal, R.M.D Alwathugoda, Cecile Ndjebet, Patricia Moreno-Casasola, Richard Mackenzie and Mulzadi Tantra**-participated in a panel discussion titled “The way forward: managing a vital resource for achieving the SDGs and the Paris Agreement”. The discussion, moderated by **Dr Hwan Ok Ma**, was framed by the following four guiding questions:

1) How can mangroves contribute to the achievement of the SDGs and the Paris Agreement?
2) What makes a successful mangrove strategy at the local, national and international levels?
3) How can the strategy be put into action and what should be the priority?

Dr Agus Justianto, Senior Advisor to the Indonesian Ministry for the Environment and Forests said that although mangroves cover 3.5 million hectares in Indonesia, less than half the estate was in good condition. Mangroves could contribute to the achievement of several of the SDGs, including by way of food security. In relation to the Paris Agreement, mangroves sometimes present a situation of conflict between use and carbon storage, and a way has to be found so that the harvesting of this important local resource does not reduce its mitigation potential. The impact of climate change on mangroves is also a serious concern, which needs collaborative research by leading global institutions.

Dr Sanjana Lal, from Fiji, said that the Pacific islands were most vulnerable to climate change, but little action by the global community to mitigate the situation was visible. She hoped that, as Chair of the 23rd Conference of the Parties to the United Nations Framework Convention on Climate Change, her country would be able to bring the outcomes of this conference to the notice of the global community so that the world could move forward on the matter at the highest political level. Fiji has only about 55000 hectares of mangroves, but these are very important for reducing the vulnerability of its coastline, along which most people live.

Dr Muljadi Tantra spoke of SDG 6, which relates to clean water. He said that mangroves help protect fresh waters resources from salinization in coastal regions. Mangroves could also contribute to the achievement of SDG 7 relating to clean energy because just 1 kilogram of mangrove biomass could provide enough energy to light 50 bulbs for 1 hour.

Dr Daniel Murdiyarso reflected on SDGs 13 (climate action), 14 (life below water) and 15 (life on land). Wetlands are still reported under Land Use, Land-use Change and Forestry, but this is set to change with the new guidelines of the Intergovernmental Panel on Climate Change. The Paris Agreement places high importance on adaptation, particularly for developing countries. Loss and damage is a binding clause, and it would be useful for developing countries to uses it in relation to the mangroves. Access to global public finance remains a major concern. The Special Climate Change Fund is meant for least-developed countries, which could use this fund for mangrove restoration. Carbon markets are important for providing stability to carbon prices, and developing countries should not ignore them. Promoting sustainability has several dimensions, of which the financial dimension is no less crucial.

Dr. Cecile Bibiane Ndjebat spoke on the importance of engaging local communities and women for achieving sustainability. Their financial, managerial and technical capacities need to be built up and tenures have to be secured. The thrust for sustainability comes from inside and it grows best when this internal urge gets outside support. Mangroves cannot sustain without support of women and other marginalized groups. Mangroves will be safe if they continue to be utilized for energy sustainably because then the support of women for their survival would be assured.

Dr. Patricia Moreno-Casasola from Mexico emphasized the criticality of coordination between actors. Decision makers living in cities should know what mangroves mean for the lives of poor people living along the coasts. Local communities need to know what would happen without mangroves and it would be useful to celebrate a World Mangrove Day every year for this purpose.

Ms. R M D Alwathugoda stated that in Srilanka the rehabilitation of mangroves is a part of the ongoing task of rehabilitation of degraded areas. There is an urgent need is to protect the mangroves through a judicious balance in allocation of coastal land resources for conservation and development. There was a need to formulate a national mangrove policy and mangrove management plans.

Dr. Richard Mackenzie of US Forest Service said the first priority area is trying to develop science based restoration activities since restoration often fails because it is not based on science. Inclusion of women, and communities as a whole, at all levels to get their fullest support for rehabilitation efforts is an important prerequisite for success. Financing is more than just making money available, monitoring should be a very important component of it because often it the only thing that separates success from failure.

Key Messages of Panel Discussion

- Notwithstanding big targets for restoration of mangroves by 2020 in several developing countries under climate change related commitments very little has actually been achieved so far
- Mangroves restoration is an important aspect of financing policies of most global funding mechanisms like the GCF, GEF and the SCCF and yet little money has yet been disbursed in most mangrove territories
- Inclusion of women, and of the communities as a whole, at all stages of planning and implementation is critical to the success of restoration
- Tenure concerns of the community should be addressed with empathy failing which strong opposition to restoration efforts is likely to build up among the local communities
- The ecological health of mangrove habitats is of high importance in their functioning as breeding grounds for marine life and thereby enhancing marine catch of fishing communities and ensuring food security
- Mangrove ecosystems act to reduce the ingress of ocean salinity into coastal freshwaters and thereby serve to increase access to good quality water to the coastal communities
- Mangrove conservation should not result in ban on harvesting of this important local resource for household energy. Sustainable production of mangrove biomass for local usage should be made part of the conservation strategy
- Mangroves are one of the most important sinks for carbon and attempts should, therefore, be made to link them with the evolving international and domestic carbon markets to encourage private investment and bring additional benefits to the local communities
- Mangroves reduce vulnerability of the coastal lands and communities to tropical storms and are, therefore, an important climate change adaptation tool making them an attractive target for international financing for adaptation to climate change. This fact should be kept in consideration during restoration planning
- Restoration should be science based for ensuring its success. This would require adequate human and financial investment in ecological and silvicultural research on mangroves.
- Capacity building of the concerned institutional personnel and of the local communities is of high importance for the success of mangrove restoration efforts

- Monitoring is a key requirement for ensuring success of the restoration processes and restoration financing should invariably be linked to robust monitoring that appropriately involves local communities, too

- Multiple uses of mangrove ecosystems means a range of stakeholders in their management and co-ordination of their activities is of high importance in sustainable management of this resource. A common body is required to ensure the engagement of these actors in a well-coordinated manner.

- Mangrove conservation and restoration needs a sound and sustained awareness campaign to ensure widest public support. For this campaign to be effective right messages need to be delivered on the right media for the right target

Rapporteurs: Mr. Yus Rusila Noor, Indonesia and **Dr. Promode Kant**, India


CONFERENCE


Mangroves 2017
Closing Session
13:30-15:00, 21 April

BALI CALL TO ACTION

The Conference adopted the **Bali Call to Action for Sustainable Mangrove Ecosystems** at the conclusion of the conference:

International Conference on Sustainable Mangrove Ecosystems

Making a vital resource for achieving the SDGs and the Paris Agreement

As a matter of urgency, we, the 272 participants from 25 countries attending the International Conference on Sustainable Mangrove Ecosystems, held on 18–21 April 2017 in Bali, Indonesia, urge policymakers, land-use planners, mangrove practitioners and scientists, international organizations, the private sector, donors and coastal communities to redouble their work to ensure the conservation, restoration, protection and sustainable management and use of the world's remaining mangrove forest ecosystems.

Mangroves provide many goods and ecosystem services essential for the livelihoods of coastal communities, including sustaining fisheries, conserving biodiversity, and storing among the highest densities of carbon of any ecosystem globally. Mangroves cover about 15 million hectares but are under threat worldwide, with the total area declining by at least 20% since 1980. At least one-quarter of surviving mangroves are moderately to severely degraded.

Evidence and case studies presented at this conference demonstrate that, with adequate investment, sustainable mangrove management can play a significant role in conserving and enhancing carbon sinks, enabling adaptation to climate change, and achieving the UN's Sustainable Development Goals 5, 13, 14 and 15.

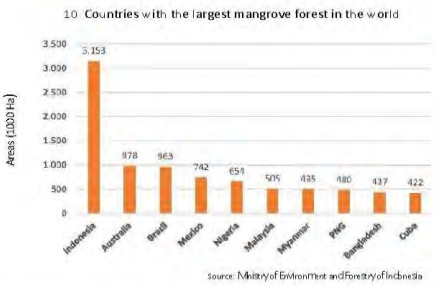
The conference has also shown the leading role of women in the restoration and rehabilitation of mangroves worldwide and the importance of involving local communities in sustainable mangrove management.

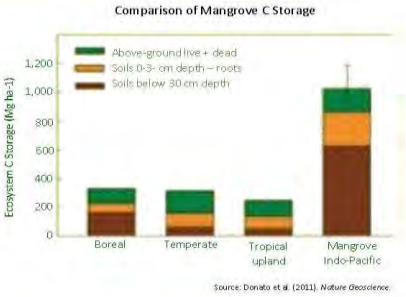
Greater national and international efforts should be made and more funding provided, therefore, for mangrove conservation, restoration and sustainable management and use. Countries and those responsible for mangrove resources are invited to consider and implement the following key measures, if appropriate, to help ensure that mangrove ecosystems are protected, expanded and managed sustainably for the benefit of coastal communities, countries and the global environment.

Ministry of Environment and Forestry of Indonesia
International Tropical Timber Organization
International Society of Mangrove Ecosystems

Key Messages

1. **Prioritizing the conservation and sustainable management and use of mangrove ecosystems** in national policies, laws and regulations at all levels of government, and strengthening law enforcement to reduce the continuing loss and degradation of mangrove ecosystems.
2. **Promoting sound land-use planning, clarifying land tenure and user rights for communities** with consideration for cultural sensitivity, and ensuring the effective involvement and empowerment of local communities, especially women.
3. **Promoting effective mangrove restoration** through the improved assessment of degraded and deforested mangrove ecosystems, science-based decision-making to identify the best estoration strategies and practices, and long-term monitoring and management to determine and improve the overall success of restoration programmes and increase productivity.
4. **Facilitating access to international financing mechanisms as well as national public and private-sector sources** to scale up mangrove-based climate-change mitigation and adaptation and enhance the resilience of coastal regions and communities.
5. **Generating and disseminating knowledge** on the causes, patterns and consequences of change in mangrove ecosystems at the local to globe scales, reporting on the status of mangrove management worldwide, and raising awareness of the vital importance of mangrove ecosystems to planetary well-being.





We thank the government and people of Indonesia and the Province of Bali for their kind hospitality in hosting the conference which was organized jointly by ITTO, MoEF of Indonesia and ISME with the support of many partners includingCIFOR, FAO, USFS and AFoCo as well as proactive mangrove related civil society groups and the private sector in Indonesia. We also thank the governments of Japan and the USA for their generous contributions to ITTO that allowed the conference to take place.

POSTERS

The titles, authors and affiliations of the 16-posters displayed at the conference are listed below.

Titles of posters and authors with affiliations

- A challenge to support mangrove rehabilitation by drone, **Shin Watanabe[1], Shoichiro Uchiyama[2], Joseph Tangah[3], Toyohiko Miyagi[4]** and **Shigeyuki Baba[5]** [1]Iriomote Station, University of the Ryukyus, Taketomi, Okinawa, Japan; [2] National Research Institute for Earth Science and Disaster Resilience, Tsukuba, Ibaraki, Japan; [3]Sabah Forestry Department, Sandakan, Sabah, Malaysia; [4]Tohkoku Gakuin University, Sendai, Miyagi, Japan; [5]International Society for Mangrove Ecosystems, Nishihara, Okinawa, Japan
- A criteria and indicators approach to sustainable mangrove management: Towards a participatory governance framework, **T. Cadman** and **T. Maraseni** Institute for Ethics, Governance and Law, Griffith University; Institute for Agriculture and Environment, University of Southern Queensland, Australia
- Assessment of ecosystem carbon stocks and land cover changes of Kubu Raya mangrove forests in West Kalimantan, Indonesia **Haruni Krisnawati, Wahyu C. Adinugroho, Rinaldi Imanuddin** and **Daniel Murdiyarso** Forest Research and Development Center, Research, Development and Innovation Agency, Ministry of Environment and Forestry, Bogor, Indonesia
- Community participation: an option for the conservation and restoration of the mangrove forest in Guatemala, **M.M. Velásquez Villatoro** University of San Carlos de Guatemala, University Center of Nor-Occidente, Aldea Chivacabé, Guatemala
- Community-based restoration and sustainable management of mangroves in Fiji: Past and present, **Sanjana Devi Lal** Ministry of Fisheries and Forests, Suva Fiji
- Ecological and economic evaluation of mangrove forest resources: case study in the Ngurah Rai Forest Park, Bali, **Hamiudin Hamiudin[1]** and **Rachmad Firdaus[2]** [1] Division of Forestry, Forestry Service of Bali Province Government, Indonesia; [2] Division of Forestry Governance, Coordinating Ministry for Economic Affairs, Indonesia
- Mangrove plantations for manifold benefits: a case study in Gujarat, India, **Bharatkumar Jethva,** Technical Advisor, ISME Mangrove Plantation Project, Gujarat, India
- Mangrove reforestation through scaling up community forestry in the Ayeyarwady Delta of Myanmar, **Maung Maung Than** Country Program Coordinator, RECOFTC, Myanmar
- Mangrove restoration in fish pond areas of Sembilang National Park, South Sumatra, Indonesia, **Tengku Zia Ulqodry[1], Rujito Agus Suwignyo[2], Mudi Yuliani[3], Sarno[1]** and **Heron**
- Mapping mangrove forest cover using Landsat 8 imagery and Google Earth engine algorithm for entire Cambodia, **T. Tieng[1], S. Sharma[2,3]** and **R.A. MacKenzie[3]** [1] Asian Institute of Technology, Thailand; [2] University of Hawaii, Honolulu, Hawaii, USA; [3] USDA Forest Service, Institute of Pacific Island Forestry, Hilo, Hawaii, USA
- Molecular identification of Sonneratia ovata and *S.* x *hainanensis* in the northeast of Sabah, Malaysia, **Mami Kainuma[1,2,3], Isabel Colin[2], Shigeyuki Baba[1], Chan Hung Tuck[1], Joseph Tangah[4], Michael Cohen[2], Richard Whitkus[2]** and **Ong Jin-Eong[1]** [1] International Society for Mangrove Ecosystems, Okinawa, Japan; [2] Sonoma State University, California, USA; [3] Okinawa

Institute of Science and Technology, Okinawa, Japan; [4] Sabah Forestry Department, Sandakan, Sabah, Malaysia

- Prioritisation of mangrove tree species for conservation in Indonesia, **Kusumadewi S. Yulita[1], Arief Hamidy[2]** and **Tukirin Partomihardjo[1]** [1] Research Centre for Biology, Indonesian Institute of Sciences; [2] Fauna and Flora International Indonesia Programme
- Reflection of stable isotopes with inundation pattern at the Matang Mangrove Forest Reserve, **Waseem Razzaq Khan[1], M. Nazre[1], Syaizwan Zahmir Zulkifli[2], Umer Rashid[3], Kamziah Abd Kudus[1]** and **Martin Zimmer[4]** [1] Department of Forest Management, Faculty of Forestry, Universiti Putra Malaysia (UPM), Serdang, Selangor; [2] Department of Biology, Faculty of Science, UPM, Serdang, Selangor; [3] Institute of Advance Technology, UPM, Serdang, Selangor; [4] Leibniz-Center for Tropical Marine Ecology, Fahrenheitstrasse, Bremen, Germany
- Restoration activities for sustainable mangrove management and utilization in Indonesia, **Naoto Akune** YL Forest Co. Ltd., Hakata-ku, Fukuoka, Japan
- Spatial dynamic modelling as the basis for determining strategy in sustainable mangrove rehabilitation in Indramayu, West Java, Indonesia, **Sodikin[1], Satun R.P. Sitorus[1], Lilik Budi Prasetyo[1]** and **Cecep Kusmana[1], Surbakti[2], Munandar[3], Tatang[4], Syahimin[4]** and **Hideki Miyakawa[5],** [1]Bogor Agricultural University, Darmaga Bogor, Indonesia; [2]Faculty of Mathematics and Natural Science, Sriwijaya University, Inderalaya, South Sumatra; [3]Faculty of Agriculture, Sriwijaya University, Inderalaya, South Sumatra; [4]Office of Sembilang National Park, Palembang, South Sumatra; [5]Project on Capacity Building for Restoration of Ecosystem in Conservation Areas, JICA, Jakarta
- The mangroves of Congo Brazzaville, **Victor Mamonekene** Ministère de l'Economie Forestière, du Développement Durable et de l'Environnement Brazzaville, the CONGO

Appendix

Conference programme

Tuesday, 18 April 2017	
08:00	Registration of participants
09:00	**Opening Session (Agung Room, 1st Floor)** • Welcome address by **H.E. I Made Mangku Pastika**, Governor of Bali Province (Represented by **I Ketut Sudikerta**, Vice Governor of Bali Province) • Welcome remarks by **Professor Sanit Aksornkoae**, President of ISME and Senator of Thailand • Welcome remarks by **Dr Steven Johnson**, Officer-in-charge, ITTO • Welcome remarks by **Dr Manoel Sobral Filho**, Director of UN Forum on Forests (UNFF) • Inaugural speech by **H.E. Dr Siti Nurbaya**, Minister of Environment and Forestry of Indonesia (Represented by **Dr Hilman Nugroho**, DG of Watershed and Forest Protection, MoEF Indonesia) • Photo session • Cultural performance [Moderator] **Ms Inge Yangesa**, MoEF, Indonesia [Rapporteur] **Dr Hiras Sidabutar**, Indonesia
10:20	Tea/Coffee Break (Introduction of exhibition booths)
10:50	Presentation of the Program; Announcements, **Dr Hwan-ok Ma**, ITTO
11:00	**Keynote Presentations** • **Professor Sanit Aksornkoae**, President of ISME and Senator of Thailand • **Dr Chandra Giri**, Chief of Sensing and Spatial Analysis Branch, Office of R&D. U.S. Environmental Protection Agency, USA: Mangrove Mapping and Monitoring using Earth Observation Satellite Data • **Professor Daniel Murdiyarso**, Principal Scientist, Center for International Forestry Research (CIFOR), Indonesia: Mainstreaming blue carbon into global and national policy processes and implementations • **Dr Antung Deddy**, Director of Essential Ecosystem Management, DG of Natural Resources and Ecosystem Conservation, MoEF, Indonesia [Moderator] **Mr Rahman Dako**, JAPESDA Gorantalo / Mangrove Working Group Gorontalo, Sulawesi, Indonesia [Rapporteur] **Dr Dixon T. Gevaña**, University of the Philippines Los Baños, Philippines
12.30	*Lunch Break*

14:00	**Session 1:** Promoting the sustainable management of mangrove ecosystems
	Overview of the management of mangrove forests and ecosystems in selected countries/region: • Indonesia - **Mr Agung Kuswandono**, Deputy Minister, Coordinating Ministry of Maritime, Indonesia • Malaysia - **Mr Roslan bin Rani**, Principal Assistant Director, Forestry Department, Peninsular Malaysia: A century of management and new challenges in the management of the Matang Mangroves, Malaysia • Myanmar - **Dr Toe Toe Aung**, Assistant Director, Mangrove Conservation Unit, Forest Department, Ministry of Natural Resources and Environmental Conservation: Myanmar's Efforts on Conservation and Management of Mangrove Ecosystems
15:20	Tea/Coffee Break
15:40	Session 1 (cont'd) • Latin America and the Caribbean – **Dr Luiz Drude de Lacerda**, Marine Sciences of Universidade Federal do Ceará, Brazil: Neotropical mangroves: conservation and sustainable use in a scenario of global climate changes • Mexico – **Mr Jacinto Samuel García Carreón**, Manager of Environmental Compensation for Land Change Use, National Forestry Commission (CONAFOR): Restoration and sustainable management of mangroves in Mexico • Mozambique – **Ms Fatima Kanji Bonete**, Natural Resources & Community Management Department, Ministry of Land, Environment and Rural Development • Madagascar – **Ms RAKOTOARIDERA Rantonirina**, Director of Protected Area Systems, the Ministry of Environment, Ecology and Forestry: Towards Sustainable Management of Mangroves in Madagascar [Moderator] **Dr Tachrir Fathoni**, Indonesia [Rapporteur] **Dr Aulia Aruan**, Indonesia and **Dr Antonio Villa-Lopera**, Colombia
17:20-17:50	Poster presentations (one minute presentation by each poster presenter) [Facilitators] **Dr Hwan-ok Ma & Dr Tetra Yanuariadi**, ITTO
19:45-21:00	Welcome dinner hosted by the MoEF of Indonesia

Wednesday, 19 April 2017		
09:00	**Parallel Session**	
	Session 2: Addressing Climate-Change Adaptation and Mitigation (Bali Hai meeting room, 10th Fl)	**Session 3: Enhancing the Sustainable Livelihoods of Mangrove-Dependent Communities**(Baris room, 1st Fl)
	[Keynote speaker] **Dr Nur Masripatin**, DG Climate Change, MoEF, Indonesia: Addressing Climate Change Mitigation and Adaptation in Indonesia and Role of Mangrove Ecosystems [Speakers] • **Professor Dedi Hadrianto**, Mulawarman University, Indonesia: Toward Future Management of Mangroves in Mahakan Delta FMU, East Kalimantan, Indonesia • **Dr Ong Jin Eong**, Honorary Chief Technical Advisor to ISME & Mangrove Specialist Group of the IUCN Species Survival Commission: Measuring Mangrove Blue Carbon Fluxes • **Dr Tomomi Inoue**, Senior Researcher, Center for Environmental Biology and Ecosystem Studies, National Institute for Environmental Studies (NIES), Japan: Carbon storage of mangrove ecosystems: global maps of reported data and estimated models • **Dr Kangkuso Analuddin**, Department of Biology, Halu Oleo University, Southeast Sulawesi, Indonesia: Mangrove forests and conservation their services in the Coral Triangle Eco-region, Southeast Sulawesi, Indonesia • **Mr Barakalla**, Blue Carbon Coordinator, Conservation International (CI)- Indonesia: CI' S Blue Carbon Approach in Kaimana, West Papua, Indonesia [Moderator] • **Professor Daniel Murdiyarso**, Principal Scientist, CIFOR, Indonesia [Rapporteurs] • **Ms Yani Septiani**, Indonesia	[Keynote speaker] **Ms Cécile Bibiane Ndjebet**, African Women's Network for Community Management of Forests (REFACOF), Cameroon: Women's response activities in the restoration and management of mangroves in Cameroon [Speakers] • **Dr Hadi Daryanto**, DG Social Forestry and Environment Mgmt, MoEF, Indonesia: Social Forestry in Indonesia • **Dr Mohammad Basyuni,** Department of Forestry, University of Sumatera Utara, Indonesia: Community-based ecotourism in North Sumatra, Indonesia • **Professor Kithsiri Ranawana**, University of Peradeniya-Kandy, Sri Lanka: Community development in the Mangrove conservation programme of Small Fishers Federation, Sri Lanka • **Dr Pham Duc Chien**, Deputy Director Research Institute for Forest Ecology and Environment, Vietnamese Academy of Forest Sciences, Vietnam: Sustainable Development of Mangrove Forest Ecosystems in Thai Binh, Viet Nam • **Dr Kenichi Shono**, Forest Resources Officer, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand: Income for Coastal Communities for Mangrove Protection [Moderator] • **Dr Victor AGYEMAN**, PDG and Chief Research Scientist, Council for Scientific and Industrial Research (CSIR), Ghana [Rapporteurs] • **Ms Retno Surastri**, Indonesia

	• **Mr Ben Brown**, Charles Darwin University, Australia	• **Dr Leni D. Camacho**, University of the Philippines Los Baños, Philippines
12:00	*Lunch Break*	
13:30	**Session 4: Restoration of Degraded Mangrove Ecosystems** (Bali Hai meeting room, 10th Fl)	**Session 5: Strengthening Good Governance, Monitoring and Law Enforcement** (Baris room, 1st Fl)
	[Keynote speaker] **Dr Richard A. MacKenzie** Acting Watershed National Program Leader, US Forest Service; Institute of Pacific Islands Forestry, USA: Mitigation of climate change through more effective rehabilitation of degraded and deforested mangroves [Speakers] • **Dr Muhammad Firman**, DG Watershed, Forest and Environment, MoEF: Mangrove Ecosystem Management Policy in Indonesia • **Mr Nyoman Suryadiputra**, Director of Wetlands International, Indonesia: Restoring degraded coastal mangrove areas in Banten Bay Indonesia using sediment trap • **Mr Joseph Tangah**, Sabah Forestry Department, Malaysia: The SFD and ISME Collaboration on Rehabilitation of Degraded Mangroves in Sabah: A Success Story towards Sustainable Forest Management • **Mr LOKOSSOU Achille Orphée**, Management of Forests and Natural Resources, Ministry of Environment, Benin: Restoration and sustainable management of mangroves in Benin • **Ms Benjamas Chotthong,** Thailand Environment Institute, Thailand: Secure Costal Ecosystems, Secure Communities in Tsunami-Affected Areas [Moderator] • **Dr Luiz Drude de Lacerda**, Brazil [Rapporteurs] • **Dr Aulia Aruan**, Indonesia • **Dr Samsudin Musa**, Forest Research Institute of Malaysia (FRIM), Malaysia	[Keynote speaker] **Mr Rasio Ridho Sani**, DG Law Enforcement, MoEF, Indonesia [Speakers] • **Dr Dan Friess**, Department of Geography, National University of Singapore: Rates and causes of mangrove deforestation in Southeast Asia from 2000 to 2012 • **Dr MONIKA RUWAIMANA**, Universitas Atma Jaya Yogyakarta, Indonesia: Comparison of Satellite and Drone Imagery for Mangrove Mapping • **Mr Ruhuddien Pandu Yudha**, PT. BINTUNI UTAMA MURNI WOOD INDUSTRIES, Indonesia: FSC Certified Sustainable Mangrove Forest Management - Best Practices • **Dr Dixon T. Gevaña**, University of the Philippines Los Baños, Philippines: Community-Based Mangrove Management in the Philippines: Experience and Challenges of Forest Governance in the Context of CC • **Dr Victor AGYEMAN**, DGI and Chief Research Scientist, Council for Scientific and Industrial Research (CSIR), Ghana: Untapped Potentials of Mangrove Ecosystems: Community-based Mangrove Management as Inspiration for Effective National Forest Policy Development [Moderator] • **Dr Hadi Pasaribu**, Chairman, Forest for Life-Indonesia (FFLI) Foundation, Indonesia [Rapporteurs] • **Ms Yani Septiani**, Indonesia • **Mr Barney Chan**, ITTO TAG, Malaysia

<table>
<tr><th colspan="3">Thurday, 20 April 2017</th></tr>
<tr><td>09:00</td><td colspan="2">Parallel Session</td></tr>
<tr><td></td><td>Session 6: Payments for Environmental Services in Mangroves (Bali Hai Meeting Room, 10th Fl)</td><td>Session 7: Research and Education for Sustainable Mangrove Ecosystems Development(Baris Room, 1st Fl)</td></tr>
<tr><td></td><td>[Keynote speaker]
Dr. Patricia Moreno-Casasola, Institute of Ecology, Mexico: Mangroves and freshwater flooded forests, their value to society

[Speakers]
• Mr Ben Brown, Charles Darwin University, Australia: Building consensus for climate compatible development (CCD) in the Lorentz Lowlands, the world’s most productive mangrove and tropical lowland swamp forest landscape
• Dr Leni D. Camacho, University of the Philippines Los Baños, Philippines: Economic Valuation for Sustainable Mangrove Ecosystems Management in the Philippines
• Dr Vien Ngoc Nam, Faculty of Forestry, Nong Lam University, Viet Nam: Mangrove Payment Forest Ecosystem Services in Ca Mau Province, Viet Nam
• Mr Daniel Coronel, Alternate Development Mechanisms (MDA), Lima, Peru: Strengthening the conservation of mangroves ecosystem in the Northwest Biosphere Reserve of Peru
• Ms Leah Glass – Blue Ventures; Blue Carbon and Coastal Communities – Lessons learned from the implementation of mangrove carbon projects in Madagascar

[Moderator]
• Ms Akiko Nakano, Deputy Director, Biodiversity Policy Division, Ministry of Environment, Japan

[Rapporteurs]
• Ms Retno Suratri, Indonesia
• Dr Dixon T. Gevaña, Philippines</td><td>[Keynote speaker]
Dr Jurgenne Primavera, Chief Mangrove Scientific Advisor of the Zoological Society of London, Philippines: Mangrove Rehabilitation in the Philippines: Science VS. Quotas

[Speakers]
• Dr Promode Kant, Foundation Member, Asia Pacific Forest Policy Think Tank of FAO, Director, Institute of Green Economy, India: Development of a new marine silvicultural system in India for short rotation marketable biomass production and uninterrupted ecosystem services
• Mr Muljadi Tantra, Green Forest Product and Tech. Pte Ltd., Singapore: Value Development of Mangrove Forest in South East Asia
• Dr Adji Sapta, TOYOTA-Indonesia, CSR: Toyota Forest Program-Mangrove for Life
• Dr Noriaki Sakaguchi, JICA, Japan: JICA cooperation on forest conservation including Mangrove and climate change
• Dr Antonio Villa-Lopera, Biologist, Colombia: Long-term action plan on mangroves

[Moderator]
• Dr Mami Kainuma, ISME

[Rapporteurs]
• Mr Yus Rusila Noor, Wetlands Indonesia
• Dr Maung Maung Than, Country Program Coordinator, RECOFTC-Myanmar</td></tr>
<tr><td>12:00</td><td colspan="2">Lunch Break</td></tr>
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13:00	**Field Visit to the Mangrove Information Center**
	• Gathering at Lobby of Inna Grand Bali Beach Hotel • Presentation of the Mangrove Information Center (MIC) • Visit to MIC Exhibition Hall • Ceremonial planting (20 participants) • Tracking mangrove forest trails of MIC • Trip to Krisna souvenir center CP : Rangga Agung Prabowo / Rachmad Budiyanto / PPI/ BKSDA/ P3E [Rapporteurs] • **Mr Yus Rusila Noor**, Indonesia

Friday, 21 April 2017	
09:00	Presentation of key outcomes of Sessions 2-7 (Bali Hai Meeting Room, 10th Fl)
	Feedback and wrap-up of Sessions 1-7 [Presenters] • Session 1: **Dr Aulia Aruan**, Indonesia • Session 2: **Mr Ben Brown**, Australia • Session 3: **Ms Retno Suratri**, Indonesia • Session 4: **Dr Samsudin Musa**, Malaysia • Session 5: **Mr Barney Chan, Malaysia** • Session 6: **Dr Dixon T. Gevaña**, Philippines • Session 7: **Dr Mami Kainuma**, ISME [Moderator] • **Dr Tetra Yanuariadi**, ITTO
10:10	Tea/Coffee Break
10:50	**Panel Discussion**
	The way forward: Managing a vital resource for achieving the SDGs and the Paris Agreement [Panelists] • **Dr Agus Justianto**, Senior Adviser to the Minister, MoEF, Indonesia • **Professor Daniel Murdiyarso**, CIFOR, Indonesia • **Ms Sanjana Lal**, Ministry of Fisheries and Forests, Fiji • **Ms R.M.D. Alawathugoda**, Conservator of Forest research, Sri Lanka • **Ms Cécile Ndjebet**, African Women's Network for Community Management of Forests (REFACOF), Cameroon • **Dr Patricia Moreno-Casasola**, Institute of Ecology, Mexico • **Dr Richard A. MacKenzie**, Institute of Pacific Islands Forestry, USA • **Mr Muljadi Tantra**, Green Forest Product and Tech. Pte Ltd., Singapore [Moderator] • **Dr Hwan-ok Ma**, ITTO [Rapporteurs] • **Mr Yus Rusila Noor**, Indonesia • **Dr Promode Kant**, Institute of Green Economy, India
12:00	Lunch Break
13:30	**Closing Session**
	Draft outcomes of the conference and Bali Mangroves [Presenters] • **Dr Antung Deddy,** Indonesia • **Mr Yus Rusila Noor**, Indonesia • **Dr Chan Hung Tuck**, ISME [Master of Ceremony] • **Ms Inge Yangesa**, MoEF, Indonesia
15:30	**Closing Remarks**
	• **Dr Hwan-ok Ma**, ITTO; • **Professor Shigeyuki Baba**, ISME • **Dr Agus Justianto**, Senior Adviser to the Minister, MoEF, Indonesia

All PowerPoint presentation materials are made available on ITTO website at http://www.itto.int/mangrove2017/presentations/.