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Promoting the Conservation, Restoration and Sustainable Management of Mangrove Ecosystems

Synthesis Report

prepared by

International Society for Mangrove Ecosystems

(ISME)

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Acronyms and Abbreviations

ACTMANG = Action for Mangrove Reforestation, Tokyo, Japan
AIT = Asian Institute of Technology, Bangkok, Thailand
AL = Atlas Logistique, France
AMSN = Australian Mangrove and Saltmarsh Network
APAFRI = Asia Pacific Association of Forestry Research Institutions, Malaysia
APOWA = Action for Protection of Wild Animals, Orissa, India
ASG = Antioquia State Government, Colombia
ATO = African Timber Organization
AU = Annamalai University, India
BFAR = Bureau of Fisheries and Aquatic Resources, Philippines
BMZ = German Federal Ministry for Economic Cooperation and Development, Germany
BR = Biosphere Reserve
CA = cenTER Aarhus, Denmark
CBD = Convention of Biodiversity
CDM = Clean Development Convention
cenTER = Center for Tropical Ecosystems Research, Aarhus University, Denmark
CI = Conservation International, USA
COC = Cosmos Oil Company, Ltd., Tokyo, Japan
CRES = Center for Natural Resources and Environmental Studies, Viet Nam
CRNIEO = Center for Research on New International Economic Order, India
CU = Chiba University, Tokyo, Japan
DANIDA = Danish International Development Agency, Denmark
DEFRA = Department of Environment, Food and Rural Affairs, UK
DEKK = Department of Environment, Koh Kong, Cambodia
DNLR = Department of National Land and Resource, Guangxi, China
DMCR = Department of Marine and Coastal Resources, Thailand
DS = Daheda Sangh, Gujarat, India
EF = EMACE Foundation, Sri Lanka
EU = European Union
FACT = Fisheries Action Coalition Team, Cambodia
FAO = Food and Agriculture Organization of the United Nations, Rome, Italy
FREDA = Forest Resource Environment Development and Conservation Association, Yangon, Myanmar
FRIM = Forest Research Institute Malaysia, Kepong, Malaysia
GEC = Gujarat Ecology Commission, India
GEF = Global Environment Facility
GFC = Guyana Forestry Commission
GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit, Germany
GMRC = Guangxi Mangrove Research Center, China
GNF = Global Nature Fund, Germany
GOM = Government of Mexico
GPFLR = Global Partnership on Forest Landscape Restoration
GSL = Government of Sri Lanka
HCMC = Ho Chi Minh City, Viet Nam
HELP = Hilfe zur Selbsthilfe heute, Germany
HNU = Hanoi National University, Viet Nam
IAS = Institute for the Advanced Study of Sustainability, Japan
IBF = Indonesian Biodiversity Foundation, Indonesia
IGES = Institute for Global Environmental Strategies, Japan
IMRD = Institute of Mangrove Research and Development, Indonesia
IPSI = International Partnership for the Satoyama Initiative
ISME = International Society for Mangrove Ecosystems, Okinawa, Japan
ITTC = International Tropical Timber Council
ITTO = International Tropical Timber Organization, Yokohama, Japan
IUCN = International Union for Conservation of Nature, Gland, Switzerland
JAM = Japan Association for Mangroves
JICA = Japan International Cooperation Agency, Tokyo, Japan
JIFPRO = Japan International Forestry Promotion and Cooperation Center
JSM = Japan Society for Mangroves

JSPS = Japan Society for the Promotion of Science
KEIDANREN = Japan Business Federation
LEAD = Low Emissions Asian Development
LEAF = Lowering Emissions in Asia's Forests
LF = Livelihoods Fund, Paris, France
MAB = Man and the Biosphere
MAI = Ministry of Agriculture, Indonesia
MAP = Mangrove Action Project
MBR = Mangrove Biosphere Reserve
MEF = Ministry of Environment and Forests, India
MELAD = Ministry of Environment, Land and Agriculture Development, Kiribati
MERD = Mangrove Ecosystem Research Department, Viet Nam
MEST = Ministry of Education, Science and Technology, Japan
MEYS = Ministry of Education, Youth and Sports, Kiribati
MFD = Myanmar Forest Department, Yangon, Myanmar
MFF = Mangroves for the Future, Bangkok, Thailand
MSG = Mangrove Specialist Group
MOEB = Ministry of Environment, Brazil
MOEI = Ministry of Environment, Indonesia.
MPDO = Municipal Planning and Development Office, Iloilo, Philippines
MSN = Mangrove Service Network, Myanmar
MPFMB = Mangrove Protection Forest Management Board, Ho Chi Minh City, Viet Nam
MU = Malaya University, Kuala Lumpur, Malaysia
NEWS = Nature, Environment and Wildlife Society, India
NF = Nagenahiru Foundation, Sri Lanka
NIES = National Institute for Environmental Studies, Tsukuba, Japan
NLU = Nong Lam University, Ho Chi Minh City, Viet Nam
NORAD = Norwegian Agency for Development Cooperation
NPB = National Parks Board, Singapore
NUS = National University of Singapore
PSFD = Perak State Forestry Department, Malaysia
PSG = Perak State Government, Malaysia
PU = Planete Urgence, France
Ramsar = Ramsar Convention on Wetlands
RBR = Ranong Biosphere Reserve, Thailand
RFD = Royal Forest Department, Thailand
SCSP = South China Sea Program
SEMARNAT = Secretaría de Medio Ambiente y Recursos Naturales, Mexico
SD = Sime Darby, Malaysia
SERC = Smithsonian Environmental Research Center, USA
SFD = Sabah Forestry Department, Sandakan, Malaysia
SIDA = Swedish International Development Cooperation
SIEP = Sirindhorn International Environmental Park, Thailand
SPREP = Secretariat of the Pacific Regional Environment Program, Samoa
SSC = Species Survival Commission, USA
SWAMP = Sustainable Wetlands Adaptation and Mitigation Program
SWCS = Sabah Wetlands Conservation Society, Sabah, Malaysia
TBRC = Tropical Biosphere Research Center, Okinawa, Japan
TDF = Trowel Development Foundation, Philippines
TFU = Tropical Forest Update
TGU = Tohoku Gakuin University, Sendai, Japan
TM = Tokio Marine and Nichido Fire Insurance Co., Ltd., Tokyo, Japan
TNC = The Nature Conservancy, USA
TUA = Tokyo University of Agriculture, Japan
UF = University of Florida, Gainesville, Florida, USA
ULB = Université Libre de Bruxelles, Belgium
UM = University of Madras, Chennai, India
UMF = Ursula Merz Foundation, Germany
UMSME = United Mexican States Ministry of the Environment, Mexico
UNDP = United Nations Development Program, New York, USA
UNEP = United Nations Environment Program, Nairobi, Kenya
UNFCC = UN Framework Convention on Climate Change, Bonn, Germany

UNESCO = United Nations Educational, Scientific and Cultural Organization, Paris, France
UNIDO = United Nations Industrial Development Organization, Vienna, Austria
UNU = United Nations University, Tokyo, Japan
UR = University of Ruhuna, Sri Lanka
USAID = United States Agency for International Development
USGS = United States Geological Survey
VUB = Vrije Universiteit Brussel, Belgium
WB = World Bank, New York, USA
WI = Wetlands International, Wageningen, Netherlands
WRI = World Resources Institute, Washington DC, USA
XU = Xiamen University, China
YAGASU = Yayasan Gajah Sumatra, Indonesia
ZSL = Zoological Society of London, UK

Executive Summary

As stipulated in Activity 10 of the ITTO Biennial Work Program 2015−2016, ISME was appointed to prepare a Synthesis Report with the following terms of reference: 1. Review and analyze mangrove-related activities and projects undertaken by ITTO; 2. Prepare a compendium of recent mangrove-related activities/initiatives for conservation and sustainable management of mangrove forests being undertaking by leading mangrove-related organizations; 3. Prepare a background paper and draft program for an international mangrove conference in June/July 2016; and 4. Review and identify priority areas to support the development of ITTO mangrove strategies, and suggest action plans.

Initiatives of ITTO with relevance to mangroves reviewed included Mangrove Workplan 2002−2006; Strategic Action Plan 2013−2018; Collaborative Initiative for Tropical Forest Biodiversity 2011; Children's Environmental Education Program 2009−2011; Thematic Programs of REDDES and IDE; Fellowship Program; Policy Paper and Guidelines; Technical Reports; and Tropical Forest Update. ITTO-funded mangrove projects (44 in total), along with the significance of their outputs, publications with citations and reports, were analyzed and evaluated.

A compendium of recent mangrove-related activities/initiatives of other organizations was compiled under Initiatives and Strategic Actions; Protected Forests and Centers; Demonstration Sites; Restoration Projects; Meetings and Workshops; Research Projects; Training Courses; Publications; Websites and Portals; and Additional Information.

For the international mangrove conference scheduled for 2016, a background paper, theme, objectives, and topics and issues were presented, with supplementary information on the date, duration, venue, program and list of invitees. The proposed theme is *Towards a Sustainable Future for Mangrove Forests and Ecosystems: Monitoring their Protection, Restoration and Production*

For priority areas in support of future mangrove-related activities of ITTO, six strategies and 12 practical actions have been identified:

Strategy 1: Update the ITTO Mangrove Workplan 2002−2006

Action 1.1: *Document and launch ITTO Mangrove Charter 2016−2020*

Action 1.2: *Develop criteria and indicators for sustainable management of mangrove forests*

Strategy 2: Maintain, Expand and Improve Mangrove Information Outreach

Action 2.1: Support existing mangrove information databases e.g. GLOMIS and TroCEP in collaboration with other organizations such as ISME and NIES

Action 2.2: Package information on past and present ITTO-funded mangrove projects and their outputs for wider dissemination

Strategy 3: Build Capacity for Sustainable Management, Conservation and Utilization of Mangrove Forests and Ecosystems

Action 3.1: Conduct training courses on sustainable management and utilization of mangrove ecosystems, and on environmental education for sustainable development

Action 3.2: Conduct environmental education field programs on mangrove ecosystems for children and accompanying parents

Strategy 4: Monitor the Status of Protected and Rehabilitated Mangrove Areas

Action 4.1: Commission a study on the status of selected protected mangrove areas using remote sensing

Action 4.2: Produce a manual for monitoring indicators of ecosystem recovery following mangrove rehabilitation

Strategy 5: Establish the fact that mangrove forest plantations can be managed to supply wood on a sustainable basis

Action 5.1: Showcase the success story of Matang in Malaysia, the largest tract of mangroves in the world that has been sustainably managed for wood production more than 100 years

Action 5.2: Document the technologies for producing value-added wood products and by-products from planted mangrove forests

Strategy 6: Safeguard mangrove forest biodiversity by promoting non-timber forest products

Action 6.1: Review the current knowledge on the phytochemistry and pharmacological properties of mangrove plants based on scientific evidence

Action 6.2: Document case studies of non-timber uses of mangrove forests and ecosystems

1. ITTO BIENNIAL WORK PROGRAM 2015−2016 ON MANGROVE FORESTS

1.1 Background

The ITTO Biennial Work Program 2015−2016 was endorsed by the ITTC during its 50th Session held in Yokohama, Japan, from 3−8 November 2014. The work program entailed six strategic priorities identified in the ITTO Strategic Action Plan 2013−2018 (Appendix I). Under Strategic Priority 3 (Enhancing the contribution of tropical timber producing forests to the conservation and sustainable use of biodiversity), Activity 10 (Promoting the conservation, restoration and sustainable management of mangrove ecosystems) has recommended three core activity targets. The activity targets were:

- To produce a synthesis report reviewing the actions having been taken by ITTO and other organizations and stakeholders

- To organize an international conference in June/July 2016 to share lessons learned and challenges and opportunities recognized for the conservation, restoration and sustainable management of mangrove forests and ecosystems

- To discuss and identify strategies and practical actions which ITTO and its member countries can take, such as the development of a comprehensive action plan, the improvement of database and information system and the enhancement of partnerships for knowledge sharing and capacity development

1.2 Terms of Reference

The following are the terms of reference for the International Society for Mangrove Ecosystems (ISME), the international consultant appointed by ITTO under Agreement No. (F) F15/10:

Key responsibilities: The main objective of this consultancy is to review main lessons from the conservation and sustainable management of mangrove forests by ITTO and other leading agencies, and identify practical actions and partnerships to facilitate the conservation, restoration and sustainable management of mangrove forests and ecosystems.

Specifically, the international consultant will conduct the following:

1. Review and analyze mangrove-related activities and projects undertaken by ITTO to conserve, restore and sustainably manage mangrove forests and ecosystems. This review includes 44 mangrove-related projects, and publication of the World Atlas of Mangrove and the Mangrove Educational Book Series;

2. Prepare a compendium of recent mangrove-related activities/initiatives for conservation and sustainable management of mangrove forests being undertaking by selected mangrove-related leading organizations and NGOs at national, regional and international levels. These include mangrove restoration with the engagement of the private sector, mangrove conservation financing opportunities including payments for environmental services (PES), capacity building programs, and mangrove partnerships;

3. Prepare a background paper, including a draft program, for an international mangrove conference which will take place in June/July 2016 (tentative) in close collaboration with ISME and other partners, as well as ITTO member countries, to:

- Share lessons learned and challenges and opportunities recognized for the conservation, restoration and sustainable management of mangrove forests and ecosystems;

- Discuss and identify strategies and practical actions which ITTO and its member countries can take in collaboration with partners, such as the development of a comprehensive action plan, the improvement of database and information system and the enhancement of partnerships for knowledge sharing and capacity development;

4. Review and identify priority areas to support the development of ITTO mangrove strategies, and suggest action plans;

5. Submit a report, including an executive summary, compiling the outcomes of implementing Items 1, 2, 3 and 4 above to the ITTO Secretariat by 1 September 2015;

6. Present the outcome of this study activity at a side event on 9 September 2015 during the 14th World Forestry Congress (WFC2015), 7−11 September 2015 in Durban, South Africa;

7. Present the outcome of this activity at the 51st Session of the ITTC, 16−21 November 2015, in Kuala Lumpur, Malaysia.

2. REVIEW AND ANALYSIS OF MANGROVE-RELATED ACTIVITIES AND PROJECTS OF ITTO

The International Tropical Timber Organization (ITTO), with its headquarters in Yokohama, Japan, is an intergovernmental organization that promotes the conservation and sustainable management, use and trade of tropical forest resources. Its 60 member countries represent 85% of the world's tropical forests and over 90% of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation, and assists member countries to adapt such policies to local circumstances and to implement them in the field through projects.

With its mandate of promoting sustainable development through the conservation and sustainable management, use and trade of tropical forest resources, ITTO functions to collect, analyse and disseminate data on the production and trade of tropical timber and funds projects and other actions aimed at developing industries. All projects are funded by voluntary contributions, mostly from consumer member countries. Since ITTO became operational in 1987, the organization has funded over 1,000 projects, pre-projects and activities costing around US$350 million. Major donors are the governments of Japan, Switzerland, the United States, Norway and the European Union.

In the last 25 years, ITTO has funded more than 40 mangrove-related projects, formulated guidelines for the mangrove management and conservation, produced publications and held meetings in member countries. This section reviews and analyzes ITTO's mangrove-related activities including projects, initiatives, publications and meetings, and discusses the organization's possible future direction and activities.

2.1 Initiatives, Strategies and Actions

ITTO has developed a series of internationally agreed policy documents for achieving the conservation and sustainable management, use and trade of tropical forest resources and assisted tropical member countries to adapt these guidelines to local circumstances and to implement them in the field.

In November 2000, at the 29th Session of ITTC held in Yokohama, Japan, the council reiterated and strengthened its support for mangrove forest through Decision 9 (XXIX), Mangrove Conservation Program (Appendix II).

In the Yokohama Action Plan 2002−2006, under Reforestation and Forest Management and GOAL 1: Support activities to secure the tropical timber resource base, the commitment of ITTO to mangrove forests was reflected in Action 4: Promote the conservation, rehabilitation and sustainable management of threatened forest ecosystems *inter alia* mangroves, in collaboration with relevant organizations

The ITTO Action Plan 2008–2011 noted the significance of the ITTO Mangrove Workplan for 2002–2006, adopted and published to provide guidance on the sustainable management of tropical mangrove forests. The action plan also mentioned that country-level mangrove projects have been implemented using the guidelines of the workplan and that the production of a global mangrove atlas was underway, in collaboration with other organizations.

The following are highlights of major initiatives of ITTO related to mangroves or can be applied for mangroves:

ITTO Mangrove Workplan 2002–2006

The ITTO Mangrove Workplan 2002–2006 (Figure 1) focuses on mangrove conservation and sustainable management; information and awareness; socioeconomic aspects; ecosystem functions and health; cooperation and capacity building; and policies and legislation. Details of the plan are as follows:

Conservation and Sustainable Management

- Develop criteria and indicators for sustainable management of mangroves

- Implement sustainable mangrove management and establish protected mangrove areas, including buffer zones
- Prepare and implement mangrove management plans
- Implement trans-boundary conservation and management areas
- Rehabilitate degraded mangroves

Mangrove Information and Awareness

- Maintain, expand and improve access to existing mangrove information databases in collaboration with other organizations

Socioeconomic Aspects

- Assess the contribution of mangroves and impacts of mangrove degradation
- Document and promote use of traditional mangrove knowledge and management
- Valuate wood and non-wood goods and services from mangrove areas

Mangrove Ecosystem Functions and Health

- Improve understanding of mangrove forest structure, growth and function
- Evaluate the health of mangrove species and their habitat including the effects of climate change and sea level rise
- Assess the ecological impacts of wood harvesting and other human actions and develop innovative technologies for reducing such impacts

Cooperation and Capacity Building

- Establish national mangrove committees to coordinate all mangrove activities
- Increase mangrove management capacity
- Encourage and support cooperative relations between all stakeholders

Policies and Legislation

- Formulate appropriate laws and policies on mangroves with participation of all stakeholders and ensure their enforcement
- Analyze existing laws and policies and their impacts on mangrove management

ITTO Strategic Action Plan 2013−2018

The ITTO Strategic Action Plan 2013-2018 (Figure 1) builds on and draws from achievements of the three previous Action Plans. The plan is made operational through the Biennial Work Programs, Thematic Programs and Projects. The plan communicates the objectives and priorities of ITTO to member countries, stakeholders, partner organizations and the international community, including potential donors, and provides a reference for members in formulating project proposals and for donors in allocating their voluntary contributions.

The ITTO Strategic Action Plan comprises four parts:

Part I provides background information on ITTO, its comparative advantages and recent developments relevant to tropical forests.

Part II contains detailed descriptions of the six strategic priorities that ITTO will focus on during the six-year period of the Strategic Action Plan 2013−2018 and during the two-year period of the Biennial Work Program 2015−2016 (Appendix I).

Part III presents the expected outcomes and indicators of their achievement based on the six strategic priorities. It also includes guidance for monitoring the implementation of the Strategic Action Plan.

Part IV provides indicative fund mobilization targets to achieve each strategic priority.

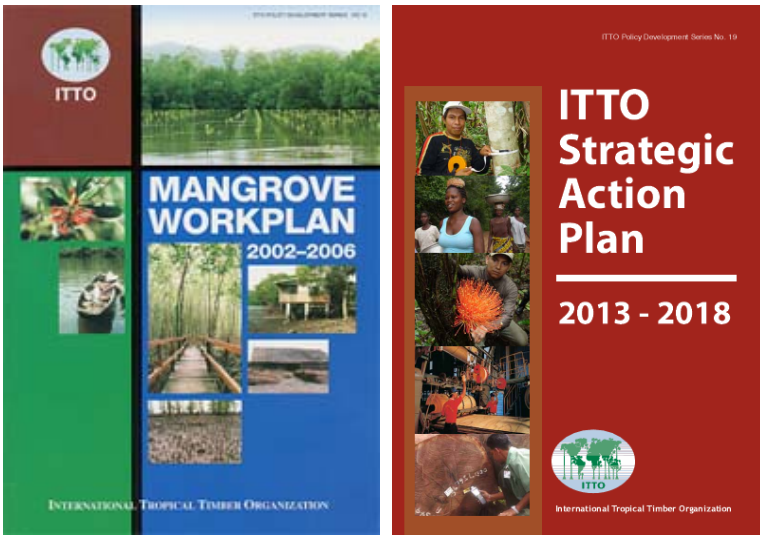

Figure 1 The ITTO Mangrove Workplan Plan 2002–2006 (left) and the ITTO Strategic Action Plan 2013–2018 (right)

Collaborative Initiative for Tropical Forest Biodiversity 2011

The Joint ITTO-CBD Collaborative Initiative for Tropical Forest Biodiversity 2011 (Figure 2) unites two organizations—the International Tropical Timber Organization (ITTO) and the Convention on Biological Diversity (CBD)—to enhance biodiversity conservation in tropical forests with the direct participation of local stakeholders.

This collaborative initiative has four key objectives:

1. To enhance local capacity for biodiversity conservation in production forests and the rehabilitation of degraded and secondary forests

2. To improve the conservation and management of protected forest areas, especially with respect to buffer zones and transboundary conservation

3. To safeguard tropical forest biodiversity in forestry interventions, including in REDD+ projects

4. To improve the welfare of indigenous and local communities through biodiversity conservation and the sustainable use of natural resources

The initiative identifies, develops and implements joint activities in production and protection forests, with the assistance of donors and in close collaboration with partner organizations in producer member countries of ITTO.

In its first four years (2011–2014), the initiative has funded eleven projects in 26 countries. Financial contributions have been made by the governments of Japan, Switzerland and the USA for a total investment of US$15 million.

Some projects involve the development of alternative improved local livelihoods. One such project involving mangrove-dwelling communities is the ITTO-funded Community-based Restoration and Sustainable Management of Vulnerable Forests of the Rewa Delta, Viti Levu, Fiji. PD 696/13 Rev.2 (F)

Children's Environmental Education Program 2009–2011

Recognizing that many issues concerning forests and the environment are often overlooked in the educational systems of schools, ITTO has developed an environmental education program for children. Activities include supplementary teaching materials, school forests, forest-friendship experience, learning network, forest education camp, dispatch of teachers, and children conferences. The ITTO Children's

Environmental Education Program (CEEP) 2009–2011 was launched in Yokohama on 10 July 2009 (Figure 2). About 900 people attended the occasion, which was graced by their Imperial Highnesses, the Crown Prince and Crown Princess of Japan.

Figure 2 Launching ceremony of the ITTO Children's Environmental Education Program 2009–2011 (left) and the ITTO-CBD Collaborative Initiative for Tropical Forest Biodiversity 2011 (right)

2.2 Thematic Programs

ITTO has adopted a thematic approach towards sustainable management of tropical forests. In 2008, ITTC approved five thematic programs. Of these, the REDDES and IDE programs are particularly relevant to mangroves.

REDDES Program

The ITTO program on Reducing Deforestation and Forest Degradation and Enhancing Environmental Services in Tropical Forests (REDDES) provides solutions to reduce deforestation and forest degradation in forest communities and promote the restoration of environmental services by implementing sustainable forest management (SFM). Launched in 2009, the REDDES program has funded over 31 projects across Africa, Asia and Latin America. The program collaborates closely with FAO, the UN-REDD Program and REDD+ initiatives of other international and bilateral aid agencies. REDDES projects supported by ITTO fall under four key areas:

Assessment and Diagnosis
- Improve data and knowledge on forest environmental services
- Provide policy related assessments to assist with planning and design of enabling conditions for SFM and help establish country capacity for effective REDD+ implementation

Enabling Conditions and Capacity Building
- Create enabling conditions for reducing deforestation and forest degradation and enhancing environmental services for global carbon and local community benefits
- Build capacity among stakeholders in implementing SFM

Demonstration Activities
- Implement local demonstration projects and activities targeting SFM and the restoration and rehabilitation of degraded forests
- Assist communities in realizing the benefits of environmental services through their direct participation

Expansion and Dissemination
- Establish scalable communication tools, networks, products and events to raise awareness of opportunities associated with REDD+ projects
- Support knowledge management and lessons learned in cooperation with existing REDD+ initiatives

IDE Program

The Industry Development and Efficiency (IDE) program is another key area of work of ITTO. The main objectives of the program are to:

- Strengthen the capacity of tropical timber producing countries to produce, process and trade tropical timber and forest products from sustainably managed and legally harvested forests
- Improve efficiency in the processing and utilization of tropical timber and timber products and non-timber forest products
- Support research and development to improve forest management, increase efficiency, and enhance the quantity and diversity of timber and non-timber forest products.

Activities of the IDE program include:

- Improving management and technical skills in small- and medium-sized forest enterprises
- Developing efficient harvesting and processing technologies
- Maximizing the use of wood residues and wood wastes
- Developing non-timber forest products and lesser-used timber species

2.3 Fellowship Program

The ITTO fellowship program, which began in 1989, offers fellowships to promote human resource development and to strengthen expertise in member countries in tropical forestry and related disciplines such as sustainable management of tropical forests, efficient use and processing of tropical timber, and better information about international trade in tropical timber. The program supports short-term activities such as participation in international conferences, training courses and study tours; preparation of manuals and monographs; and post-graduate studies.

As of December 2014, the program has funded more than 1300 young and mid-career people from over 40 countries. The program has offered fellowships to people from Asia-Pacific (41%), Africa (32%), Latin America/Caribbean (24%), and to people from consumer countries carrying out activities in producer countries (3%). Women accounted for 29% of the awardees. The total value of fellowships awarded to date amounted to US$7.5 million through the generous voluntary contributions from Japan, USA, Netherlands, Australia and others.

An impact assessment of the fellowship program showed that it has made significant contribution to human capacity development in ITTO producer member countries (Aoki, 2011). From the data, it would be interesting to find out the number of fellowships that are mangrove-related. An earlier report on the fellowship mentioned of an awardee from Nigeria (Temilola Elisabeth Fatoyinbo), who pursued her PhD research on mangrove forest growth, biomass and structure estimations (Aoki, 2006).

2.4 Policy Papers and Guidelines

ITTO has developed a series of internationally agreed policy documents for achieving the conservation and sustainable management, use and trade of tropical forest resources. These documents are intended to assist tropical member countries to adapt the guidelines to local circumstances and to implement them in the field. Some of these documents, which can be adapted for sustainable management of mangroves are listed (in chronological order) below:

1998. Criteria and indicators for sustainable management of natural tropical forests. ITTO Policy Development Series No. 7.

1999. Manual for the application of criteria and indicators for sustainable management of natural tropical forests. ITTO Policy Development Series No. 9.

2002. ITTO guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests. ITTO Policy Development Series No. 13.

2003. ATO/ITTO principles, criteria and indicators for the sustainable management of African tropical forests. ITTO Policy Development Series No. 14.

2005. Revised ITTO criteria and indicators for the sustainable management of tropical forests including reporting format. ITTO Policy Development Series No. 15.

2009. ITTO/IUCN guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests. ITTO Policy Development Series No. 17.

2015. Voluntary guidelines for sustainable management of natural tropical forests. ITTO Policy Development Series No. 20.

2.5 Technical Reports

Studies are commissioned by ITTO to facilitate informed decision-making. The technical reports are the outcome of these studies and their contents do not necessarily reflect the views of ITTO or its members. Those listed (in chronological order) below can be adapted for sustainable management of mangroves:

2005. Encouraging industrial forest plantations in the tropics. ITTO Technical Series No. 33.

2006. Status of tropical forest management 2005. ITTO Technical Series No. 24.

2007. Issues and opportunities for investment in natural tropical forests. ITTO Technical Series No. 27.

2008. Tropical forests and climate changes. ITTO Technical Series No. 30.

2009. Gifts from the forests. ITTO Technical Series No. 32.

Blaser, J., Sarre, A., Poore, D. & Johnson, S., 2011. Status of tropical forest management 2011. ITTO Technical Series No. 38.

Caswell, S.J., Tomaselli, I. & Hirakuri, S.R., 2014. Indicating progress: Uses and impacts of criteria and indicators for sustainable forest management. ITTO Technical Series No. 42.

Abad, C.R., 2015. Technical guide on the quantification of carbon benefits in ITTO projects. ITTO Technical Series No. 43.

2.6 Tropical Forest Update

The Tropical Forest Update (TFU) is an informative newsletter of ITTO to promote conservation and sustainable development of tropical forests. Issues of TFU related to mangroves are listed (in chronological order) below:

Sanchez, H., 1999. Working with mangroves: An ITTO project addresses the conservation and management of Colombian mangrove swamps for multiple use and development. ITTO Tropical Forest Update 9(2): 8-11.

Laura, M. & Sosa, R., 2003. Managing mangroves: An ITTO project is helping Hondurans protect and manage mangrove forests in the Gulf of Fonseca. ITTO Tropical Forest Update 13(1): 9.

Gasana, J.K. & Borobia, M., 2004. Managing mangroves: ITTO projects in Colombia, Panama, Thailand, India and Japan have advanced the cause of mangrove conservation and sustainable management. ITTO Tropical Forest Update 14(4): 14-16.

Than, M.M., Mochida, Y. & Kogo, M., 2006. How well do mangroves planted on ex-agricultural land in Myanmar's Ayeyarwady Delta survive and grow? ITTO Tropical Forest Update 16(3): 22-23.

Ekindi, J.H.M., 2011. Mucking in: Community participation in mangrove ecosystem restoration can be improved in Cameroon's Douala-Edea Wildlife Reserve. ITTO Tropical Forest Update 21(1): 15-17.

Chan, H.T., Spalding, M., Baba, S., Kainuma, M., Sarre, A. & Johnson, S., Editors, 2012. Special edition summarizing the findings of the 2010 World Atlas of Mangroves. ITTO Tropical Forest Update 21(2): 1-24.

Berdiales, J.A., Chavarria, J. & Lozano, L., 2013. The tide turns for Panama's mangroves: An ITTO project helps to conserve and reforest threatened mangroves on Panama's Pacific coast. ITTO Tropical Forest Update 22(2): 20-22

Ndjebet, C. & Ngokoy, P., 2014. Master plan for Cameroon estuary mangrove forests: An ITTO project has helped develop a plan to save a crucial forest ecosystem from destruction while improving local livelihoods. ITTO Tropical Forest Update 23(2): 13-15.

2.7 Projects and Outputs

Analysis and Evaluation of Projects

Since 1989, ITTO has funded 44 mangrove-related projects of which 13 were pre-projects and three were REDD projects (Table 1). This indicates that ITTO has been recognizing the importance of conservation and sustainable management of mangroves for over two decades. The organization has been supporting member countries to conduct country-specific as well as global-level mangrove activities.

ITTO's work on mangroves is consistent with the organization's objectives as laid in the International Tropical Timber Agreement (ITTA) 2006 which promotes the expansion and diversification of international trade in tropical timber from sustainably managed and legally harvested forests, and the sustainable management of tropical timber producing forests.

The 44 mangrove-related projects were implemented by 21 member countries. The breakdown of projects by regions (Table 2) was West Africa (7) Middle East (1) South Asia (2) South East Asia (4) East Asia (14) Pacific Islands (1) Central America (9) and South America (6).

Table 1 Mangrove projects funded or to be funded by ITTO

No.	Project ID	Title	Country	Status
1	PD752/14 Rev.1 (F)	RESTAURACIÓN DEL PAISAJE FORESTAL DE MANGLARES; UNA OPORTUNIDAD DE DESARROLLO SOCIAL EN EL SITIO RAMSAR SISTEMA LAGUNAR DE ALVARADO, VERACRUZ, MÉXICO	MEXICO	PF
2	PPD180/14 Rev.1 (F)	PRE-PROJECT FOR THE REHABILITATION AND SUSTAINABLE MANAGEMENT OF THE MANGROVE FORESTS IN THE COASTAL AREA OF COTE D'IVOIRE	COTE D'IVOIRE	PF
3	PPD177/14 Rev.1 (F)	INVENTORY OF MANGROVE ECOSYSTEM AND DEVELOPMENT OF A MANAGEMENT PLAN FOR GABON	GABON	PF
4	PD 696/13 Rev.2 (F)	COMMUNITY BASED RESTORATION AND SUSTAINABLE MANAGEMENT OF VULNERABLE FORESTS OF THE REWA DELTA, VITI LEVU, FIJI	FIJI	OP
5	RED-SPD 079/12 Rev. 1 (F)	STRENGTHENING OF GOVERNANCE AND SUSTAINABLE MANAGEMENT OF MANGROVE ECOSYSTEM IN GUATEMALA AS A CLIMATE CHANGE ADAPTATION MEASURE	GUATEMALA	OP
6	PD601/11 Rev.3 (F)	STRENGTHENING MANGROVE ECOSYSTEM CONSERVATION IN THE BIOSPHERE RESERVE OF NORTHWESTERN PERU	PERU	OP
7	RED-PD 045/11 Rev. 2 (M)	ENVIRONMENTAL ASSESSMENT AND ECONOMIC VALUATION OF ECOSYSTEM SERVICES PROVIDED BY COASTAL FORESTS (MANGROVE FORESTS, FLOOD FORESTS, RAIN FORESTS AND SCRUB FORESTS ON DUNES) AND THEIR AGRICULTURAL REPLACEMENT SYSTEMS ON THE CENTRAL COASTAL PLAIN OF VERACRUZ, MEXICO	MEXICO	OP
8	RED-PD 064/11 Rev. 2 (F)	PROMOTING LOCAL COMMUNITY INITIATIVE ON THE REHABILITATION OF MANGROVE ECOSYSTEM WITH DEMONSTRATION ACTIVITIES IN BINTAN ISLAND TO REDUCE FURTHER DEFORESTATION AND FOREST DEGRADATION	INDONESIA	CO
9	PD564/09 Rev.1 (F)	PRODUCTION OF AN EDUCATIONAL BOOK SERIES ON MANGROVES FOR SUSTAINABLE MANAGEMENT AND UTILIZATION OF MANGROVE ECOSYSTEMS	JAPAN	CO
10	PPD143/09 (F)	ASSESSMENT OF MANGROVE FOREST AFFECTED BY CYCLONE NARGIS TO FACILITATE THE DEVELOPMENT OF AN INTEGRATED MANGROVE ECOSYSTEM MANAGEMENT IN AYEYARWADY DELTA, MYANMAR	MYANMAR	CO
11	PD492/07 Rev.3 (F)	PARTICIPATORY REHABILITATION AND MANAGEMENT PROJECT FOR MANGROVES AND WATERSHEDS IN THE COASTAL AREA OF THE DOUALA/EDEA WILDLIFE RESERVE - “DOUALA-EDEA MANGROVE PROJECT”	CAMEROON	CO
12	PD460/07 Rev.1 (F) I	ACHIEVING SUSTAINABLE MANAGEMENT OF MANGROVE FORESTS IN CHINA THROUGH LOCAL CAPACITY BUILDING AND COMMUNITY DEVELOPMENT	CHINA	CO
13	PD460/07 Rev.1 (F) II	ACHIEVING SUSTAINABLE MANAGEMENT OF MANGROVE FORESTS IN CHINA THROUGH LOCAL CAPACITY BUILDING AND COMMUNITY DEVELOPMENT	CHINA	SS
14	PPD134/07 Rev.1 (F)	GUIDELINES FOR THE RESTORATION OF MANGROVES AND OTHER COASTAL FORESTS DAMAGED BY TSUNAMIS AND OTHER NATURAL HAZARDS IN THE ASIA-PACIFIC REGION	JAPAN	CO
15	PPD130/06 Rev.1 (F)	IDENTIFICATION OF A PROJECT FOR THE REGENERATION AND MANAGEMENT OF MANGROVE FORESTS SURROUNDING THE DOUALA/EDEA RESERVE, DEPARTMENT OF SANAGA MARITIME, CAMEROON	CAMEROON	CO
16	PD372/05 Rev.1 (F)	CONTRIBUTION TO FOREST REHABILITATION IN THAILAND’S AREAS AFFECTED BY THE TUSNAMI DISASTER	THAILAND	CO
17	PD349/05 Rev.2 (F)	CRITERIA FOR THE MANAGEMENT OF MANGROVE AND FLOOD FORESTS IN THE CENTRAL COASTAL PLAINS OF VERACRUZ, MEXICO: A COMMUNITY MANAGEMENT TOOL	MEXICO	CO
18	PPD114/05 Rev.1 (F)	DEMONSTRATION OF INTEGRATED MODELS FOR SUSTAINABLE MANAGEMENT OF MANGROVE IN CHINA	CHINA	CO
19	PD276/04 Rev.2 (F)	REVISED WORLD ATLAS OF MANGROVE FOR CONSERVATION AND RESTORATION OF MANGROVE ECOSYSTEMS	JAPAN	CO
20	PPD108/04 Rev.1 (F)	SUSTAINABLE COMMUNITY MANAGEMENT, UTILISATION AND CONSERVATION OF MANGROVE ECOSYSTEMS IN GHANA	GHANA	CO
21	PPD095/04 (F)	MODEL OF REHABILITATION AND SUSTAINABLE UTILIZATION OF MANGROVE FOREST AT LANGKAT, NORTH SUMATRA	INDONESIA	CO

Table 1 Mangrove projects funded or to be funded by ITTO (continued)

No.	Project ID	Title	Country	Status
22	PD194/03 Rev.2 (M)	EXPANDING AND IMPROVING GLOBAL MANGROVE DATABASE AND INFORMATION SYSTEM (GLOMIS) AND ITS NETWORKING	JAPAN	CO
23	PD156/02 Rev.3 (F) I	CONSERVATION AND REFORESTATION OF THREATENED MANGROVE FOREST AREAS ALONG THE PACIFIC COAST OF PANAMA - PHASE I	PANAMA	CO
24	PD156/02 Rev.3 (F) II	CONSERVATION AND REFORESTATION OF THREATENED MANGROVE FOREST AREAS ALONG THE PACIFIC COAST OF PANAMA - PHASE II	PANAMA	CO
25	PPD037/02 Rev.1 (F)	STUDY FOR THE CONSERVATION, REHABILITATION AND SUSTAINABLE MANAGEMENT OF MANGROVES IN TOGO	TOGO	CO
26	PPD040/02 Rev.1 (F)	CONSERVATION AND SUSTAINABLE MANAGEMENT OF MANGROVES IN THE KOUILOU COASTAL AREA WITH THE PARTICIPATION OF LOCAL COMMUNITIES ESTABLISHED IN THE AREA - SOUTH CONGO	CONGO	CO
27	PD063/01 Rev.2 (F)	ASSESSMENT AND MANAGEMENT OF MANGROVE FORESTS IN EGYPT FOR SUSTAINABLE UTILISATION AND DEVELOPMENT	EGYPT	CO
28	PD060/01 Rev.1 (F)	SUSTAINABLE MANAGEMENT AND REHABILITATION OF MANGROVE FORESTS BY LOCAL COMMUNITIES ON THE CARIBBEAN COAST OF COLOMBIA	COLOMBIA	CO
29	PPD017/01 Rev.1 (F)	ACTION PLAN ON SUSTAINABLE MANGROVE MANAGEMENT	JAPAN	CO
30	PD055/98 Rev.3 (F)	EVALUATION OF MANGROVE FORESTS IN THE NORTH-EAST OF THE ORINOCO DELTA REGION IN VENEZUELA WITH A VIEW TO SUSTAINABLE FOREST UTILIZATION	VENEZUELA	CO
31	PD014/97 Rev.1 (F)	GLOBAL MANGROVE DATABASE AND INFORMATION SYSTEM (GLOMIS) - PHASE I & ADDENDUM/PHASE II	JAPAN	CO
32	PD044/95 Rev.3 (F) I	MANAGEMENT AND CONSERVATION OF MANGROVES IN THE GULF OF FONSECA, HONDURAS - PHASE I	HONDURAS	CO
33	PD044/95 Rev.3 (F) II	MANAGEMENT AND CONSERVATION ON MANGROVES IN THE GULF OF FONSECA, HONDURAS - PHASE II	HONDURAS	CO
34	PPD008/95 Rev.2 (F)	MANGROVE RESOURCE INFORMATION SYSTEM OF THE SCOPE AND CONTENT OF EXISTING DATABASES	JAPAN	CO
35	PD006/93 Rev.2 (F)	MANUAL AND WORLD NATURAL MANGROVE ATLAS FOR MANGROVE ECOSYSTEM RESTORATION	JAPAN	CO
36	PD011/92 Rev.1 (F)	DEVELOPMENT AND DISSEMINATION OF RE-AFFORESTATION TECHNIQUES OF MANGROVE FORESTS	JAPAN	CO
37	PD171/91 Rev.2 (F) I	CONSERVATION AND MANAGEMENT FOR MULTIPLE USE AND DEVELOPMENT OF COLOMBIAN MANGROVE SWAMPS - PHASE I	COLOMBIA	CO
38	PD171/91 Rev.2 (F) II.I	CONSERVATION AND MANAGEMENT FOR MULTIPLE USE AND DEVELOPMENT OF COLOMBIAN MANGROVE SWAMPS - PHASE II, STAGE I	COLOMBIA	CO
39	PD171/91 Rev.2 (F) II.II	CONSERVATION AND MANAGEMENT FOR MULTIPLE USE AND DEVELOPMENT OF COLOMBIAN MANGROVE SWAMPS - PHASE I and II STAGE II	COLOMBIA	CO
40	PD128/91 Rev.2 (F)	MANAGEMENT, CONSERVATION, AND DEVELOPMENT OF MANGROVE FORESTS IN PANAMA	PANAMA	CO
41	PD157/91 Rev.2 (F)	ESTABLISHMENT OF AN INTERNATIONAL NETWORK FOR THE CONSERVATION AND SUSTAINABLE UTILIZATION OF MANGROVE FOREST GENETIC RESOURCES	INDIA	CO
42	PD114/90 (F)	WORKSHOP ON CONSERVATION AND SUSTAINABLE UTILIZATION OF MANGROVE FORESTS IN THE LATIN AMERICAN AND AFRICAN REGIONS	JAPAN	CO
43	PD076/90 Rev.1 (F)	PROJECT FORMULATION WORKSHOP FOR ESTABLISHING A NETWORK OF GENETIC RESOURCES CENTRES FOR ADAPTING TO SEA LEVEL RISE	INDIA	CO
44	PD071/89 Rev.1 (F)	THE ECONOMIC AND ENVIRONMENTAL VALUE OF MANGROVE FORESTS AND PRESENT STATE OF CONSERVATION	JAPAN	CO

Abbreviations: CO = Completed; OP = Operational; PF = Pending finance; SS = Sunset

Table 2 ITTO mangrove projects by region and country
(pending finance and sunset projects included)

Region (total)	Country	No. of projects
West Africa (7)	Cameroon	2
	Congo	1
	Cote D'Ivoire	1
	Gabon	1
	Ghana	1
	Togo	1
Middle East (1)	Egypt	1
South Asia (2)	India	2
South-East Asia (4)	Indonesia	2
	Myanmar	1
	Thailand	1
East Asia (14)	China	3
	Japan*	11
Pacific Islands (1)	Fiji	1
Central America (9)	Guatemala	1
	Honduras	2
	Mexico	3
	Panama	3
South America (6)	Colombia	4
	Venezuela	1
	Peru	1

*: Mainly implemented by ISME, all were international projects − global or regional

To date, 36 projects have been completed (82%), four are operational (9%), three are pending finance (7%) and one is sunset (2%).

Out of the 10 international projects completed by ISME, three were on the global mangrove database and information system (GLOMIS), and two were related to mapping of global mangroves (World Mangrove Atlas 1997 and World Atlas of Mangroves 2010). The project by the Japan Association for Mangroves (JAM) was on mangrove re-afforestation techniques based in Thailand.

In Colombia, the four completed projects were on Conservation and Management for Multiple Use and Development of Colombian Mangrove Swamps (Phase I, Phase II Stage I and Phase II Stage II), and on Sustainable Management and Rehabilitation of Mangrove Forests by Local Communities on the Caribbean coast.

The five operational projects are being carried out by Indonesia, Mexico, Peru, Guatemala and Fiji. Pending financing are projects to be implemented by Gabon, Cote D'Ivoire and Mexico.

Examination of project-funded years showed that 13 mangrove projects were approved from 2001−2005 (Table 3), which coincided with the ITTO Mangrove Workplan 2002−2006. During that period, ITTO was likely the leading organization for the mangrove conservation and sustainable management in the world. Unfortunately, the number of mangrove projects funded has decreased since then with eight projects approved for 2006−2010, and seven projects approved for 2011−2014. The reviewers recommend implementing more mangrove projects by ITTO.

Since 1990, ITTO has allocated more than USD 9.6 million to implement 40 mangrove projects (Table 3). Although the number of projects funded had declined from 2001 over five-year intervals of 2001−2005 (13 projects), 2006−2010 (8 projects) and 2011−2014 (7 projects), the amount of funds allocated remained relatively unchanged, ranging from USD 1.67 million to USD 1.88 million. For 2006−2010, projects with significant budget were PD 349/05 Rev.2 (F) by Mexico, PD 156/02 Rev.3 (F) II by Panama, PD372/05 Rev.1 (F) by Thailand and PD 492/07 Rev.3 (F) by Cameroon. For 2011−2015, projects with significant

budget were PD 601/11 Rev.3 (F) by Peru, RED-PD 045/11 Rev.2 (M) by Mexico and RED-PD 064/11 Rev.2 (F) by Indonesia.

Table 3 Number of mangrove projects funded by ITTO in five-year intervals

Year	No. of projects	Fund allocated (USD)
1990-1995	9	3,385,000
1996-2000	3	821,300
2001-2005	13	1,668,000
2006-2010	8	1,867,200
2011-2014	7	1,885,200
Total	40	9,626,700

In this analysis and evaluation exercise of ITTO-funded mangrove projects, it is possible to identify two broad categories of projects:

- The first category are primarily task-oriented projects e.g. production of a revised world atlas of mangroves PD 274/04 Rev.2 (F) and development of an action plan for sustainable mangrove management PPD 017/01 Rev.1 (F). These projects are easier to evaluate, as their achievements are verifiable in terms of the quality and quantity of outputs.

- The second category of projects have both task- and people-oriented components e.g. promoting local community initiative on the rehabilitation of mangrove ecosystem with demonstration activities in Bintan island RED-PD 064/11 Rev.2 (F), and sustainable community management, utilisation and conservation of mangrove ecosystems in Ghana PPD108/04 Rev.1 (F). The components involving human activities such as community participation, public awareness and environmental education are more abstract and difficult to evaluate.

Significance of Project Outputs

A number of significant outputs were achieved through the ITTO-funded mangrove projects. Some noteworthy outputs are highlighted by categories below:

Initiatives

Outputs of many ITTO mangrove projects formulated guidelines, policies, or master plans for conservation and sustainable management of mangroves for the respective areas. Often, such effort supports development of national and regional policies for conservation and sustainable management of mangroves. Examples are:

- PD 156/02 Rev.3 (F) Phases I, II Panama: The project established the first Mangrove Multiple Use Management Plan in Panama over an area of 5,980 ha of mangrove forests.
- PD 44/95 Rev.3 (F) Phases I, II Honduras: A Land-use Planning and Mangrove Management Plan for the Gulf of Fonseca was developed and came into force legally through AFE-COHDEFOR Resolution No. GG-PMF/O2/2003 in May 2003 and its implementation initiated.
- PD 171/91 Rev.2 (F) Phases I, II, III Colombia: Two motions that dictated measures to guarantee the sustainability of mangroves in Colombia were formulated at the national level. The Ministry of the Environment subsequently enacted Ministerial Resolutions 1602 in December 1995 and 020 in January 1996. The regional governments followed suit and developed ordinances in compliance with the ministerial resolutions.
- PD 060/01 Rev.1 (F) Colombia: With the project's support, the Ministry of Environment, Housing and Territorial Development emitted Resolution 0721 in July 2002, which established the guidelines for the formulation of integrated mangrove management plans for Colombia.
- PPD 17/01 Rev.1 (F) Japan: The ISME Action Plan for the Sustainable Management of Mangroves 2004-2009 was utilized for ISME/JICA mangrove management training course by participants to draft Action Plans for their respective countries and some of them were implemented.

Rehabilitation

- PD 060/01 Rev.1 (F) Colombia: 200 ha of mangrove forest were rehabilitated

- PD 156/2 Rev.3 (F) Panama: 540 ha of mangrove forest were rehabilitated

Visits to ITTO project sites of other countries

- PD 156/02 Rev.3 (F) Panama: Field visits to the ITTO mangrove project sites of Colombia and Mexico by project staff and mangrove community staff were organized.
- PPD 143/09 (F) Myanmar: For the rehabilitation of Cyclone Nargis damaged mangroves, a study tour was conducted to the ITTO project site in Bali, Indonesia, to observe community participation of mangrove rehabilitation.

Participation by indigenous people

- PD 055/98 Rev.3 (F) Venezuela: The project proponents identified the indigenous communities of Warao ethnic group as the primary stakeholders for the success of the project by integrating the native people's knowledge on the potential of mangrove forests, their use, management and conservation.

International collaboration

- PD 276/04 Rev.2 (F) Japan: The production of the World Atlas of Mangroves 2010 in three languages was a collaborative effort of relevant international organizations (FAO, UNESCO-MAB, UNEP-WCMC, UNU-INWEH, TNC) beside ITTO and ISME (Executing Agency).

Project Publications and Citations

Many completed ITTO-funded mangrove projects have produced publications that are authoritative and well cited. They can be downloaded from the web. The following are a list of the project publications with their citations from the Google Scholar citation index:

Baba, S., Chan, H.T. & Aksornkoae, S., 2013. Useful Products from Mangrove and other Coastal Plants. ISME Mangrove Educational Book Series No. 3, International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO), 99 pp. (Citations: 7) SPD 564/09 Rev.1 (F)

Chan, H.T. & Baba, S., 2009. Manual on Guidelines for Rehabilitation of Coastal Forests Damaged by Natural Hazards in the Asia-Pacific Region. International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO), 66 pp. (Citations: 7) PPD 134/07 Rev.1 (F)

Chan, H.T. & Ong, J.E., Editors, 2009. Proceedings of the Meeting and Workshop on Guidelines for the Rehabilitation of Mangroves and other Coastal Forests damaged by Tsunamis and other Natural Hazards in the Asia-Pacific Region. Mangrove Ecosystems Proceedings No. 5, 105 pp. International Society for Mangrove Ecosystems (ISME), International Tropical Timber Organization (ITTO) and University of the Ryukyus. PPD 134/07 Rev.1 (F)

Clough, B., 2013. Continuing the Journey Amongst Mangroves. ISME Mangrove Educational Book Series No. 1, International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO), 86 pp. (Citations: 8) SPD 564/09 Rev.1 (F)

Clough, B., Editor, 1993. The Economic and Environmental Values of Mangrove Forests and their Present State of Conservation in the South-East Asia/Pacific Region. Mangrove Ecosystems Technical Reports, Volume 1, 202 pp. International Tropical Timber Organization (ITTO), International Society for Mangrove Ecosystems (ISME) and Japan International Association for Mangroves (JIAM). (Citations: 17) PD 71/89 Rev.1 (F)

Diop, E.S., Editor, 1993. Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa Regions, Part II − Africa. Mangrove Ecosystems Technical Reports, Volume 3, 262 pp. International Tropical Timber Organization (ITTO) and International Society for Mangrove Ecosystems (ISME). (Citations: 34) PD 114/90 (F)

Field, C.D., 1995. Journey Amongst Mangroves. International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO), 140 pp. (Citations: 102) PD 6/93 Rev.2 (F)

Field, C.D., Editor, 1996. Restoration of Mangrove Ecosystems. International Society for Mangrove Ecosystems (ISME) International Tropical Timber Organization (ITTO), 250 pp. The Spanish version of the manual was published in 1997. (Citations: 140) PD 6/93 Rev.2 (F)

JAM, 1994. Proceedings of the Workshop on Development and Dissemination of Re-afforestation Techniques of Mangrove Forests, Bangkok, Thailand, 18-20 April 1994. Japan Association for Mangroves (JAM), National Mangrove Committee of Thailand and International Tropical Timber Organization (ITTO), 216 pp. PD 11/92 Rev.1 (F)

Lacerda, L.D. & Field, C., Editors, 1992. Proceedings of a Workshop on Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa Regions. Mangrove Ecosystems Proceedings No. 1, 28 pp. International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO). PD 114/90 (F)

Lacerda, L.D., Editor, 1993. Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa Regions, Part I − Latin America. Mangrove Ecosystems Technical Reports, Volume 2, 272 pp. International Tropical Timber Organization (ITTO) and International Society for Mangrove Ecosystems (ISME). (Citations: 41) PD 114/90 (F)

Ong, J.E. & Gong, W.K., 2013. Structure, Function and Management of Mangrove Ecosystems. ISME Mangrove Educational Book Series No. 2, International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO), 71 pp. (Citations: 12) SPD 564/09 Rev.1 (F)

Spalding, M., Kainuma, M. & Collins, L., 2010. World Atlas of Mangroves (English Version). A collaborative project of ITTO, ISME, FAO, UNEP-WCMC, UNESCO-MAB, UNU-INWEH and TNC, 319 pp. The French version of the atlas was published in 2011 while the Spanish version was published in 2012. (Citations: 366) PD 276/04 Rev.2 (F)

Spalding, M.D., Blasco, F. & Field, C.D., 1997. World Mangrove Atlas. International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO), 202 pp. (Citations: 662) PD 6/93 Rev.2 (F)

Project Reports

Out of 33 technical and non-technical reports of ITTO-funded mangrove projects listed below, 14 were written in Spanish, and some with a respectable number of citations:

1995. Diagnostico y Zonificacion Preliminar de los Manglares del Pacifico de Columbia. (Citations: 79) PD 171/91 Rev.2 Phase I (F)

1995. Diagnostico y Zonificacion Preliminar de los Manglares del Caribe de Colombia. PD 171/91 Rev.2 Phase I (F)

1996. Mangrove Resource Information System: Evaluation of the Scope and Content of the Existing Database. PPD 8/95 Rev.2 (F)

1997. Plan de Acción para las rea de manglares de Chame, Azuero y Chiriquí, Panamá. PD 128/91 Rev.2 (F)

1997. (Manual para el) Estudio de la dinámica de los bosques de manglar del Pacifico Colombiano. PD 171/91 Rev.2 (F)

1997. Conservacion y Uso Sostenble de los Manglares del Caribe Colombiano. (Citations: 5) PD 171/91 Rev.2 (F)

1997. Conservación y Uso Sostenible de los Manglares del Pacifico Colombiano. (Citations: 14) PD 171/91 Rev.2 (F)

1997. Diversidad Cultural y Manglares del Pacifico Colombiano. (Citations: 17) PD 171/91 Rev.2 (F)

1997. Manual para la restauración de los bosques de manglar en rea degradadas del Pacifico Colombiano. PD 171/91 Rev.2 (F)

1997. Manual sobre dinámica de crecimiento, regeneración natural y aspectos fenologicos de los manglares del Caribe Colombiano. PD 171/91 Rev.2 (F)

1997. Manual sobre técnicas de vivero y restauración de áreas de Manglar del Caribe Colombiano. (Citation: 1) PD 171/91 Rev.2 (F)

1997. Plan de Ordenamiento de los manglares de Panamá, Enfásis en Chame, Chiriquí y Azuero, Panamá. PD 128/91 Rev.2 (F)

1998. Hacia la Recuperación de los Manglares del Caribe de Colombia. (Citations: 17) PD 171/91 Rev.2 (F)

1998. Lineamientos Estrategicos para la Conservacion y Uso Sostenible de los Manglares de Colombia, Propuesta Tecnica para Analisis. (Citations: 10) PD 171/91 Rev.2 (F)

2001. Global Mangrove Database & Information System Phase I & Addendum/Phase II (CD-ROM). International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO). PD 14/97 Rev.1 (F) Phase I

2001. Introduction and Some Contents of Global Mangrove Database and Information System (GLOMIS) PD 14/97 Rev.1 (F) Phase I

2004. Restauracion de Manglares del Caribe de Colombia. PD 60/01 Rev.1 (F)

2004. Introduction and Some Contents of the Global Mangrove Database and Information System (GLOMIS). International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO), 225 pp. PD 14/97 Rev.1 (F)

2004. Manejo Integral de los Manglares por Comunidades Locales Caribe de Colombia. (Citations: 2) PD 60/01 Rev.1 (F)

2004. Manual Sobre Zonificacion y Planificacion para el Manejo Sostenible de los Manglares del Caribe de Colombia. (Citations: 5) PD 60/01 Rev.1 (F)

2005. Completion Report on Model of Rehabilitation and Sustainable Utilization of Mangrove Forest in North Sumatra. PPD 95/04 (F)

2005. Mapping of Mangrove Distribution at North Sumatera Province. PPD 95/04 (F)

2005. Policy Analysis of Mangrove Forest Management in North Sumatera Province. PPD 95/04 (F)

2005. Project Proposal on Implementation of a Model Community Stewardship for Rehabilitation and Sustainable Use of Mangroves in North Sumatera Province. PPD 95/04 (F)

2005. Review of Data and Information of Mangrove Forest Ecosystem at North Sumatera Province. PPD 95/04 (F)

2005. Technical Report on Model of Rehabilitation and Sustainable Utilization of Mangrove Forest in North Sumatra. PPD 95/04 (F)

2006. Completion Report on Demonstration of Integrated Models for Sustainable Management of Mangroves in China. PPD 114/05 Rev.1 (F)

2006. Report on Expanding and Improving Global Mangrove Database and Information System (GLOMIS) and its Networking. International Society for Mangrove Ecosystems (ISME) and International Tropical Timber Organization (ITTO). PD 194/03 Rev.2 (M)

2007. Consultancy Report on Sustainable Community Management, Utilization and Conservation of Mangrove Ecosystems in Ghana. International Tropical Timber Organization and Government of Ghana, 45 pp. PPD 108/04 Rev.1 (F)

2009. Conservación y Repoblación de las Areas Amenazadas del Bosque De Manglar del Pacífico Panameño. PD 156/02 Rev.3 (F)

2009. Proyecto de Conservación y Repoblación de Areas Amenazadas del Bosque del Manglar del Pacifico Panameno – Fases I y II- Informe Final de Los Resultados del Proyecto Fases I y II. PD 156/02 Rev.3 (F)

2013. Activity Report - Review and Policy Analysis on Community-based Mangrove Ecosystem Management in Bintan District. Ministry of Forestry (MOF) Indonesia and International Tropical Timber Organization (ITTO), 90 pp. RED-PD 064/11 Rev.2 (F)

2013. Preparation of Baseline Data Mangrove Ecosystem Management in Bintan Island. Ministry of Forestry (MOF) Indonesia and International Tropical Timber Organization (ITTO), 71 pp. RED-PD 064/11 Rev.2 (F)

3. COMPENDIUM OF RECENT MANGROVE-RELATED ACTIVITIES OF OTHER ORGANIZATIONS

A compendium of recent mangrove-related activities/initiatives for the conservation and sustainable management of mangrove ecosystems being undertaken by major mangrove-related organizations at national, regional and international levels. The contributions by government and non-government organizations including the private sector are acknowledged. The mangrove-related activities include initiatives, centers, protection, restoration, research, meetings, training, publications (manuals and guidelines, and reports and books), and websites.

Additional information on some key activities/initiatives shown with an asterisk is provided at the end of this compendium. They include Inauguration of ISME; Mangrove for the Future Initiative; Matang Working Plan (2010−2019), Perak, Malaysia; Kota Kinabalu Wetlands, Sabah, Malaysia; Ranong Biosphere Reserve, Thailand; Can Gio Mangrove Biosphere Reserve, Viet Nam; Batu Ampar Mangrove Demonstration Site in Kalimantan, Indonesia; Restoration of Mangroves and Community Development, Myanmar; Mangrove Planting in Tarawa, Kiribati; Rehabilitation of Degraded Mangroves, Sabah, Malaysia; GoM-LME Mangrove Conservation and Restoration, Mexico; Studies in the Can Gio Mangrove Biosphere Reserve, Viet Nam; and Research and Capacity Building in Coastal Resources, Sabah, Malaysia.

3.1 Initiatives and Strategic Actions

Initiative and Strategic Action	Location	Year	Organization
Protection of mangrove forests through logging ban, conservation and restricted utilization	Thailand	1989	RFD, DMCR
Inauguration of ISME as the International Society for Mangrove Ecosystems*	Okinawa, Japan	1990	ISME
Prohibition of all coastal development in mangrove areas	Mexico	2007	GOM
Implementation of Mangroves for the Future (MFF) Initiative*	Participating Asian countries	2007	IUCN, MFF
Development of the South China Sea Strategic Action Program	Countries of the South China Sea	2008	UNEP, GEF
Declaration of the Satoyama Initiative	Paris, France	2010	IPSI
Signing the Mangrove Charter with country-specific Action Plans	Mauritania, Gambia, Guinea Bissau, Senegal, Guinea	2010	WI, IUCN
Development of the National Mangrove Management Action Plan	Guyana	2010−2012	GFC, MAP
Implementation of Matang Mangrove	Matang, Perak,	2010−2019	PSFD

Initiative and Strategic Action	Location	Year	Organization
Working Plan (Sixth Revision)*	Malaysia		
Launching of the Bonn Challenge	Bonn, Germany	2011	GPFLR, IUCN
Development of the Pacific Regional Environment Program Strategic Plan	Pacific Island Countries	2011−2015	SPREP
Implementation of the Strategic Plan for Biodiversity 2011−2020 and Aichi Targets	Participating Countries	2011−2020	CBD
Launching of Forest Landscape Restoration Mechanism	Participating Countries	2014	FAO
Initiative 20x20	Latin America, Caribbean	2014	WRI, IUCN
Development of Pakistan National Strategy and Action Plan	Pakistan	2014	IUCN, MFF
Declaration that all mangroves in the nation are protected	Sri Lanka	2015	GSL

RFD = Royal Forestry Department of Thailand; DMCR = Department of Marine and Coastal Resources of Thailand; ISME = International Society for Mangrove Ecosystems; GOM = Government of Mexico; IUCN = International Union for Conservation of Nature; MFF = Mangrove for the Future; UNEP = United Nations Environment Program; GEF = Global Environment Facility; IPSI = International Partnership for the Satoyama Initiative; WI = Wetlands International; GFC = Guyana Forestry Commission; MAP = Mangrove Action Project; PSFD = Perak State Forestry Department; GPFLR = Global Partnership on Forest Landscape Restoration; SPREP = Secretariat of the Pacific Regional Environment Program; CBD = Convention of Biodiversity; FAO = Food and Agriculture Organization of the United Nations; WRI = World Resources Institute; GSL = Government of Sri Lanka

3.2 Protected Forests and Centers

Forest and Center	Location	Year	Organization
Sundarbans Biosphere Reserve	Sundarbans, India	1989	MEF
Sepilok Laut Mangrove Discovery Center	Sabah, Malaysia	1994	SFD
Kota Kinabalu Wetlands*	Sabah, Malaysia	1996	SWCS
Ranong Biosphere Reserve*	Ranong, Thailand	1997	RFD
Can Gio Mangrove Biosphere Reserve*	HCMC, Viet Nam	2000	MPFMB
Matang Nature Education Center	Perak, Malaysia	2000	PSFD
Mangrove Information Center	Bali, Indonesia	2001	JICA
Sirindhorn International Environmental Park	Cha Am, Thailand	2003	SIEP
Mangrove Research Center	Carey Island, Malaysia	2003	SD, MU
Trusan Kinabatangan Ramsar site	Sabah, Malaysia	2008	SFD
Beilun Estuary Marine Nature Reserve Ramsar site	Guangxi, China	2008	GMRC

MEF = Ministry of Environment and Forests, India; SFD = Sabah Forestry Department; SWCS = Sabah Wetlands Conservation Society; RFD = Royal Forest Department; HCMC = Ho Chi Minh City; MPFMB = Mangrove Protection Forest Management Board; PSFD = Perak State Forestry Department; JICA = Japan International Cooperation Agency; SIEP = Sirindhorn International Environmental Park; SD = Sime Darby; MU = Malaya University; GMRC = Guangxi Mangrove Research Center

3.3 Demonstration Sites

Mangrove Site	Location	Year	Organization
Trat	Trat, Thailand	2005	DMCR, UNEP, SCS, GEF
Fangchenggang	Guangxi, China	2006	DNLR, UNEP, SCS, GEF
Batu Ampar*	Kalimantan, Indonesia	2006	IMRD, UNEP, SCS, GEF
Peam Krasop	Koh Kong, Cambodia	2008	DEKK, UNEP, SCS, GEF

DMCR = Department of Marine and Coastal Resources of Thailand; UNEP = United Nations Environment Program; SCS = South China Sea Program; GEF = Global Environment Facility; DNLR = Department of National Land and Resource, Guangxi; IMRD = Institute of Mangrove Research and Development, Indonesia; DEKK = Department of Environment, Koh Kong, Cambodia.

3.4 Restoration Projects

Project	Location	Year	Organization
Restoration of Mangrove Ecosystems and Community Development*	Pyindaye, Myanmar	1999	FREDA, ACTMANG, MFD, TM, JIFPRO
Restoration of Mangrove Ecosystems by Community Participation	Viet Nam	1999	MERD, ACTMANG, TM
Mangrove Reforestation Project	Ranong, Thailand	1999	OISCA, DMCR,TM
Mangrove Reforestation Project	Java, Indonesia	1999	OISCA, TM
Mangrove Reforestation Project	Luzon, Philippines	1999	OISCA, TM
Green Carpet Project	Thailand	1999−2004	RAGM, KEIDANREN
Coastal Wetland Protection Project	Viet Nam	2000−2007	WB
Mangrove Reforestation Project	Fiji	2004	OISCA, TM
Post-tsunami Mangrove Rehabilitation Program	Aceh and North Sumatera, Indonesia	2005−2010	YAGASU, WI, CI, UNESCO, KF, PU, AL, HELP, MOEI KEIDANREN
Mangrove Rehabilitation on Atolls*	Tarawa, Kiribati	2005	MELAD, MEYS, ISME, COC
Ecological Mangrove Restoration Project	Ayeyarwady Delta, Myanmar	2006−2010	MSN
Mangrove Restoration Project	Senegal	2008−2012	Océanium
Conservation and Restoration of Mangrove Ecosystems*	Gulf of Mexico	2009	UNIDO, NORAD, SEMARNAT
Viet Nam−Japan Friendship Mangrove Forest Planting Exchange	Dong Rui, Tien Yen, Viet Nam	2007−2013	MERD, CRES, HNU, ACTMANG
Mangrove Plantation Activities on Mudflats	Gujarat, India	2009	DS, ISME, TM
Mangrove Rehabilitation Project	Iloilo, Philippines	2009	MPDO
Mangrove Restoration Project	Sabah, Malaysia	2009−2014	SWCS

Project	Location	Year	Organization
Mangrove Restoration Project	Guyana	2010	MAI, EU
Mangrove Afforestation, Reforestation and Restoration	Sundarbans, India	2010	NEWS
Fishing Communities Seek Security in Aquaculture and Mangrove Restoration	Philippines	2010−2011	WB, TDF
Rehabilitation of Degraded Mangroves*	Sabah, Malaysia	2011	SFD, ISME, TM
Mangrove Rehabilitation Project	Aceh and North Sumatra, Indonesia	2011	YAGASU, LF
Mangrove Plantation Project	Apuao Island, Philippines	2011	BFAR
Mangrove Reforestation Project	Chittagong, Bangladesh	2011	OISCA, TM
Mangrove Rehabilitation in Asia	India, Sri Lanka, Cambodia, Thailand	2012−2015	CRNIEO, FACT, NF, EF, MAP, BMZ, UMF, GNF

FREDA = Forest Resource Environment Development and Conservation Association; ACTMANG = Action for Mangrove Reforestation; MFD = Myanmar Forest Department; TM = Tokio Marine and Nichido Fire Insurance Co., Ltd.; JIFPRO = Japan International Forestry Promotion and Cooperation Center; MERD = Mangrove Ecosystem Research Department; OISCA = Organization for Industrial, Spiritual and Cultural Advancement; DMCR = Department of Marine and Coastal Resources, Thailand; RAGM = Research Association for Global Mangroves; KEIDANREN = Japan Business Federation; WB = World Bank; YAGASU = Yayasan Gajah Sumatera; WI = Wetlands International; CI = Conservation International; UNESCO = United Nations Educational, Scientific and Cultural Organization; IBF = Indonesian Biodiversity Foundation; PU = Planete Urgence; AL = Atlas Logistique, HELP = Hilfe zur Selbsthilfe heute; MOEI = Ministry of Environment, Indonesia; MELAD = Ministry of Environment, Land and Agriculture Development; MEYS = Ministry of Education, Youth and Sports; ISME = International Society for Mangrove Ecosystems; COC = Cosmos Oil Company, Ltd.; MSN = Mangrove Service Network; UNIDO = United Nations Industrial Development Organization; NORAD = Norwegian Agency for Development Cooperation; SEMARNAT = Secretaría de Medio Ambiente y Recursos Naturales; CRES = Center for Natural Resources and Environmental Studies; HNU = Hanoi National University; DS = Daheda Sangh; MPDO = Municipal Planning and Development Office; SWCS = Sabah Wetlands Conservation Society; MAI = Ministry of Agriculture, Indonesia; EU = European Union; NEWS = Nature, Environment and Wildlife Society; WB = World Bank; TDF = Trowel Development Foundation; SFD = Sabah Forestry Department; LF = Livelihoods Fund; BFAR = Bureau of Fisheries and Aquatic Resources; CRNIEO = Center for Research on New International Economic Order; FACT = Fisheries Action Coalition Team; NF = Nagenahiru Foundation; EF = EMACE Foundation; MAP = Mangrove Action Project; BMZ = German Federal Ministry for Economic Cooperation and Development; UMF = Ursula Merz Foundation; GNF = Global Nature Fund

3.5 Meetings and Workshops

Meeting and Workshop	Location	Date	Organizer
Exchange Program on Conservation Genetics of Mangroves	Tokyo, Japan	Oct 2011	CU, TBRC, ISME, JSPS
Mangroves as Coastal Protection Workshop	Bogor, Indonesia	19−22 Jan 2012	TNC
Global Workshop on National Experiences in Implementing the Strategic Plan for Biodiversity 2011-2020	Brasilia, Brazil	12−14 Mar 2012	MOE, CBD, DEFRA

Meeting and Workshop	Location	Date	Organizer
Natural Protection Workshop	Cambridge, UK	27−29 Mar 2012	TNC
Transboundary Diagnostic Analysis of Indochina Mangrove Ecosystems	SIEP, Thailand	27−30 Jun 2012	SIEP, SIDA
MMM3: International Meeting on Mangrove Ecology, Functioning and Management	Galle, Sri Lanka	2−6 Jul 2012	VUB, ULB, UR
Regional Colloquium on Sharing Lessons on Mangrove Restoration and a Call for Action	Mamallapuram, India	30−31 Aug 2012	IUCN, MFF, MEF
Workshop on Gender, Resilience and Conservation Approach to Planning, Implementation and Management of Research	Dhaka, Bangladesh	23 Oct 2012	IUCN, MFF
Private Sector Sensitizing Workshop	Male, Maldives	4 Dec 2012	IUCN, MFF
International Workshop on Mangrove Conservation in India	Gandhinagar, Gujarat, India	26−27 Jul 2013	GEC, WB
Workshop on Studies in the Can Gio Mangrove Biosphere Reserve	TGU, Sendai, Japan	4−6 Nov 2013	TGU, MEST
Workshop on Ecological Considerations in Coastal Development	Colombo, Sri Lanka	22 Nov 2013	IUCN, MFF
International Conference on Mangroves of Asia-Pacific Countries in View of Climate Change	Kuala Lumpur, Malaysia	11−13 Nov 2014	FRIM, APAFRI
Annual Meeting of the Japan Society for Mangroves	Tokyo, Japan	22−23 Nov 2014	TUA, JSM
Matang Mangrove Forest Management Conference 2014	Ipoh, Perak, Malaysia	24−26 Nov 2014	PSG, PSFD
Regional Symposium on Coastal Community Resilience	Dhaka, Bangladesh	30−31 Nov 2014	IUCN, MFF, UNDP
Mangroves and Climate Change Component Review Workshop	HCMC, Viet Nam	1−4 Jun 2015	IUCN, MFF
International Conference Mangroves and Climate Change (ICMCC2015)	Chennai, India	16−18 Jul 2015	UM
International Forum for Sustainable Asia and the Pacific	Yokohama, Japan	28−29 Jul 2015	IGES, UNU-IAS
Symposium ‘Turning the Tide on Mangrove Loss’	Xiamen, China	12−13 Nov 2015	IUCN, SSC, MSG, XU
2016 Australian Mangrove and Saltmarsh Network Conference and Workshops	Darwin, Australia	3−6 May 2016	AMSN
Fourth Mangrove Macrobenthos Meeting (MMM4)	Florida, USA	18−22 Jul 2016	SERC, UF, USGS

CU = Chiba University; TBRC = Tropical Biosphere Research Center; ISME = International Society for Mangrove Ecosystems; JSPS = Japan Society for the Promotion of Science; TNC = The Nature Conservancy; MOE = Ministry of Environment; CBD = Convention of Biodiversity; DEFRA = Department of Environment, Food and Rural Affairs; SIEP = Sirindhorn International Environmental Park; SIDA = Swedish International Development Cooperation; VUB = Vrije Universiteit Brussel; ULB = Université Libre de

Bruxelles; UR = University of Ruhuna; IUCN = International Union for Conservation of Nature; MFF = Mangrove for the Future; MEF = Ministry of Environment and Forests; GEC = Gujarat Ecology Commission; WB = World Bank; TGU = Tohoku Gakuin University; MEST = Ministry of Education, Science and Technology; FRIM = Forest Research Institute Malaysia; APAFRI = Asia Pacific Association of Forestry Research Institutions; TUA = Tokyo University of Agriculture; JSM = Japan Society for Mangroves; PSG = Perak State Government; PSFD = Perak State Forestry Department; UNDP = United Nations Development Program; UM = University of Madras; IGES = Institute for Global Environmental Strategies; UNU = United Nations University; IAS = Institute for the Advanced Study of Sustainability; SSC = Species Survival Commission; MSG = Mangrove Specialist Group; XU = Xiamen University; AMSN = Australian Mangrove and Saltmarsh Network; SERC = Smithsonian Environmental Research Center; UF = University of Florida, USGS = United States Geological Survey

3.6 Research Projects

Project	Location	Year	Organization
Coastal Wetland Conservation Program	Yucatan Peninsula, Mexico	2003−2008	UMSME, JICA, TGU, ACTMANG
Studies in the Can Gio Mangrove Biosphere Reserve	HCMC, Viet Nam	2000	MPFMB, TGU, NLU, JSPS, MEST
Research and Capacity Building in Coastal Resources*	Sabah, Malaysia	2013	SFD, TBRC
Mangrove Inventory of Antioquia Expedition	Gulf of Urabá, Colombia	2013	ASG

UMSME = United Mexican States Ministry of the Environment; TGU = Tohoku Gakuin University; ACTMANG = Action for Mangrove Reforestation; JICA = Japan International Cooperation Agency; MPFMB = Mangrove Protection Forest Management Board; NLU = Nong Lam University; JSPS = Japan Society for the Promotion of Science; MEST = Ministry of Education, Science and Technology; SFD = Sabah Forestry Department; TBRC = Tropical Biosphere Research Center; ASG = Antioquia State Government

3.7 Training Courses

Training	Location	Date	Organizer
International Training Course on Conservation and Sustainable Management of Mangrove Ecosystems	Okinawa and Iriomote, Japan	1995−2012	ISME, JICA
International Training Course on Mangrove Biodiversity and Ecosystems	Annamalai, India	Since 2004	UNU-INWEH, AU, UNESCO
International Training Course on Environmental Education for Sustainable Development − Conservation of Coastal Ecosystems for the Livelihoods of Local Communities	Okinawa and Iriomote, Japan	2005−2012	ISME, JICA
Ecological Mangrove Restoration (EMR) Training	Krabi, Thailand	27−28 Mar 2012	BMZ, UMF, GNF, MAP
Short Course on Carbon Stock Assessment and Emissions Inventory in Asian Mangroves	Bangkok, Thailand	24−26 Apr 2013	USAID, LEAD, SWAMP
Field Training on Carbon Stock Assessment and Emissions Inventory in Asian Mangroves	Trang, Thailand	29 Apr to 8 May 2013	USAID, LEAD, LEAF, SWAMP
Regional Training Course on Mangrove Restoration and Management	SIEP, Thailand	14−20 Aug 2013	SIEP, IUCN, MFF
Media Training Workshop on Coastal Ecosystem Services in Mekong Delta	HCMC, Viet Nam	26−30 Nov 2013	IUCN, MFF

MFF Internal Training Workshop on Applying Gender Integrated Planning in the MFF Program	Asian Member Countries	20−24 Apr 2015	IUCN, MFF
Fifth Postgraduate Certificate Course on Integrated Coastal Management	Bangkok, Thailand	8 Jun to 29 Jul 2015	AIT, IUCN, MFF

ISME = International Society for Mangrove Ecosystems; JICA = Japan International Cooperation Agency; UNU = United Nations University; INWEH = Institute for Water, Environment and Health; AU = Annamalai University; UNESCO = United Nations Educational, Scientific and Cultural Organization; BMZ = German Federal Ministry for Economic Cooperation and Development; UMF = Ursula Merz Foundation; GNF = Global Nature Fund; MAP = Mangrove Action Project; USAID = United States Agency for International Development; LEAD = Low Emissions Asian Development; SWAMP = Sustainable Wetlands Adaptation and Mitigation Program; LEAF = Lowering Emissions in Asia's Forests; SIEP = Sirindhorn International Environmental Park; IUCN = International Union for Conservation of Nature; MFF = Mangrove for the Future; AIT = Asian Institute of Technology

3.8 Publications

Only documents of international significance to mangrove ecosystems are listed below:

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Ellison, J.C., 2012. Climate Change Vulnerability Assessment and Adaptation Planning for Mangrove Systems. WWF, Washington DC, USA.

FREDA-ACTMANG, 2012. Ten Years in Pyindaye: Restoration of Mangrove Ecosystems and Community Development, Ayeyarwady Delta, Myanmar (1999−2008). The Key Publishing House, Yangon, Myanmar, 164 pp.

Garcias, J.R., 2012. Community strategy for mangrove forest conservation: Conquista Campesina Conservation Easement. Field Actions Science Report, Special Issue 7, 15 pp.

Greiber, T., Editor, 2009. Payments for Ecosystem Services: Legal and Institutional Frameworks. IUCN, Gland, Switzerland, 296 pp.

Hutchison, J., Spalding, M. & Ermgassen, P., 2014. The Role of Mangroves in Fisheries Enhancement. The Nature Conservancy and Wetlands International, 56 pp.

IUCN, 2013. Proceedings of the Workshop on Ecological Considerations in Coastal Development, Colombo, Sri Lanka. 22 November 2013. IUCN, Sri Lanka, 80 pp.

Kaufman, J.B. & Donato, D.C., 2012. Protocols for the measurement, monitoring and reporting of structure, biomass and carbon stocks in mangrove forests. Working Paper 86. CIFOR, Bogor, Indonesia.

Macintosh, D.J., Mahindapala, R. & Markopoulos, M., Editors, 2012. Sharing Lessons on Mangrove Restoration. Mangroves for the Future (MFF) and IUCN.

McIvor, A.L., Möller, I., Spencer, T. & Spalding, M., 2012a. Reduction of Wind and Swell Waves by Mangroves. Natural Coastal Protection Series: Report 1. The Nature Conservancy and Wetlands International.

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MFF, 2009. National Strategy and Action Plan: An Ecosystem-based Integrated Coastal Management in Sri Lanka. Mangrove for the Future (MFF) and IUCN, 254 pp.

MFF, 2013. Proceedings of the National Workshop on Application of Viet Nam's Marine and Coastal Spatial Planning - An Ecosystem based Management Approach. Mangrove for the Future (MFF) and IUCN, 89 pp.

MFF, 2014. Pakistan National Strategy and Action Plan. Mangrove for the Future (MFF) and IUCN, 56 pp.

Primavera, J.H., Savaris, J.D., Bajoyo, B., Coching, J.D., Curnick, D.J., Golbeque, R., Guzman, A.T., Henderin, J.Q., Joven, R.V., Loma, R.A. & Koldewey, H.J., 2012. Manual on Community-based Mangrove Rehabilitation. Mangrove Manual Series No. 1. Zoological Society of London, U.K., 240 pp.

Primavera, J.H., Yap, W.G., Savaris, J.P., Loma, R.J.A., Moscoso, A.D.E., Coching, J.D., Montilijao, C.L., Poingan, R.P. & Tayo, I.D., 2013. Manual on Mangrove Reversion of Abandoned and Illegal Brackishwater Fishponds. Mangrove Manual Series No. 2. Zoological Society of London, U.K., 108 pp.

Roslan Ariffin & Nik Mohd Shah, N.M., 2013. The Matang Mangrove Working Plan 2010−2019 (Sixth Revision), Perak, Malaysia, 229 pp.

Spalding, M., McIvor, A., Tonneijck, F.H., Tol, S. & van Eijk, P., 2014. Mangroves for Coastal Defence: Guidelines for Coastal Managers and Policy Makers. Wetlands International and The Nature Conservancy, 42 pp.

SPREP, 2011. Pacific Regional Environment Program Strategic Plan 2011–2015. Secretariat of the Pacific Regional Environment Program, Samoa, 40 pp.

Sukardjo, S. & Alongi, D.M., 2012. Mangroves of the South China Sea: Ecology and Human Impacts on Indonesia's Forests. Nova Publishers, Inc., New Yory, USA, 229 pp.

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UNEP, 2014. The Importance of Mangroves to People: A Call to Action. van Bochove J, Sullivan E, Nakamura, T, Editors. United Nations Environment Program and World Conservation Monitoring Centre and Wetlands International, 128 pp.

van Lavieren, H., Spalding, M., Alongi, D., Kainuma, M., Clüsener-Godt, M. & Adeel, Z., 2012. Securing the Future of Mangroves. A Policy Brief. UNU-INWEH, UNESCO-MAB with ISME, ITTO, FAO, UNEP-WCMC and TNC, 53 pp.

VLIZ, 2015. Book of Abstracts: VLIZ Young Marine Scientists' Day. Mees, J. & Seys, J., Editors. Brugge, Belgium: Vlaams Instituut voor de Zee (VLIZ) Special Publication 71, 196 pp.

WB, ISME & CA, 2013. Draft Code of Conduct for the Sustainable Management of Mangrove Ecosystems. Report of the World Bank, International Society for Mangrove Ecosystems and cenTER Aarhus, 79 pp.

WI, 2015. Wetland Solutions for People and Nature: Strategic Intent 2015–2025. Wetlands International, 40 pp.

ZSL, 2014. Abstracts of the Symposium 'Turning the Tide on Mangrove Loss'. Zoological Society of London, IUCN, SSC and MSG, 30 pp.

3.9 Websites and Portals

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Blue Carbon Initiative: Mitigating Climate Change through Coastal Ecosystem Management – http://thebluecarboninitiative.org

Department of Agriculture and Fisheries, Queensland Government: Marine Plants including Mangroves – https://www.daf.qld.gov.au/fisheries/habitats/marine-plants

International Society for Mangrove Ecosystems (ISME): New Publications – http://www. mangrove.or.jp/isme/english/

International Society for Mangrove Ecosystems (ISME): GLOMIS Database and Information System, and ISME/GLOMIS Electronic Journal – http://www.glomis.com

International Tropical Timber Organization (ITTO): Mangroves – http://www.itto.int/ feature07

International Union for Conservation of Nature (IUCN): The IUCN Red List of Threatened Species – http://www.iucnredlist.org/
James Cook University (JCU): MangroveWatch – www.mangrovewatch.org.au

Kyoto and Carbon Initiative: K & C Global Mangrove Watch – http://www.eorc.jaxa.jp/ ALOS/en/kyoto/mangrovewatch.htm

Mangroves for the Future (MFF): Documents by Countries (Bangladesh, Cambodia, India, Indonesia, Maldives, Myanmar, Pakistan, Seychelles, Sri Lanka, Thailand, Viet Nam) – https://www.mangrovesforthefuture.org/countries

Mangroves for the Future (MFF): Documents by Topics (Apply Knowledge; Enhance Governance; Private Sector; Empower Civil Society; Cross Cutting) – https://www. mangrovesforthefuture.org/topics

Mangrove Action Project (MAP): About Mangroves; Getting involved with Mangroves; Mangrove Issues – http://mangroveactionproject.org

Mangrove Org®: Mangrove Reforestation, Sustainable Development, Green Infrastructure, Ecological Engineering − http//www.mangrove.org

MangroveRestoration.com: Restoring the world's precious mangroves today for generations of tomorrow − www.mangroverestoration.com

Zoological Society of London (ZSL): IUCN SSC Mangrove Specialized Group – http://www. zsl.org/iucn-ssc-mangrove-specialist-group

MapWorks Learning: Mapping the Mangroves – http://www.mappingthemangroves.org/ reports/view/385

Marine Education Society of Australasia (MESA): Mangroves of Australia – http://www. mesa.edu.au/default.asp

National Commission for Knowledge and Use of Biodiversity: Mexican Biodiversity – http://www.biodiversidad.gob.mx/v_ingles

National Institute of Environmental Studies (NIES): Tropical Coastal Ecosystems Portal (TroCEP) – https://project.nies.go.jp/TCEP/index.html

National Parks Board (NPB) of Singapore: Mangroves – https://www.nparks.gov.sg/bio diversity/our-ecosystems/mangroves

National University of Singapore (NUS): Mangroves of Singapore – mangrove.nus.edu.sg

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Secretariat of the Pacific Regional Environment Program (SPREP): Documents – https:// www. sprep.org/library-information-resource-center/publications

Smithsonian National Museum of Natural History: Ocean Portal (Mangroves) – http://www. ocean.si.edu/mangroves

South China Sea (SCS) Program: Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand – http://www.unepscs.org/Project_Background.html

The Mangrove Lab: Geomorphology, Ecology, Ecosystems Services, Remote Sensing − http://www.themangrovelab.com

Wetlands International: Global – www.wetlands.org; Southeast Asia – http://www.wetlands. or.id; The Americas – http://lac.wetlands.org; Africa – www.afrique.wetlands.org

Wild Singapore: Mangroves on the Shores of Singapore – www.wildsingapore.com/wild facts/plants/mangrove/mangroves.htm

3.10 Additional Information

Inauguration of ISME, Okinawa, Japan

On 23 August 1990, the Inaugural General Assembly of ISME was held in Yokohama, Japan, formalizing the establishment of the International Society for Mangrove Ecosystems. The auspicious occasion was graced by their Imperial Highnesses Prince and Princess Hitachi. Present were the Executive Director of ITTO, Director General of UNESCO, Mayor of Yokohama City, and representatives from the Okinawa Prefecture and National Mangrove Committees. Since then, the Secretariat of ISME has been located at the Faculty of Agriculture, University of the Ryukyus in Okinawa.

As stipulated in the Statutes, the aims of ISME are to disseminate information on mangroves; promote mangrove-related research, training and extension services; foster sustainable development, rational utilization, conservation and rehabilitation of mangroves; sponsor activities related to mangrove research and training; promote government and public awareness on mangroves; and publish papers related to mangrove research and management.

ISME has implemented several international mangrove projects with the support of ITTO, the most significant being the World Mangrove Atlas 1997 and the World Atlas of Mangroves 2010. The society has also implemented mangrove projects in nearly 20 countries for over 20 years, and the knowledge and experiences gained have been disseminated through publications and international collaboration.

Mangroves for the Future Initiative

As a response to the 2004 Indian Ocean tsunami, Mangroves for the Future (MFF) was established as a partnership-based initiative to promote investment in coastal ecosystems for sustainable development (Bich Tien, 2014). Supported by national governments, IUCN, NGOs, donor agencies, and the private sector, MFF provides a unique regional platform for concerted action in support of Integrated Coastal Management (ICM). The initiative adopted mangroves as its flagship ecosystem in recognition of their protective role in reducing the impact of the 2004 Indian Ocean tsunami. MFF also embraces other coastal ecosystems, including coral reefs, estuaries, lagoons, wetlands, beaches and sea-grass beds.

The mission of MFF is to promote healthy coastal ecosystems through a partnership-based, people-focused, policy-relevant and investment-orientated approach. It builds and applies knowledge, empowers communities and other stakeholders, enhances governance, secures livelihoods, and increases resilience of ecosystems towards natural hazards and climate change. Following the completion of the first phase (2007–2009) and second phase (2010–2013), MFF is being implemented in 10 member countries, including Bangladesh, Cambodia, India, Indonesia, Maldives, Pakistan, Seychelles, Sri Lanka, Thailand and Viet Nam.

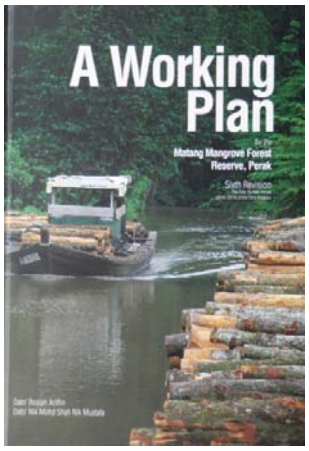
Matang Working Plan (2010−2019), Perak, Malaysia

The Matang Working Plan (2010−2019) has been published in 2013 (Roslan Ariffin & Nik Mohd Shah, 2013). Copies are available and can be purchased from the Perak State Forestry Department, Ipoh, Perak, Malaysia. In a new A4 format with a refreshing front cover and attractive layout, the hardcover document of 229 pages has 24 chapters, nine maps, three boxes, 23 tables, 63 figures and 23 appendices (Chan, 2014). Illustrations including photos are relevant and of commendable quality. This revision has maintained the approach adopted by the previous 2000−2009 working plan in terms of zoning, silviculture, and allocation of final felling and intermediate sub-coupes. All the chapters have been retained to provide for continuity. The chapters on mangrove flora and fauna, and on forest products have been expanded, with a new chapter on research and development.

The most significant change in this working plan is the increase in the number of charcoal kiln (40%) and charcoal contractors (67%) allowed to operate in the Matang Mangroves, from 350 kilns and 86 contractors

in the previous plan (Roslan Ariffin & Nik Mohd Shah, 2013). This has been attributed to the policy of the State Government of Perak to foster greater participation of Bumiputra entrepreneurs in the lucrative charcoal industry. With more participants, there is a need to maximize the availability of resource by allocating more forest for final felling. There is continuing high demand for charcoal from Matang especially from overseas markets such as Japan, which is consistent in yield and quality, and produced from the sustainably managed forests.

Matang is the largest tract of mangroves in the world that has come under sustainable management for more than 100 years. The present working plan reflects the unwavering commitment of the State Government of Perak to continue managing the Matang Mangroves and their associated ecosystems sustainably.



Management highlights of the working plan

- Total area: 40,288 ha
- Management objectives:
  To supply wood on a sustainable basis for the production of charcoal and poles
- Rotation: 30 years
- Regulation of yield: Volume and area
- Silvicultural system: Stick thinning, clear felling and direct planting of propagules
- Annual budget: RM 2.8 million in revenue and RM 1.2 million in expenditure

Kota Kinabalu Wetlands, Sabah, Malaysia

Covering an area of 24 ha, the Kota Kinabalu (KK) Wetlands is located in the heart of the capital city of Sabah. The area was gazetted a protected wildlife sanctuary in 1996, and managed by the Sabah Wetland Conservation Society. Mangrove planting to restore degraded sites has been a priority and was successfully carried out as evident by its area covered with lush mangroves. In the KK wetlands, the most common mangrove plants are *Rhizophora apiculata*, *Rhizophora mucronata*, *Bruguiera cylindrica*, *Avicennia alba*, *Avicennia marina*, *Lumnitzera littorea*, *Lumnitzera racemosa* and *Sonneratia alba* (Lee, 2011b). The mangrove fern *Acrostichum aureum* and sea hibiscus *Hibiscus tiliaceus* also occur in abundance. More than 90 species of migratory and resident birds, 20 fish species, 14 crustacean species, 13 mollusc species, 9 insect species and 5 reptile species have been recorded in the KK wetlands (Lee, 2011a).

Ranong Biosphere Reserve, Thailand

The Ranong Biosphere Reserve (RBR) is the fourth Man and Biosphere (MAB) Reserve in Thailand, but the first to include coastal habitats (Macintosh *et al*., 2002). Established in 1997, RBR is in the district of Muang Ranong in Ranong Province. RBR covers 30,000 ha of mangrove forests and associated waterways, representing the largest single tract of mangroves in Thailand. The Royal Forest Department (RFD) manages RBR and is rehabilitating the mangrove forest after decades of destructive use for charcoal making, tin mining and shrimp farming. Besides the restoration and conservation of mangrove ecosystems for fish and wildlife, another fundamental concept of the MAB Program is that management should also include local community participation. The concept of mangrove biodiversity protection and restoration, and sustainable utilization of resources by the local communities, is central to the management of RBR.

Four fishing village communities live within the mangrove forest in the buffer and core zones of RBR. These are Ban Hat Sai Khao (a Thai Buddhist village) at Klong Ngao, Koh Kam (a Chinese community), Ban Koh Lao (a Thai Moslem community), and a group of Sea Gypsies at Ban Koh Lao Nok. These communities still rely on mangrove resources for their subsistence, especially fish, shrimp, crabs and molluscs. Five coastal villages, namely, Ban Thung Ngao, Ban Ngao, Ban Tha Chang, Ban Lang and Ban Hat Sai Dam are located in the transition zone.

Can Gio Mangrove Biosphere Reserve, Viet Nam

In January 2000, Can Gio was designated as the first Mangrove Biosphere Reserve (MBR) in Viet Nam (Hoan *et al*., 2007; Nam *et al*., 2014). The MBR has a core zone of 4,720 ha, which is protected for long-term conservation of biodiversity, research and monitoring purposes. The buffer zone of 37,340 ha provides a natural landscape, serving as corridors for wildlife, and as ecological and cultural destinations for tourists. The transition zone of 29,310 ha, surrounding the core and buffers zones, is allocated for the socio-economic development. The forested area of 31,800 ha comprises planted forests (60%) and natural forests (40%). In the non-forested area of 39,600 ha, 55.8% are waterways, 35.3% are utilised land and 8.9% are wasteland. The MBR is divided into 24 forest compartments with Compartments 4a, 6, 11, 12 and 13 in the core zone and the remaining forming the buffer zone. Villages and towns include Binh Khanh, An Thoi Dong, Ly Nhon, Long Hoa and Can Thanh. The Can Gio Forest Park, Vam Sat Tourist Site and Can Gio Resort are major tourist attractions.

In Can Gio MBR, 35 species of 19 genera are true mangroves while 24 species of 22 genera are mangrove associates. In the World Atlas of Mangroves, 30 mangrove species have been recorded for Viet Nam (Spalding *et al*., 2010). Of these, all species are found in Can Gio including *Kandelia obovata* which was introduced from north Viet Nam. *Lumnitzera littorea*, *Rhizophora x lamarckii* and *Xylocarpus moluccensis* are not listed in the world atlas. Silvicultural treatments such as thinning of the planted *Rhizophora apiculata* forests are no longer carried out and studies revealed that most of the forests are beyond its rotation age of 21 years with the oldest forests being 35 years old. Trees in such old forests are dying or having pest problems such as termites and wood borers. The Mekong delta including Can Gio MBR is susceptible to typhoons. Typhoon Durian (Category 4) made landfall in December 2006 and damaged only 28 ha of Compartment 17 with no loss of human lives and properties.

Batu Ampar Mangrove Demonstration Site, Kalimantan, Indonesia

The Batu Ampar mangrove demonstration site, established in September 2006, is located in the districts of Batu Ampar, Kubu and Teluk Pakedai districts of West Kalimantan in Indonesia. Of the total area of mangrove forest, 33,400 ha are classed as protected forest and 32,200 ha are classed as production forest from which timber is harvested sustainably. There are 20 true mangrove species and 30 associate species within the Batu Ampar site, of which species of *Rhizophora*, *Bruguiera* and *Nypa fruticans* are the most dominant. *Rhizophora apiculata* maintains the highest density and timber volume ranges from 170−180 m^3/ha in the production forest and between 340−350 m^3/ha in the protection forest.

The total human population of Batu Ampar, Kubu and Teluk Pakedai Districts is 88,500 comprising mainly of farmers and fishermen who are dependent on the mangrove forest. Communities in Kubu and Teluk Pakedai districts include charcoal producers, operating 135 kilns and producing 423 metric tons of charcoal annually.

The key achievement for Batu Ampar has been the development of the management plan. Another major activity has been the development and implementation of the business plan for
sustainable livelihood and business opportunities. Alternative livelihoods and business opportunities based on the use of non-timber mangrove products have been identified. They include the introduction of coconut-shell charcoal production and the production of soft-shelled crab.

Training and study visits have been provided to individuals from local communities who were interested in these activities. A training course on the improvement of charcoal quality has been conducted for small-scale charcoal producers. Numerous training, education and public awareness activities have been implemented including improvement of charcoal quality, management of mangrove ecosystems and silvofishery techniques.

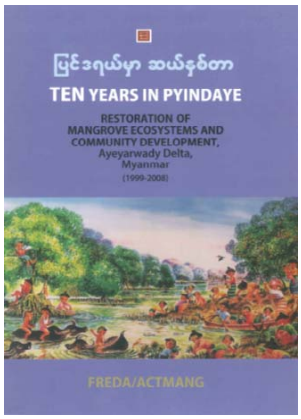
To enhance public awareness, Batu Ampar has established a Sustainable Mangrove Utilization Information Center, which is located in the Faculty of Forestry of Tanjungpura University in Pontianak. The South China Sea (SCS) Program funded the activities of Batu Ampar with co-financing from the Department of Forestry, the Department of Marine and Fisheries, and the Provincial Government.

Restoration of Mangroves and Community Development, Myanmar

Restoration of Mangroves and Community Development in the Ayeyarwady Delta, Myanmar, was a collaborative effort of FREDA (Forest Resource Environment Development and Conservation Association, Myanmar), MFD (Myanmar Forest Department) and ACTMANG (Action for Mangrove Reforestation, Japan) with the direct involvement of forest user groups or villagers

(FREDA-ACTMANG, 2012). In Phase 1 (1999−2003), the project established 610 ha by 310 households from 10 villages, In Phase 2 (2004−2008), the area of 680 ha was established by 375 households from 12 villages. A total of 1,290 ha were successfully restored by community forestry in 10 years. The project has just completed Phase 3 (2009−2014). Donors of the project were Tokio Marine and Nichido Fire Insurance Co., Ltd., Japan, Japan Fund for Global Environment, and Japan International Forestry Promotion and Cooperation Center.

Beside mangrove restoration, community development, R&D and capacity building were significant components of the project. In community development, various small-scale socio-economic activities such as livestock rearing, fish/crab/shrimp aquaculture, plant nurseries, charcoal making and ecotourism were initiated to generate additional income for the villagers. Two tube wells were dug in one of the villages to supply drinking water, several schools were built or refurbished, and environmental courses were conducted. The project supported four Ph.D. and numerous M.Sc. theses under R&D. Staff members of FREDA and MFD visited Japan and Viet Nam. Most importantly, the project assisted the people who suffered from the damage of Cyclone Nargis in 2008.



With significant contributions to the local people, a book entitled, “Ten Years in Pyindaye: Restoration of Mangrove Ecosystems and Community Development, Ayeyarwady Delta, Myanmar (1999−2008)” was published by FREDA and ACTMANG. In addition to the words of wisdom from Miyazawa Kenji (a famous Japanese poet), and from Ahhmya (Buddhist philosophy in Myanmar), the book has the following advice to the people of Pyindaye (PDY), “Becoming wealthy is not a bad thing, but a cleavage in the society between the rich and poor can provoke unhappiness. I wish to remind the villagers of PDY that Small Is Beautiful” − Motohiko Kogo.

Mangrove Planting in Tarawa, Kiribati

The Republic of Kiribati is a small island nation in the Central Pacific with elevations ranging from sea level to only 3 m. In an effort to reduce coastal erosion, a mangrove plantation project has been implemented by the Kiribati government and the International Society for Mangrove Ecosystems (ISME), together with environmental youth groups and school children on the Tarawa atoll with financial support from the Japanese Cosmo Oil Co. Ltd. (Baba, *et al*. 2009).

This project has led to the development of a unique and effective close-group planting method where three propagules per group of *Rhizophora stylosa* are planted at 25 x 25 cm and 50 x 50 cm spacing along the shoreline between the mean water level and the mean high water level (Baba, 2011). At the Ananau Causeway, survival was 90% in the first year and over 50% after 3 years (Suzuki *et al*., 2009). Within 4 years, accumulation of sediments was observed and the mangroves had formed a distinct barrier with trees bearing flowers and propagules. During a special visit in September 2011, Mr. Ban Ki-moon, the Secretary General of the United Nations, planted mangroves alongside Mr. Anote Tong, the President of Kiribati, using this close-group method (Figure 3).

UN photo by E. Debebe

Figure 3 Mr. Ban Ki-moon, the Secretary General of the United Nations, planted mangroves with Mr. Anote Tong, the President of Kiribati in September 2011

GoM-LME Mangrove Conservation and Restoration, Mexico

The conservation and restoration of coastal ecosystems in Mexico is a priority because of the services and benefits they provide. An example is the Natural Protected Mangrove Area of Laguna de Terminos in the state of Campeche, where a demonstration pilot project has been carried out for three years under the program on Integrated Assessment and Management of the Gulf of Mexico Large Marine Ecosystems (GoM-LME), a bilateral project of Mexico and the United States of America (Zaldivar-Jiménez, 2014). The program has three demonstration pilot projects, namely:

1. Joint Assessment and Management of Coastal Conditions
2. Conservation and Restoration of Mangrove Ecosystems
3. Recovery of Living Marine Resources

Under the Conservation and Restoration of Mangrove Ecosystems demonstration pilot project, the main activities were mangrove rehabilitation in degraded areas, recovery processes and ecological services. A cooperative society with the communities in Isla Aguada, Campeche was formed and activities were coordinated by the Carmen University, Natural Protected Areas Commission, National Forestry Commission, and Environmental and Natural Resources Secretariat.

The model of conservation and ecological restoration was based on five guidelines:

- Environmental diagnosis and forensic ecology
- Restoration action plans
- Monitoring of success indicators
- Training, technical transfer of information and environmental education
- Socialization, public involvement and sustainability

This last guideline of using sustainability as a measure of success of the demonstration pilot project on conservation and restoration of mangrove ecosystem was considered most critical and crucial to the continuity of the medium and long-term restoration sites.

Rehabilitation of Degraded Mangroves, Sabah, Malaysia

A Memorandum of Understanding (MoU) between Sabah Forestry Department (SFD) and the International Society for Mangrove Ecosystems (ISME) was signed on 10 November 2010 in Kota Kinabalu, Sabah, Malaysia (Tangah *et al*., 2015). In 2011, the SFD-ISME collaborative project to rehabilitate degraded mangroves in Sabah was initiated. Funded by Tokio Marine and Nichido Fire Insurance Co., Ltd., the mangrove rehabilitation project was implemented by SFD with technical guidance from ISME. Both organizations collaborated well as partners to ensure the successful implementation. This collaboration presented a great opportunity for SFD to strengthen its capacity in mangrove rehabilitation. The department

was honored as Sabah was the first state in Malaysia to have such collaboration with an international agency such as ISME. The success of this project may attract other collaborative projects between institutions in Japan and Malaysia in the near future.

The main objectives of the collaborative project were to plant 50 ha of degraded mangroves in Sabah annually and to develop cost-effective methods for mangrove rehabilitation with the available funds from ISME. The project identified areas for planting and adopted silvicultural techniques that would encourage sufficient vegetation cover for subsequent natural regeneration and recovery. Planting areas were located within forest reserves, which are under the jurisdiction of SFD.

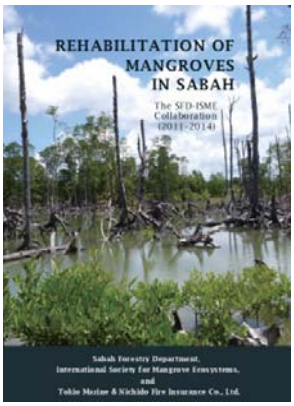
The first phase of the project was for three years (2011−2014). During this period, the project successfully planted more than 150 ha of degraded mangroves forests in 14 project sites located in five forest reserves (FR) of four forestry districts. They were Sungai Gum-Gum and Sungai Loboh FR and Sibyte FR in Sandakan, Padas Damit FR in Beaufort, Kuala Bonggaya and Kuala Labuk FR in Beluran and Sandakan, and Kuala Tingkayu FR in Kunak. Sites selected for rehabilitation included areas encroached by oil palm, degraded riverine mangroves, and areas encroached by shrimp ponds.

Important elements that led to the successful implementation of the project were:

- A Project Steering Committee (PSC) meets twice a year
- A Project Leader from SFD works closely with the ISME Secretariat in Okinawa, Japan
- A Mangrove Task Force is dedicated to all activities of the project
- Two four-wheel drives are assigned specifically for the project use
- Regular field visits are conducted to monitor the progress of project activities, and to discuss limitations and problems encountered
- Depending on site conditions, silvicultural procedures are refined as the need arises

Some key performance indicators of the project were:

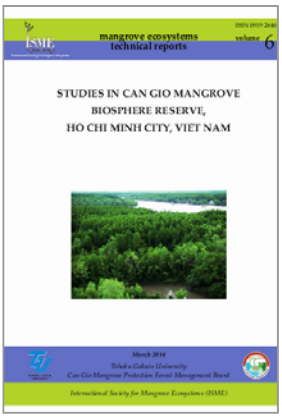
- The Scouts Association of Sandakan planted mangroves in one of the project sites in February 2012
- Students from Ritsumeikan Uji High School in Kyoto, Japan visited Sandakan and planted mangroves in March 2012
- University students and school teachers from Tokyo, Japan visited Sandakan and planted mangroves in August 2014
- University students from Chiba University in Tokyo, Japan visited Sandakan and planted mangroves in August 2015
- Other meetings held in conjunction with the SFD-ISME project included the Eighth ISME General Assembly in September 2011, and the Launching and Seminar of the ISME-ITTO Mangrove Educational Books in March 2013



The publication of a book in 2015 entitled “Rehabilitation of Mangroves in Sabah: The SFD-ISME Collaboration (2011− 2014)” and the extension of the project for another five years (2014−2019) were major manifestations of the successful collaboration. The spirit of working together and friendship between both parties had sustained, and would continue to strengthen for the next five years and beyond. The experiences gained and lessons learnt would serve as a guide when implementing the second phase of the project.

Studies in the Can Gio Mangrove Biosphere Reserve, Viet Nam

A joint mangrove research project was implemented between Tohoku Gakuin University (TGU) in Sendai, Japan; Can Gio Mangrove Protection Forest Management Board (MPFMB) of Ho Chi Minh City (HCMC), Viet Nam; and Nong Lam University (NLU), HCMC, Viet Nam (Chan and Cohen, 2014).



Papers presented at two research workshops held in Can Gio in March 2013 and in TGU in November 2013 were compiled and published as a book entitled, "Studies in Can Gio Mangrove Biosphere Reserve, Ho Chi Minh City, Viet Nam" as ISME Mangrove Ecosystems Technical Reports No. 6 in 2014.

Research and Capacity Building in Coastal Resources, Sabah, Malaysia

The close working relationship between SFD and ISME had led to the implementation of another mangrove-related project between Okinawa and Sandakan. The International Exchange Program on Coastal Resources is a collaborative effort between SFD and the Tropical Biosphere Research Center (TBRC) of University of the Ryukyus in Okinawa. Officially launched with the MoU signed on 6 November 2012 in Kota Kinabalu, main objectives of the project are joint research and capacity building in coastal ecosystems. Key researchers of TBRC are from the Mangrove Research Station in Iriomote and the Coral Reef Research Station in Sesoko. The Project Leader and the Mangrove Task Force of the SFD-ISME project are local counterparts, directly involved in the SFD-TBRC project and provide assistance in the field.

Two studies have been initiated under the project:

• Study of decapods (family Camptandriidae)

  During a scientific expedition to the RAMSAR site of Lower Kinabatangan and Segama Wetlands, a new species of crab was collected. With the proposed name of *Exagorium fidelisi*, a scientific paper has been submitted for publication in the Raffles Bulletin of Zoology.

• Study of ecological succession in mangrove plantations

  The study involved matching environmental stress and plant physiological tolerance to determine the ecological niches of planted species; development of a transcriptome database; and use of unmanned aerial vehicles or drones to monitor vegetation recovery.

4. ITTO INTERNATIONAL CONFERENCE ON MANGROVE FOREST AND ECOSYSTEMS 2016

4.1 Background

Mangroves and their Importance

Mangroves are plant communities of the tropical and subtropical inter-tidal coastal zone. Trees, shrubs and herbs have developed morphological, physiological and reproductive strategies that are adapted to the harsh saline, waterlogged and anaerobic muddy substrates. Mangroves ecosystems provide a wide range of goods and services to human communities living in coastal areas. Goods include wood and non-wood forest products, medicines and fisheries, while services include recreation, ecotourism, bio-filtration, nursery and feeding grounds, coastal protection and carbon storage (Spalding *et al*., 2010; ITTO, 2012; Kainuma *et al*., 2013). A recent study showed that mangroves are among the most carbon-rich forests in the tropics, containing on average of 1,023 MgC/ha (Donato *et al*., 2011). While the amount of carbon stored above ground was considerable (153 MgC/ha), below ground storage accounted for 71−98% and 49−90% of total storage in estuarine and oceanic mangroves, respectively. Carbon storage in mangroves of the Indo-Pacific

region was 3−4 times higher than boreal, temperate and tropical upland forests. In a recent publication, UNEP (2014) has reiterated on the importance of mangroves to people, and called for action be taken to protect and restore these magnificent forests of the sea.

Loss of World Mangroves

There is convincing evidence that the global extent of mangrove forests is decreasing due to the rapid rate of socio-economic development in many countries. Currently, the 2010 World Atlas provided the most updated global estimate of mangrove area (152,000 ha in 123 countries), it is not strictly comparable with earlier global estimates obtained using different mapping methods. FAO (2007) provided a detailed global assessment of change in mangrove area over a period of 25 years (1980−2005). All regions except Australia experienced dramatic losses in mangrove area over the 25-year period, including more than 20% loss in East Asia, Pacific Islands, Southeast Asia, and North and Central America. Although the global rates of loss have declined, they are still 3−4 times higher than the loss of all forests. In many areas, remaining mangroves are no longer pristine and highly degraded due to uncontrolled use.

The loss of world mangroves over the past decades is mainly caused by conversion of mangrove areas for urban and industrial development, and for aquaculture and agriculture (Spalding *et al*., 2010; van Lavieren *et al*., 2012; Kainuma *et al*., 2013). Where population pressures are high and space is limited, large areas of mangrove have been converted to plantations of cash crops such as rice, coconut and oil palm although mangrove soils are only marginally suitable for agriculture. The strongest driver of mangrove conversion has been the development of pond culture of shrimp especially in Southeast Asia, and in Central and South America. It has been estimated that 38% of global mangrove loss is due to clearing for shrimp ponds, while another 14% for other forms of aquaculture (Valiela *et al*., 2001).

Management and Conservation of Mangroves

Recognizing the importance of mangroves worldwide, efforts have been made to manage these ecosystems for sustainable forestry and fishery use. Policy, legislation and management are largely developed at the national level. Mangrove forests in some parts of the world have been managed for timber production. A well-known example is Matang in Perak, Malaysia, where 41,000 ha of forests have been managed successfully for more than 100 years. The forests are managed on a sustained yield basis based on comprehensive 10-year working plans with thinning at 15 and 20 years followed by final felling at 30 years and enrichment planting (Roslan Ariffin & Nik Mohd Shah, 2013). Apart from 75% of productions forests, 17% have been retained as protective forests. Successful management requires national government commitment. There may be several ways to manage mangroves effectively. The way towards sustainable forestry practices require a balance between utilization and conservation, augmented with protection and rehabilitation.

Due to the rapid decline of mangroves, many countries have made concerted efforts to conserve these ecosystems. In Thailand, all natural forests including mangroves are state owned and managed by the Royal Forest Department, the Department of National Parks, Wildlife and Plant Conservation or the Department of Marine and Coastal Resources. In 1989, a ban in logging of natural forests was imposed (Simula *et al*., 2006). In 1998, the Government of Thailand revised the national policy and management practices for mangroves, banning forest conversion and tree felling (Aksornkoae, 2004). All mangrove forests in Thailand are classified into two zones. In the conservation zone, any form of utilization is prohibited while in the utilization zone, socio-economic activities are restricted. Other countries such as Brazil, Mexico, Cambodia, El Salvador and Tanzania have also established legal frameworks for the protection of mangroves. More mangrove forests are now protected as World Heritage sites, RAMSAR sites and UNESCO-MAB biosphere reserves. Currently, there are 1,200 protected areas with mangroves, accounting for 25% of mangroves worldwide (Spalding *et al*., 2010).

A major constraint in managing mangroves is the complexity in mangrove distribution in the coastal zone. Various governmental agencies such as fisheries, forestry, coastal planning, agriculture and environment have jurisdiction over the coastal resources, and their policies are often in conflict. It is therefore important that relevant government agencies and stakeholders work together to establish sound policies and legislations, protecting not only mangroves but also adjacent ecosystems such as sea grasses and coral reefs.

Restoration of Mangroves

Soon after the Indian Ocean tsunami in 2004, that devastated Aceh in Indonesia and damaged the shores of other countries bordering the ocean, many international organizations rushed into Aceh to be seen offering humanitarian aid and implementing mangrove restoration programs. UNEP (2007) reported that 27,500 ha had been planted with 30 million mangrove seedlings in Aceh, Indonesia, following the tsunami. However, most of the planting were unsuccessful due to poor species and site selection, insufficient preparation, inadequate guidance, and lack of tending (Wibisono & Suryadiputra, 2006; Hanley *et al*., 2008; Chan & Baba, 2009). Emphasis was on the number of seedlings planted and not on survival rate. Another important lesson learned is that it is critical to involve local communities in any mangrove restoration projects as reported in the Philippines (Primavera & Esteban, 2008).

International Cooperation on Mangroves

As there is an urgent need for conservation and sustainable management of mangrove ecosystems, and to restore degraded mangroves in different countries worldwide, it is wise to share their lessons learnt (success and failure) from case studies. In this context, international collaboration and cooperation are pertinent.

Considerable knowledge on sustainable management and utilization of mangroves is available, and a number of international organizations and global initiatives can provide financial and/or technical support. Among others, they include:

- Mangrove for the Future (MFF) of International Union for Conservation of Nature (IUCN)
- International Society for Mangrove Ecosystems (ISME)
- International Tropical Timber Organization (ITTO)
- Clean Development Mechanism (CDM) under the UN Framework
- Convention on Climate Change (UNFCC) of the Kyoto Protocol
- Reduced Emission from Deforestation and Degradation (REDD+)
- Blue Carbon Initiative
- Aichi Biodiversity Targets of the Convention of Biodiversity (CBD) Strategic Plan for Biodiversity 2011−2020; and
- Satoyama Initiative of International Partnership for Satoyama Initiative (IPSI)

4.2 International Conference

Background

ITTO and ISME will be co-organizing a Meeting on Mangrove Forests and Ecosystems − Opportunities and Challenges for their Future on 9 September 2015 as a side event during the coming XIV World Forestry Congress (WFC2015) in Durban, South Africa. As a follow-up from this side event, there is a need for ITTO to organize an international conference in collaboration with ISME and other partners as endorsed by the ITTC. *Towards a Sustainable Future for Mangrove Forests and Ecosystems: Monitoring their Protection, Restoration and Production* may be an appropriate theme for the conference.

With 40% of the mangrove forests worldwide under some form of protection for conservation, this would imply that the remaining 60% are available for production and other purposes. It is therefore pertinent for ITTO to monitor the present status of these protected and production mangroves in the timber producing countries.

The objectives of the conference are to discuss:

1. The challenges and experiences in the implementation of mangrove management or action plans

2. The present status of protected and production mangrove forests and ecosystems

3. The monitoring of growth and recovery of restoration projects

Proposed Topics and Issues

□ **Mangrove management or action plans**

- *Challenges and experiences in implementation*
- *Sustainability of implemented activities*

□ **Protected mangrove forests**

- *Present status and plans for the future*
- *Surveillance and enforcement*

□ **Production mangrove forests**

- *Present status and plans for the future*
- *Forest management and production*

□ **Mangrove restoration projects**

- *Lessons learnt from failed and success stories*
- *Monitoring plant growth and ecosystem recovery*

Date June or July 2016

Duration Three days

Venue Malaysia or Indonesia

Program Two days of conference
One day of field excursion

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5. PRIORITY AREAS IN SUPPORT OF ITTO MANGROVE STRATEGIES AND PRACTICAL ACTIONS

5.1 Priority Areas

Currently, there are international organizations that specialize on mangrove and other coastal ecosystems, with many having broader mandates that include mangroves. The most noteworthy being the IUCN Mangrove for the Future (MFF) Initiative with secretariats in more than 10 Asian countries. Located in country offices of IUCN, these MFF secretariats have been actively organizing mangrove-related activities such as workshops and training courses in recent years. MFF also manages a small-grant R&D facility for member countries, suggesting that funding is not a constraint.

In the management and conservation of coastal ecosystems, many of these international organizations have adopted approaches that are impressive in concept but are difficult to implement and verify. Some of these projects are long-terms and require much financial support to remain sustainable. The approaches include:

- Adopt REDD+ as the way forward
- Incorporate better coastal resource governance
- Adopt integrated coastal management
- Monitor ecosystem dynamics
- Employ adaptive management
- Promote community-based ecosystem management
- Build resilience in coastal ecosystems and communities
- Conduct economic valuation of goods and services
- Apply payment for environmental services
- Balance gender inequality
- Undertake transboundary diagnostic analysis
- Advocate measures for disaster risk reduction

In view of the current global scenario with many players competing in the mangrove arena, the priority areas for ITTO concerning mangroves should be focused and niche-based to sustain its prominence. Adopting the strategic priorities identified in the ITTO Strategic Action Plan 2013−2018 and Biennial Work Program for 2015−2016 would be a practical approach with comparative advantage.

The organization's mission statement on sustainable management and utilization of tropical forests highlighted in the ITTO Strategic Action Plan 2013−2018, ITTO Thematic Programs and the CBD-ITTO Initiative 2010 should be the focus. Compliance with the goals and objectives of other recent international initiatives such as the Aichi Targets (Appendix III) of CBD Strategic Plan for Biodiversity 2011−2020 and the Satoyama Initiative 2010 (Appendix IV) is recommended.

5.2 Strategies and Practical Actions

In accordance to Activity 10 of Strategic Priority 3 of the Biennial Work Program for 2015−2016, which stipulates the promotion of conservation, restoration and sustainable management of mangrove ecosystems, the following strategies and practical actions for ITTO are proposed:

Strategy 1: Update the ITTO Mangrove Workplan 2002−2006

Action 1.1: *Document and launch ITTO Mangrove Charter 2016−2020*

The ITTO Mangrove Workplan 2002−2006 needs to be revised. Likewise, the ITTO-funded ISME Mangrove Workplan for Sustainable Management of Mangroves 2004−2009 (Appendix V) and the ISME Charter for Mangroves 1991 (Appendix VI) are out-dated. Using these documents as references, ITTO can proceed to document and launch ITTO Mangrove Charter 2016−2020. In view of the increasing number of international initiatives that are relevant to mangrove ecosystems by other organizations, this new charter would be visible, timely and appropriate for ITTO.

Action 1.2: *Develop criteria and indicators for sustainable management of mangrove forests*

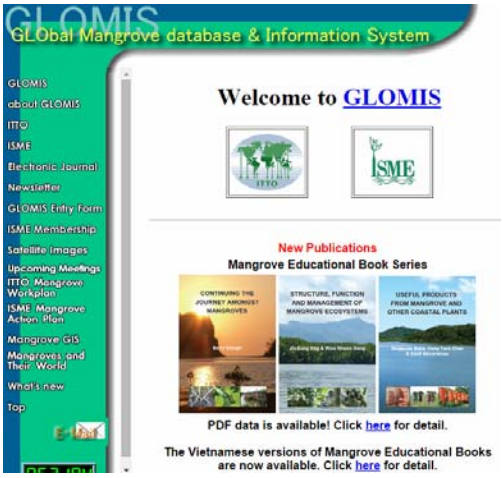
The ITTO Mangrove Workplan 2002–2006 has identified the development of criteria and indicators for sustainable management of mangroves as one of the key activities under the program of conservation

and sustainable management. ITTO has published several documents on criteria and indicators for natural tropical forests (ITTO, 1998; 1999; 2005). These can be adapted with modifications for mangrove forests and ecosystems taking into consideration the mangrove environmental conditions of the muddy, saline and anaerobic substrates, and the influence of tidal inundation.

Strategy 2: Maintain, Expand and Improve Mangrove Information Outreach

Action 2.1: *Support existing mangrove information databases e.g. GLOMIS and TroCEP in collaboration with other organizations such as ISME and NIES*

Support the maintenance of GLOMIS



The Global Mangrove Information and Database System (GLOMIS), is a searchable on-line database developed by ISME, which allows for easy access to mangrove-related information from around the world (Baba *et al*., 2004). The project was funded by ITTO and although completed in 2004, the information and database system is maintained and updated by ISME. The information within the database relates to mangroves and associated ecosystems, and falls under the following categories of People, Institutions, Projects and References. GLOMIS contains more 8,400 records and provides end-users easy retrieval of abstracts from numerous journal sources. The ISME/GLOMIS Electronic Journal is features in the GLOMIS website.

Support the expansion of TroCEP

The National Institute for Environmental Studies (NIES) in Tsukuba and ISME in Okinawa, Japan, have launched a new web-based Tropical Coastal Ecosystems Portal (TroCEP) on 21 July 2015. Plans are underway to develop TroCEP into a one-stop e-Portal for integrated mangrove information outreach (MIO). At present, with a small grant from the Ministry of Environment of Japan, the portal has icons on mangrove ecosystems; mangrove plants and their adaptations; values and uses of mangroves; threats to mangroves; and conservation and management of mangroves.

National Institute for Environmental Studies, Japan (NIES)

National Institute for Environmental Studies, Japan NIES

International Society for Mangrove Ecosystems (ISME)

International Society for Mangrove Ecosystems ISME

Other information incorporated into TroCEP are world mangrove distribution maps, taken mainly from the 2010 World Atlas of Mangroves, covering the regions of Western Indo-Pacific, Central Indo-Pacific, Eastern Indo-Pacific, the Americas, and West and Central Africa. The portal has a comprehensive list of mangrove plants categorized by geographical distribution, and by species in each country or region. Progressively, information on mangrove fauna, coral reefs and sea grasses will also be included.

With the support of ITTO, the scope of TroCEP can be expanded (Table 4) to include the following:

- Mangrove distribution maps updated for selected areas
- List of protected areas with mangroves in each country or region (their location, extent and other relevant information
- List of mangrove restorations projects in each country or region (their location, extent and species planted)
- Information on successful collaborations that have gone beyond their project objectives

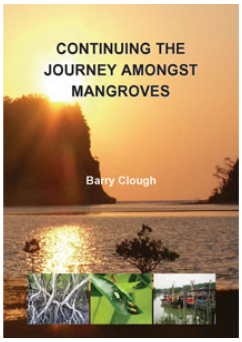
Table 4 Mangrove information of the Tropical Coastal Ecosystems Portal (TroCEP) at present and when expanded

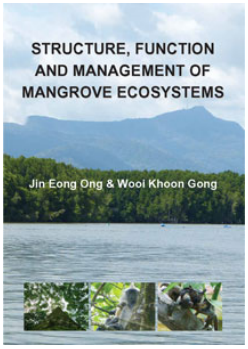
Component	At present	When expanded
Ecosystems	◦ Plants and their adaptations ◦ Values, uses and threats ◦ Conservation and management	• Faunal diversity • Animals and their adaptations
Biodiversity	◦ Geographical distribution of plant species ◦ List of plant species in each country or region	• List of animal species in each country or region • An online exercise on identification of flora and fauna species
Maps	◦ World distribution by regions from the 2010 Atlas	• Distribution maps updated for selected areas
Protection		• List of protected areas with mangroves in each country or region • Their location, extent and other relevant information
Restoration		• List of mangrove restoration projects in each country or region • Information on their location, extent and species planted
Projects		• Highlight collaborations that have gone beyond their project objectives • Showcase partners and funding agencies of such successful projects

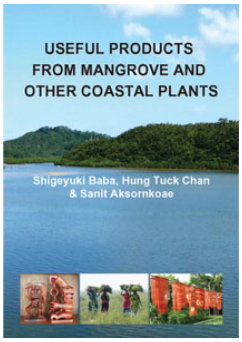
Action 2.2: *Package information on past and present ITTO-funded mangrove projects and their outputs for wider dissemination*

The Tropical Forest Update 2012; 21(2) − A special edition summarizing findings of the 2010 World Atlas of Mangroves is an excellent example of information packaging, which provides a 24-page overview of the 319-page atlas.

Such efforts should be extended to other ITTO publications such as the 2013 ITTO-ISME Mangrove Educational Book Series (Books 1, 2 & 3). Google Scholar has recorded 27 citations of the English version of the three books as of August July 2015. The books can be translated into Spanish for countries in South America and into French for countries in Africa. Recently, they have been translated into Vietnamese with gratitude to the painstaking effort of Phan Văn Hoàng from GIZ, Viet Nam. Many project reports by countries in Central America were written in Spanish and they can be translated in English for wider information dissemination.







Strategy 3: Build Capacity for Sustainable Management, Conservation and Utilization of Mangrove Forests and Ecosystems

Action 3.1: *Conduct international training courses on sustainable management and utilization of mangrove ecosystems, and on environmental education for sustainable development*

Providing training with good outcome learning on mangrove and other coastal ecosystems for sustainable management and for environmental education is a useful strategy for timber producing countries of ITTO, pending the availability of funds.

ISME conducted two international training courses for coastal resource managers, mangrove foresters and researchers each year, with the support of JICA. They were: 1) Sustainable Management and Conservation of Mangrove Ecosystems from 1995, and 2) Environmental Education for Sustainable Development − Conservation of Coastal Ecosystems for the Livelihoods of Local Communities from 2005. Both courses were however terminated in 2012 due to the lack of funds. From the positive feedback of participants, both courses generated very good and useful outcome learning. There is therefore a strong need for support from donors and funding partners to revive the training courses. The participants of these two training courses can also include news reporters, and the idea of training trainers is worth considering.

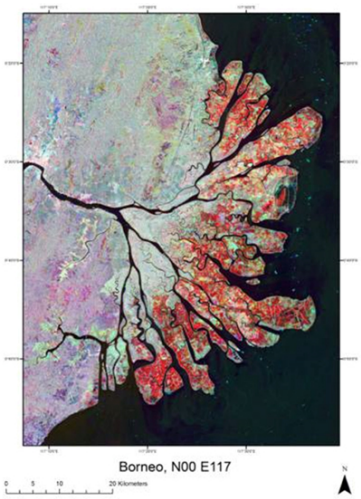
Action 3.2: *Conduct environmental education field programs on mangrove ecosystems for children and accompanying parents*

This activity is in line with the Children Environmental Education Program (CEEP) launched by ITTO in July 2009. For a start, the environmental education field programs on mangrove ecosystems can be conducted for children and accompanying parents in countries with such facilities and expertise. There is a need to produce an illustrative and easy-to-understand booklet as companion for the children. The booklet written in English can subsequently be translated into other languages for children from different parts of the world where similar field programs can be conducted. Progressively, these programs can be extended to other tropical forest ecosystems. Environmental education on mangrove and other tropical forest ecosystems for children of the world is definitely a promising niche-based activity that can become a hallmark of ITTO.

Strategy 4: Monitor the Status of Protected and Rehabilitated Mangrove Areas

Action 4.1: *Commission a study on the status of selected protected mangrove areas using remote sensing*

Under the ALOS Kyoto and Carbon (K & C) Initiative, the Global Mangrove Watch project led by the Earth Observation Research Center (EORC) of the Japan Aerospace Exploration Agency (JAXA) is of direct relevance. The center based in Tsukuba, Japan, has the expertise to conduct this study. The study will focus on selected protected mangrove areas to determine their present status and to track changes (if any).



JERS-1 (1996) and ALOS PALSAR (2007, 2010) color composite of East Kalimantan

Red areas have largely changed from mangrove forest in 1996 to aquaculture by 2007.

Action 4.2: *Produce a manual for monitoring indicators of ecosystem recovery following mangrove rehabilitation*

Often, mangrove rehabilitation projects report on the number of seedlings and area planted. There is no subsequent monitoring on the growth and mortality of planted seedlings, and on the recovery of the rehabilitated sites in terms of plant succession and faunal diversity. Scientists of the collaborative project between SFD and TBRC are currently conducting such a study in a degraded mangrove site planted by ISME and TM in Sabah, Malaysia. With the methods developed for monitoring plant and insect populations, some interesting results have been obtained. This project intends to include aquatic animals such as fish and crustaceans.

The plant component of the study involves height measurements and site matching (Figure 4) based on environmental stress and physiological tolerance of the species planted. In the planting site, an Unmanned Aerial Vehicle (UAV) or drone will be used to construct 3D information from 2D images obtained of vegetation cover over time. With the support of ITTO, it is envisaged that the documentation of a manual on monitoring ecosystem recovery will be most useful for other countries to conduct similar studies.

Figure 4 Measuring the height of planted mangrove seedlings for site matching

Strategy 5: Establish the fact that mangrove forest plantations can be managed to supply wood on a sustainable basis

Action 5.1: *Showcase the success story of Matang in Malaysia, the largest tract of mangroves in the world that has been sustainably managed for wood production more than 100 years*

The success story of sustainable forest management of the Matang mangroves, with a history of more than 100 years, can be featured as a special edition of the Tropical Forest Update. The co-existence of mangrove forests (production and protected), waterways, and people involved in forestry and forest products, and fishing communities is a splendid example of living in harmony with nature. Matang has attracted research scientists and tourists from all over the world. The article will definitely be a good read.

Action 5.2: *Document the technologies for producing value-added wood products and by-products from planted mangrove forests*

This proposed action echoes the objectives of the Industry Development and Efficiency (IDE) thematic program of ITTO. Technologies, both traditional and contemporary, for producing value-added products and by-products from mangrove wood are available. Wood products include charcoal and briquettes of export quality. New in the market is white charcoal, which fetches a high price. Wood vinegar is a by-product of charcoal processing. In Matang, Malaysia, the traditional knowledge and skill of building new and repairing old charcoal kilns is a dying art as there are only a few old master builders with no successors. The mangrove bark is a rich source tannin, which can be extracted for dyeing fabric. Mangrove tannin is used for dyeing cotton fabric (kusaki-zome) in the Ryukyu Islands of Japan, batik in Java, Indonesia and tapa cloth in the Pacific Islands. These technologies and knowledge should be documented and shared with the local communities.

Strategy 6: Reduce forest degradation and safeguard mangrove forest biodiversity by promoting non-timber forest uses

Action 6.1: *Review the current knowledge on the phytochemistry and pharmacological properties of mangrove plants based on scientific evidence*

In recent years, an increasing number of publications have reported on the phytochemistry and pharmacological properties of mangrove plants. Some of the metabolites isolated and bioactivities analyzed have potentials to be developed in pharmaceutical and nutraceutical products. An update would be timely and appropriate, as there are only two reviews (Wu *et al.* 2008; Nebula *et al*., 2013) to date.

Action 6.2: *Document case studies of non-timber uses of mangrove forests and ecosystems*

Non-timber uses of mangrove plants have been reported (Baba *et al*., 2013). Beyond plants, the uses also extend to the forest ecosystem. Examples, among others, are the collection of mangrove foliage as fodder for cattle in India; production of *Nypa* sugar in Thailand; apiculture using mangrove forests as forage in Viet Nam; mangrove ecotourism in Japan; and watching proboscis monkeys and nocturnal flashing of fireflies in Malaysia. There is justification for documenting such uses based on case studies in an effort to promote non-timber uses of mangrove forests and ecosystems. Case studies involving local communities should be given emphasis.

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Appendix I

Strategic priorities of the ITTO Biennial Work Program 2015−2016

1. Promote good forest governance and financing for sustainable forest management
2. Increase the contribution of tropical forests to national and local economies through international trade
3. Enhance the contribution of tropical timber producing forests to the conservation and sustainable use of biodiversity
4. Reduce tropical deforestation and forest degradation and enhance provision of environmental services
5. Improve the quality and availability of information on tropical forests, timber markets and trade
6. Build and develop human resource capacity to implement sustainable forest management and increase trade in forest goods and services from sustainably managed forests

Appendix II

Decision 9 (XXIX) Mangrove Conservation Program

The International Tropical Timber Council,

Recognizing the importance of the role played by mangroves in the conservation of ecosystems as well as in the economy of developing countries with sea coasts;

Noting the leading role of ITTO in the conservation of mangrove ecosystems, including its collaborative activities with the International Society for Mangrove Ecosystems;

Reiterating the benefits to be gained from the conservation of mangroves to individual Members, in promoting activities of the Organization and in assisting the achievement of the objectives of the ITTA, 1994;

Noting the continuing need for urgent international efforts on this issue;

Also noting that the ITTO's contribution through its work underway to protect mangroves to sustainable forest management has been highlighted by the recently concluded G8 Foreign Ministers' Meeting (13 July 2000, Miyazaki), endorsed by G8 Leaders;

Further noting comments made by Members during the Twenty-ninth Session of the Council on the importance of mangrove conservation and rehabilitation;

Decides to:

1. Request the Executive Director to develop a work plan, including the identification of funding requirements, to assist Members in the conservation, rehabilitation and utilization of mangroves, in particular to:
   - Increase awareness among Members to promote the conservation of mangroves;
   - Encourage cooperation among Members to intensify ITTO activities to conserve existing mangroves and rehabilitate degraded mangroves;
   - Promote the sustainable management and utilization of mangroves;

   for consideration at its Thirty-first Session;

2. Encourage Members to prepare pre-project and project proposals related to conservation, rehabilitation and utilization of mangroves for consideration by the Council at future sessions;

3. Authorize the Executive Director to arrange for financing from Sub-Account B of the Bali Partnership Fund of the above work plan, and of approved pre-project and project proposals; and

4. Invite Members and other donors to contribute the necessary resources to meet the financial requirements of this decision.

Appendix III

Aichi Biodiversity Targets 2011−2020
"Living in Harmony with Nature"

Strategic Goals
- Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
- Reduce the direct pressures on biodiversity and promote sustainable use
- Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
- Enhance the benefits to all from biodiversity and ecosystem services.
- Enhance implementation through participatory planning, knowledge management and capacity building

Targets
- Awareness increased
- Biodiversity values integrated
- Incentives reformed
- Sustainable consumption and production
- Habitat loss halved or reduced
- Sustainable management of marine living resources
- Sustainable agriculture, aquaculture and forestry
- Pollution reduced
- Invasive alien species prevented and controlled

Appendix IV

Satoyama Initiative 2010
"In Harmony with Nature"

Three-fold Approach
- Consolidate wisdom on securing diverse ecosystem services and values
- Integrate traditional ecological knowledge and modern science to promote innovations
- Explore new forms of co-management systems

Five Perspectives in the Approach
- Resource use within the carrying capacity and resilience of the environment
- Cyclic use of natural resources
- Recognition of the value and importance of local traditions and cultures
- Multi-stakeholder participation and collaboration
- Contributions to socio-economy

Appendix V

ISME Mangrove Action Plan for Sustainable Management of Mangroves 2004−2009

The following key issues were identified that need management attention:

- Overuse for forestry and fisheries
- Extensive conversion of mangroves for aquaculture
- Pollution and sedimentation from single or multiple sources
- Hydrological modifications due to upstream and coastal development
- Conversion to other land uses
- Lack of appropriate legislation and enforcement
- Shortage of capacity, mangrove specialists, managers and technicians
- Inadequate communication, education, public awareness and participation
- Climate change and sea-level rise

Each of the key issues arises primarily from increasing human populations in the coastal zone. They all result in the loss of mangroves or impairment in ecosystem functioning and productivity. The magnitude of impacts varies from one region to another.

Appendix VI

ISME Charter for Mangroves 1991

The ISME Charter proclaims the following principles and decisions for the utilization of mangrove ecosystems:

- Utilize mangrove resources so that their natural productivity is preserved
- Avoid degradation of the mangrove ecosystems
- Rehabilitate degraded mangrove areas
- Avoid overexploitation of the natural resources produced by mangrove ecosystems
- Avoid negative impacts on neighboring ecosystems
- Recognize the social and economic welfare of indigenous mangrove dwellers
- Control and restrict non-sustainable uses so that long-term productivity and benefits of the mangrove ecosystems are not lost
- Introduce regulatory measures for the wise use of mangrove ecosystems