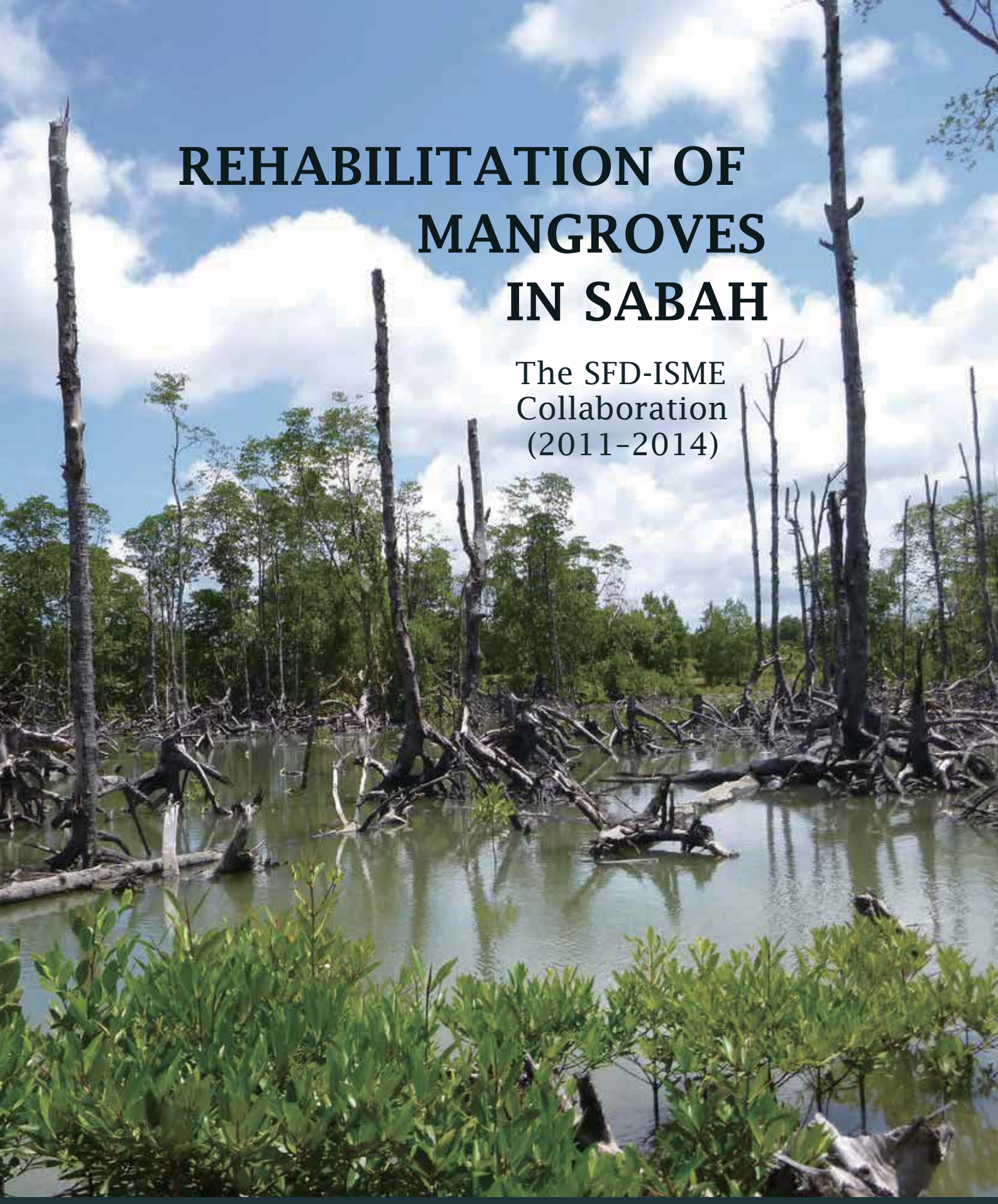

REHABILITATION OF MANGROVES IN SABAH

The SFD-ISME Collaboration (2011-2014)

Sabah Forestry Department,
International Society for Mangrove Ecosystems
and
Tokio Marine & Nichido Fire Insurance Co., Ltd.

REHABILITATION OF MANGROVES IN SABAH
The SFD-ISME Collaboration
(2011–2014)

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International Society for Mangrove Ecosystems (ISME), Okinawa, Japan

January 2015

Sabah Forestry Department
International Society for Mangrove Ecosystems
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Front Cover Photo: Project site at Sungai Lalasun showing natural mangrove forest in the background and rehabilitation in degraded sites in the foreground (photo by Dr. Tomomi Inoue)

Back Cover Photo: Project site at Sungai Lalasun showing successful rehabilitation (photo by Prof. Shigeyuki Baba)

Inside Cover Photo: An aerial view of the magnificent Elopura Mangrove Forest Reserve bordering the Sandakan Bay (photo by the Sabah Forestry Department)

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About the Authors

Joseph TANGAH

Dr. Tangah obtained his Ph.D. from Universiti Malaysia Sabah (UMS). He is currently a Senior Research Officer at the Forest Research Centre (FRC) of the Sabah Forestry Department (SFD), specialising on mangroves restoration and conservation. He was featured in ISME Newsletter No. 38 (August 2013) under Stories of Success. Since 2011, he serves as the Project Leader of Rehabilitation of Mangroves in Sabah, a collaborative project between SFD and ISME.

Fidelis Edwin BAJAU

Fidelis Edwin Bajau, the Deputy Director (Development) of SFD, was a recipient of Ahli Setia Darjah Kinabalu (ASDK) awarded by the Governor of Sabah in 2011 for his significant contributions to the state. With almost 40 years of service, he has vast experience in forestry of Sabah. He was the Head of SFD delegation that visited Okinawa, Japan in September 2013.

Werfred JILIMIN

Werfred Jilimin is the Head of Enforcement, Investigation & Prosecution Division of SFD. He is also the President of the Sports, Recreation and Welfare Club of the department. His work experience as a forester included reforestation of the 11,500 ha Timimbang and Botitian Forest Reserves.

Shigeyuki BABA

Prof. Baba obtained his Ph.D. from the University of Kyushu in Japan. He served as the Deputy Executive Secretary and Executive Secretary of International Society for Mangrove Ecosystems (ISME) since inauguration of the society in 1990. Being the Executive Director of ISME (from 2011), he has coordinated all the projects implemented by ISME. Even after his retirement from University of the Ryukyus in Okinawa in 2013, he continues his untiring efforts in managing on-going projects and in seeking funds for future projects of the society.

Hung Tuck CHAN

Dr. Chan obtained his Ph.D. from the University of Aberdeen, Scotland. A former Division Director of the Forest Research Institute Malaysia, he served as the Vice-President of ISME (from 2005) and as the Treasurer of ISME (from 2011). He was appointed Project Coordinator of the ITTO-ISME Pre-Project 134/07 Rev. 1 (F) and Small Project 564/09 Rev. 1 (F). Currently, he is the Editor-in-Chief of ISME-GLOMIS Electronic Journal and Producer of ISME Newsletter.

Mio KEZUKA

Mio Kezuka obtained her M.Sc. in Marine Biosciences from the Tokyo University of Marine Science and Technology, Japan. Currently, a Researcher at ISME, she coordinates projects in Kiribati and Malaysia. She also plans and coordinates mangrove training courses and study tours for school children and young researchers. Talented in arts, she is in charge of layout designs of ISME publications.

Foreword

Rehabilitation of Mangroves in Sabah – The SFD-ISME Collaboration (2011–2014) is a publication of the collaborative project between the Sabah Forestry Department (SFD) and the International Society for Mangrove Ecosystems (ISME). We are grateful to Tokio Marine & Nichido Fire Insurance Co., Ltd. for the financial support, and for continuing to fund the project for the next five years (2014–2019).

Published by SFD, ISME and Tokio Marine & Nichido Fire Insurance Co., Ltd., the book provides a synopsis of mangroves in Sabah, and the SFD-ISME collaborative project in the Introduction. Other sections include Strategic Approaches adopted by the Project Steering Committee, and Case Studies based on project sites in Sandakan, Beluran, Beaufort and Kunak. The book also highlights Achievements and Benefits accompanied by a Calendar of Activities.

The successful completion of the first phase of this project (2011–2014) with more than 150 ha of mangroves planted paved the way for the International Exchange Program on Coastal Resources, a collaboration between SFD and the Tropical Biosphere Research Center (TBRC) of University of the Ryukyus in Okinawa, Japan.

We are thankful to the Japan Society for Mangroves for inviting our representative as guest speaker during its annual meeting at the Tokyo University of Agriculture in November 2014. We took the opportunity to introduce the mangrove forests of Sabah with emphasis on mangrove protection and rehabilitation, and to campaign for donations and volunteers to restore degraded mangrove forests throughout Sabah.

DATUK SAM MANNAN

Director,
Sabah Forestry Department,
Sandakan, Sabah, Malaysia

Message

It was several years ago when I attended the Eighth General Assembly of ISME (September 2011), and the ISME-ITTO Mangrove Educational Book Launch and Seminar (March 2013) held in Sandakan, Sabah. The International Society for Mangrove Ecosystems (ISME) is most grateful to the Sabah Forestry Department (SFD) for graciously hosting both events.

The publication of this book *Rehabilitation of Mangroves in Sabah – The SFD-ISME Collaboration (2011–2014)* is again a clear indication of the partnership between SFD and ISME. Congratulations to the authors for their outstanding efforts. The full support of the SFD-ISME Collaborative Project by Datuk Sam Mannan, the Director of SFD and Chairman of the Project Steering Committee, is gratefully acknowledged. ISME is most grateful to Tokio Marine & Nichido Fire Insurance Co., Ltd. for the financial support of the project (2011–2014), which has been extended for another five years (2014–2019).

I am confident that this informative, easy-to-understand and well-illustrated book will be useful to mangrove scientists, naturalists, students and the public in general. The book carries a message that SFD is earnest in protecting mangrove forest reserves in Sabah, and will continue its rehabilitation efforts and outreach programs in ensuring greener mangroves.

PROF. SANIT AKSORNKOAE

President,
International Society for Mangrove Ecosystems,
Nishihara, Okinawa, Japan

Senator,
National Legislation Assembly of Thailand

Acknowledgements

We are thankful to Datuk Sam Mannan (Director of SFD) and Prof. Sanit Aksornkoae (President of ISME) for their continuous support of the collaborative project on mangrove rehabilitation in Sabah. Funds provided by Tokio Marine & Nichido Fire Insurance Co., Ltd. for the project are much appreciated. Our gratitude goes to Frederick Kugan, Dr. Mami Kainuma and Nozomi Oshiro for editing and proofreading the book. Photographs by Dr. Mami Kainuma, Dr. Tomomi Inoue, Dr. Arthur Y.C. Chung and Muhibbah National Secondary School, and the production of mangrove forest maps by Mohd. Jumri Abd. Hamid (GIS Section, FRC) are acknowledged with gratitude. The successful implementation and completion of the first phase of the project (2011–2014) was largely due to the close working relationship between SFD and ISME.

Abbreviations

asl	above sea level
Co.	Company
Ext.	Extension
FR	Forest Reserve
FRC	Forest Research Centre, Sepilok, Sandakan, Sabah
GIS	Geographical Information System
ha	hectares
HQ	Headquarters
ISME	International Society for Mangrove Ecosystems, Okinawa, Japan
K.	Kuala (Estuary)
Ltd.	Limited
MoU	Memorandum of Understanding
Mt.	Mount
NIES	National Institute of Environmental Studies, Tsukuba, Japan
P.	Pulau (Island)
PL	Project Leader
PSC	Project Steering Committee
RDC	Rainforest Discovery Centre, Sepilok, Sandakan, Sabah
SFD	Sabah Forestry Department, Sandakan, Sabah
Sg.	Sungai (River)
SMK	Sekolah Menengah Kebangsaan (National Secondary School)
TBRC	Tropical Biosphere Research Center, University of the Ryukyus, Okinawa, Japan
Tg.	Tanjung (Promontory)
VJR	Virgin Jungle Reserve

Glossary

Acid sulphate soil: Formed under waterlogged conditions, these soils contain iron sulphides that when exposed form sulphuric acid.

Beating-up: A forestry term that refers to the replanting in forest areas where mortality is unduly high due to factors such as pests and strong currents.

Cluster planting: Planting seedlings, propagules or cuttings in groups to establish intermittent plant populations as possible seed sources to regenerate degraded areas.

Coppicing: Leafy shoots sprouting from planted cuttings.

Forests reserves: Sabah has seven classes of forest reserve. They are protection forest (Class I), commercial forest (Class II), domestic forest (Class III), amenity forest (Class IV), mangrove forest (Class V), virgin jungle reserve (Class VI) and wildlife reserve (Class VII).

Gregarious: Large numbers of a species growing in a single site.

Ground-truthing: Confirming satellite images through ground surveys.

Hypocotyl: The elongated part of the propagule between the plumule and the radicle as in *Rhizophora* species.

Mangrove zones: A forest belt dominated by certain mangrove plant species.

Natural regeneration: The recruitment of seedlings by natural reproductive processes.

Pneumatophores: Aerial roots (pencil- or peg-like), which protrude vertically from under-ground horizontal roots.

Precocious: A behaviour in plants that displays early flowering and fruiting. *Rhizophora mucronata* starts to flower and fruit at 3–4 years of age while *Rhizophora apiculata* only starts at 5–6 years.

Propagules: Seeds, fruits or other plant parts, which when dispersed are able to produce new plants.

Rehabilitation: The act of restoring degraded mangroves back to its original condition.

Sedges: Grass-like herbs of the Cyperaceae family.

Silviculture: The art and science of planting, growing and tending of trees.

Stilt roots: Roots growing from the lower part of the stem, bifurcating before entering the soil (also referred to as prop roots).

Thickets: Shrubs or herbs growing in dense and often impenetrable clumps.

Viviparous: The ability for seeds to germinate while still attached to the tree.

Water-borne propagules: They are those that have fallen from the tree and carried away by the tide until they settle somewhere.

Introduction

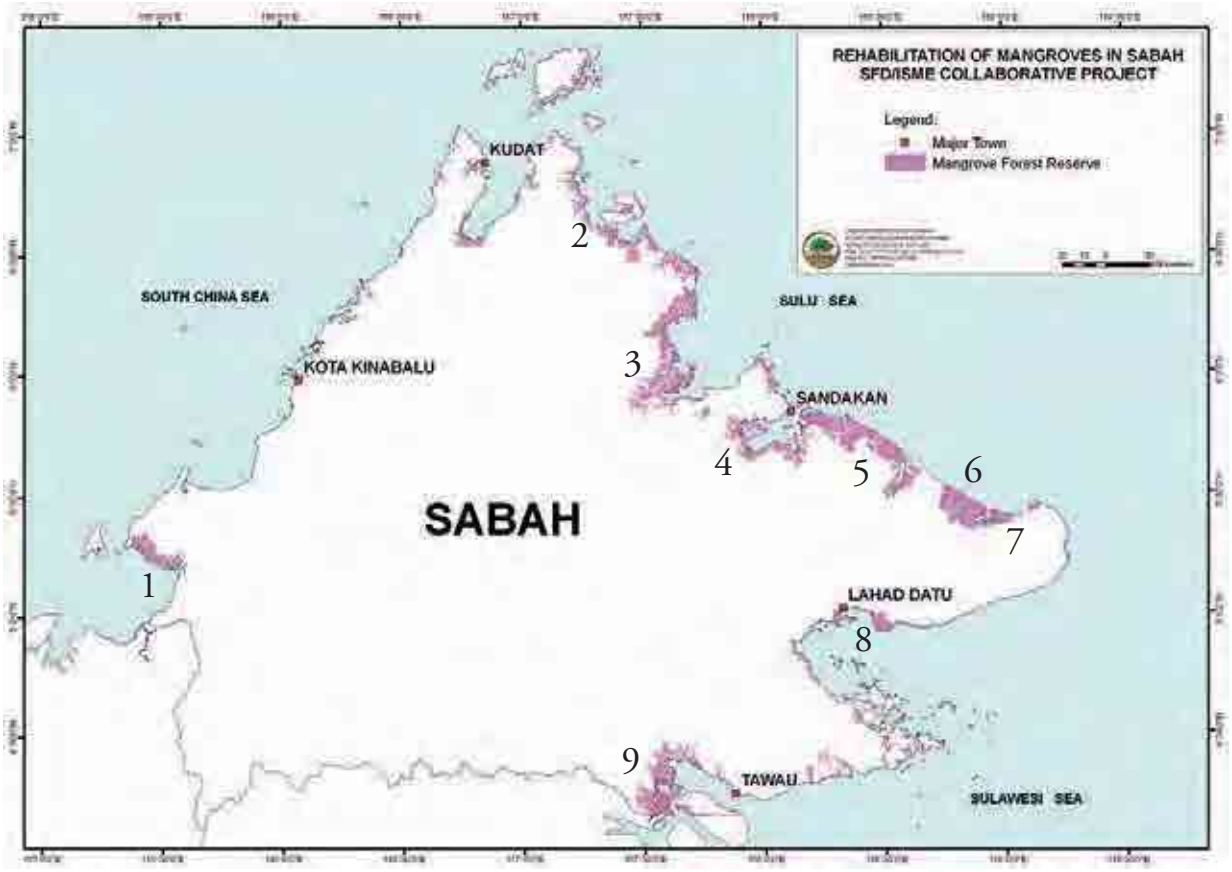
Mangroves in Sabah

In Sabah, mangroves occur mainly along the northeast coast where the town of Sandakan is located and in the southeast near the town of Tawau. These coastal plant communities cover a larger area than any other state in Malaysia. Based on the latest satellite image interpretation, the total area of mangrove vegetation within forest reserves (Class V) in Sabah is ~338,000 ha or 60% of the country's total. Currently, the state has 30 mangrove forest reserves (FR), the largest being the Kuala Bonggaya and Kuala Labuk FR (56,441 ha) followed by the Trusan Kinabatangan FR (43,759 ha), which forms part of the Ramsar site.

Forestry districts and extent of mangrove forest reserves (Class V) in Sabah.

Mangrove Forest Reserve	Forestry District	Area (ha)	FR total (ha)
Abai FR	Kota Belud		1,396
Bengkoka Peninsula FR	Kota Marudu		13,283
Elopura FR	Sandakan	24,674	
Elopura FR Ext.	Sandakan	78	24,752
K. Bonggaya & K. Labuk FR	Beluran & Sandakan	56,405	
K. Bonggaya & K. Labuk FR Ext.	Beluran & Sandakan	36	56,441
K. Segama & K. Maruap FR	Lahat Datu		23,993
K. Tingkayu FR (Kunak)	Kunak		4,745
Kudat & Marudu Bay FR	Kudat & Kota Marudu	13,396	
Kudat & Marudu Bay FR Ext. I	Kudat & Kota Marudu	572	
Kudat & Marudu Bay FR Ext. II	Kudat & Kota Marudu	12	13,980
Lahad Datu FR	Lahat Datu	9,775	
Lahad Datu FR Ext.	Lahat Datu	49	9,824
Manumbok FR	Beaufort	5,710	
Manumbok FR Ext. I	Beaufort	2,000	
Manumbok FR Ext. II	Beaufort	6,429	14,139
P. Banggi & P. Balembangan FR	Kudat		11,504
P. Malawali FR	Kudat		791
Semporna FR	Semporna		23,224
Sg. Gum-Gum & Sg. Loboh FR	Sandakan		3,086
Sg. Lasun & P. Evans FR	Lahat Datu		3,857
Sg. Maruap FR	Kinabatangan		6,789
Sg. Sugut, Sg. Paitan & P. Jembongan FR	Pitas & Beluran	38,564	
Sg. Sugut, Sg. Paitan & P. Jembongan FR Ext.	Pitas & Beluran	144	38,708
Sibyte FR	Sandakan		2,364
Sitompok FR	Beaufort		586
Sulaman Lake FR	Kota Kinabalu		2,635
Tawau FR	Tawau		38,194
Trusan Kinabatangan FR	Kinabatangan	40,471	
Trusan Kinabatangan FR Ext.	Kinabatangan	3,288	43,759
Total			338,050

Abbreviations: FR = Forest Reserve, Ext. = Extension, K. = Kuala (Estuary), Sg. = Sungai (River) and P. = Pulau (Island).



Major mangrove forest reserves (FR): 1 = Manumbok FR, 2 = Sg. Sugut, Sg. Paitan & P. Jembongan FR, 3 = K. Bonggaya & K. Labuk FR, 4 = Elopura FR, 5 = Trusan Kinabatangan FR, 6 = K. Segama & K. Maruap FR, 7 = Sg. Lasun & P. Evans FR, 8 = Lahat Datu FR and 9 = Tawau FR.

Map of Sabah showing mangrove forest reserves.

In addition to the 30 mangrove FR (Class V) in Sabah, there are mangrove forests (Class VI) designated as Virgin Jungle Reserves (VJR) e.g. the Sepilok Laut VJR (1,235 ha) in Sandakan and the Batumapan VJR (164 ha) in Tawau. Pristine mangroves occur on the shores of many islands of Darvel Bay. Some mangroves are also found in Amenity Forests (Class IV) e.g. the mangroves along the banks of Sungai Garama and Sungai Klias in the Padas Damit FR, Beaufort, and there are privately-owned mangrove forests such those of the Labuk Bay Proboscis Monkey Sanctuary (263 ha).

Mangroves in Sabah can be classified into various forest types, which are dominated by one or two tree species. They are found in the seaward zone (*Avicennia-Sonneratia* forest), main mangrove zone (*Rhizophora* forest), back mangrove zone (*Bruguiera* forest) and riparian fringes (*Nypa* forest). The flora consists of ferns, herbs, palms, woody climbers, trees and shrubs. The fauna includes invertebrates (crustaceans, chelicerates and insects) and vertebrates (fish, amphibians, reptiles, mammals and birds).

Although there are still vast areas of mangrove forests in Sabah, they are under increasing pressures for socio-economic development such as conversion to aquaculture, agriculture and urban land uses. Based on the latest assessment of forest cover of Sabah, about 3,300 ha of mangrove FR have been illegally encroached and exploited.

The pristine Sepilok Laut VJR in Sandakan from the air (top left), and from the boat (top right and bottom).

The riverine mangrove forest of Sg. Garama in Beaufort.

Rhizophora forests

Rhizophora forests form the main mangrove zone. *Rhizophora apiculata* is the dominant tree species while *Rhizophora mucronata* occurs along river and creek banks. Typical features of these forests are the dense network of stilt roots.

Avicennia-Sonneratia forests

Avicennia-Sonneratia forests comprise mainly of *Avicennia alba* and *Sonneratia alba*. With their extensive rooting systems of pneumatophores, they represent the early colonisers of the accreting seaward zone of mangroves.

Bruguiera forests

Bruguiera forests occur at the landward side of *Rhizophora* forests. They represent the back mangroves with trees of *Bruguiera cylindrica* being the dominant species. In open sites, thickets of *Acrostichum* ferns are common.

Nypa forests

Nypa forests occur along the banks of rivers in the upstream where there is greater freshwater influence. The stemless palm (*Nypa fruticans*) grows gregariously in pure stands with dense fronds and mud-lobster mounds are a common feature.

Major mangrove forest types in Sabah.

Calamus erinaceus (left) and *Oncosperma tigillarium* (right) are common palms found in the back mangrove of Sabah.

Macrobrachium rosenbergii
Photo by Arthur Y.C. Chung

Polymesoda expansa
Photo by Arthur Y.C. Chung

Photo by M. Kainuma

Commercially important crustaceans in Sabah e.g. udang galah (top left) and lokan (top right) are derived from mangrove ecosystems. Mudskippers (left) with their unique fan-like dorsal fins and bulging eyes are common on mudflats fronting the mangroves. In Sabah and elsewhere, sesarmid crabs (above) are important herbivores in the mangrove food chain.

Some peculiar insects found in the mangroves of Sabah.

Nasalis larvatus

Anthracoceros albirostris

Boiga dendrophila

Proboscis monkeys (top), hornbills (bottom left) and cat snakes (bottom right) are some of the unique fauna of mangroves in Borneo including Sabah.

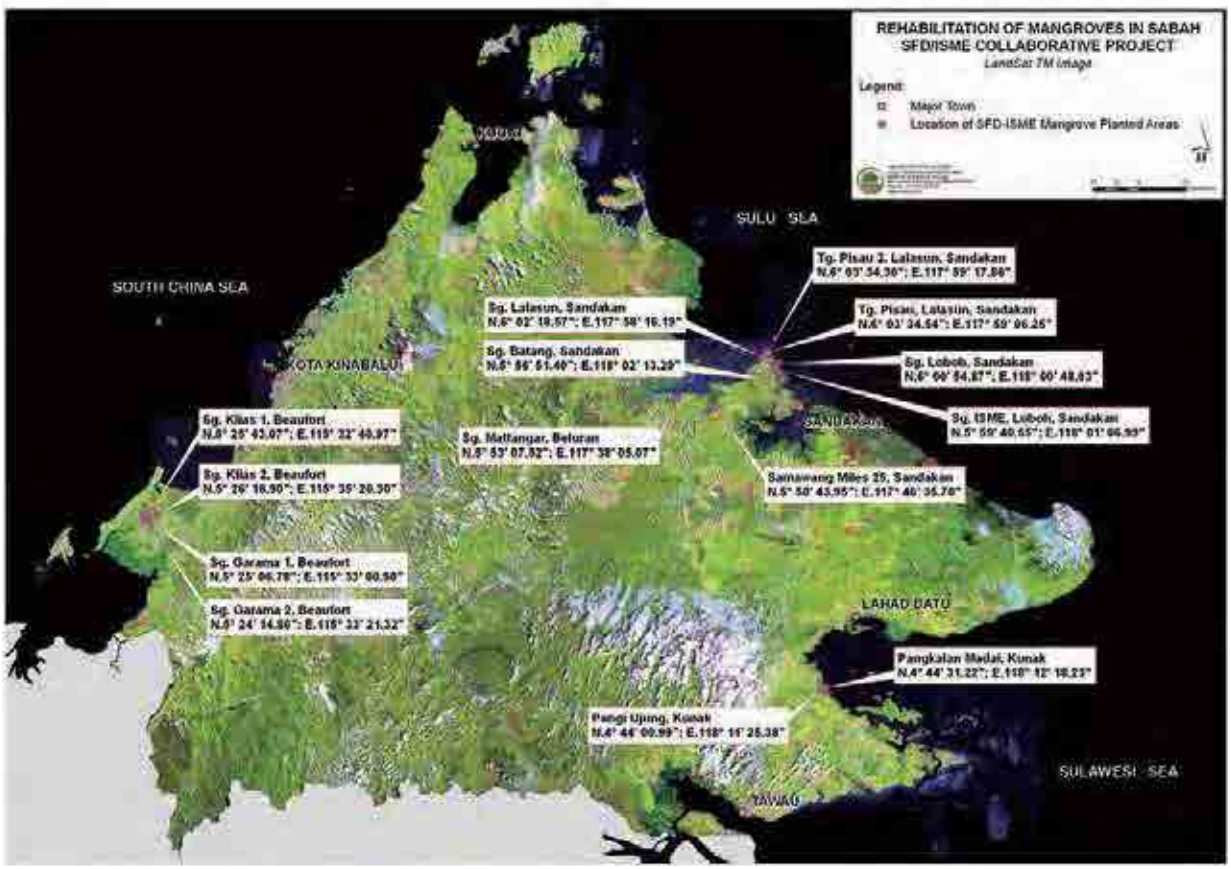
The SFD-ISME Project

In July 2010, a delegation from the International Society for Mangrove Ecosystems (ISME) headed by Prof. Shigeyuki Baba (Executive Director), accompanied by Dr. Chan Hung Tuck (Treasurer) and Nozomi Oshiro (Head of Secretariat) visited the Sabah Forestry Department (SFD) in Sandakan to discuss on the implementation of a mangrove rehabilitation project in Sabah. The visit led to the signing of a Memorandum of Understanding (MoU) between the two organisations on 10 November 2010 in Kota Kinabalu. In 2011, the SFD-ISME collaborative project to rehabilitate degraded mangroves in Sabah was initiated. Funded by Tokio Marine & Nichido Fire Insurance Co., Ltd., the mangrove rehabilitation project is implemented by SFD with technical guidance from ISME. Both organisations have collaborated well to ensure the successful implementation and completion of the first phase project activities (2011–2014).

This collaboration presents a great opportunity for SFD to strengthen its capacity in mangrove rehabilitation. The department is honoured as Sabah is 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.

Main objectives of the collaborative project are to meet an annual target of planting 50 ha of degraded mangroves in Sabah and to develop cost-effective methods for mangrove rehabilitation with the available funds from ISME. The project identifies areas for planting and adopts silvicultural techniques that will encourage sufficient vegetation cover for subsequent natural regeneration and recovery. Planting areas are located within forest reserves, which come 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 are Sungai Gum-Gum & Sungai Loboh FR and Sibyte FR in Sandakan, Padas Damit FR in Beaufort, Kuala Bonggaya & Kuala Labuk FR in Beluran and Sandakan, and Kuala Tingkayu FR in Kunak.



Map showing the locations and coordinates of 14 project sites in four forestry districts of Sabah.

About this Book

This book provides an overview of a collaborative project between SFD and ISME on rehabilitation of degraded mangroves in Sabah. The successful completion of the first phase (2011–2014) with more than 150 ha of mangroves planted has led to an extension of the project for another five years (2014–2019). It is a successful collaboration where both parties are charged with enthusiasm to implement the new phase of the project based on experiences gained and lessons learnt from the first phase. This spirit of collaboration and friendship will sustain and continue to strengthen for the next five years and beyond. Information in this book, which is semi-technical, easy-to-understand and well-illustrated, will be of interest to mangrove scientists, naturalists, students and the public.

Sabah Forestry Department

Since 1997, the vision of SFD is towards the realization of sustainable forest management and conservation of the natural environment. Its mission is to effectively and efficiently plan and implement the management of forest resources in accordance with the principles of biodiversity conservation and sustainable forest management in Sabah. Various forest formations occur extending from coastal mangroves at sea level (asl) to inland sub-alpine vegetation on Mt. Kinabalu at 4,100 m asl. Sabah has ~338,000 ha of mangrove forests under reservation, accounting for 60% of the country's total and 7.6% of the global total. Mangroves are regarded an important natural resource to the state and are legally protected under the Sabah Forest Enactment (1968) via the gazettement of forest reserves.

International Society for Mangrove Ecosystems

ISME is an international non-profit and non-governmental scientific society established in August 1990. With its headquarters in Okinawa, Japan, ISME was certified a Foundation in 1992 by the Japanese Law of Foundation. In 2003, ISME was registered as a non-profit organization under a new Japanese law of promoting specified non-profit activities. Revised at the Eighth General Assembly in 2012, the Statutes of ISME stipulate that the society shall collect, evaluate and disseminate information on mangrove ecosystems and shall promote international cooperation. ISME has been carrying out its activities at the global level through: a) application of knowledge to particular situations, b) training and education, and c) exchange of necessary information. Activities of the society have been supported through collaborations, and links with other organizations, universities, research institutes and local communities. Currently, the membership of ISME includes 40 institutions and over 1,150 individuals from 93 countries.

Tokio Marine & Nichido Fire Insurance Co., Ltd.

Tokio Marine & Nichido Fire Insurance Co., Ltd., with its headquarters in Tokyo, Japan, has been implementing its Mangrove Planting Project since 1999. Having declared its intention to continue mangrove planting for 100 years in 2007, the company has projects in Bangladesh, Fiji, India, Indonesia, Malaysia, Myanmar, the Philippines, Thailand and Viet Nam. The projects in Malaysia (Sabah) and India (Gujarat) are being implemented by ISME. Each year, company staff, agents and their family members participate in a planting mangrove volunteer tour in a selected country. A team of 26 members from three countries (Japan, USA and Malaysia), planted 2 ha of mangroves in Sandakan, Sabah in September 2012. Kouji Iwai and Kazumasa Fukada (Managing Directors at the time) headed the team, and a filming crew documented the planting operations. The company considers mangrove planting activities as "Insurance for the Future of the Earth."

Strategic Approaches

Project Steering Committee

A Project Steering Committee (PSC) has been formed for the SFD-ISME collaborative project. Chaired by Datuk Sam Mannan (Director of SFD) and co-chaired by Prof. Shigeyuki Baba (Executive Director of ISME), the committee meets twice a year to develop the work plan, to discuss the budget and to monitor the progress of the project. Site conditions, choice of species, planting techniques, growth, mortality, pests and diseases are important topics in the agenda of the PSC. Since 2011, the PSC has met eight times and the members are:

Sabah Forestry Department	
Datuk Sam Mannan	Director of Forestry
Fidelis Edwin Bajau	Deputy Director (Development)
Frederick Kugan	Deputy Director (Forest Sector Planning)
Albert Radin	Deputy Director (Forest Management Enterprise)
Dr. Lee Ying Fah	Deputy Director (Research & Development)
Dr. Joseph Tangah	Senior Research Officer & Project Leader
Werfred Jilimin	Head of Enforcement & Investigation Division
Hj. Mohd. Salleh Abbas	Senior Planning Officer
Hj. Fadzil Yahya	District Forest Officer (Sandakan)
George Angampun	District Forest Officer (Beaufort)
Petin Kilou	District Forest Officer (Beluran)
Jaime Gampawi	District Forest Officer (Kunak)
Siti Zubaidah Abdullah	International Forestry & Corporate Affairs

International Society for Mangrove Ecosystems	
Prof. Shigeyuki Baba	Executive Director
Dr. Chan Hung Tuck	Treasurer
Dr. Mami Kainuma	Senior Researcher
Katsuhiko Sato	Senior Researcher
Dr. Tomomi Inoue	Senior Researcher, NIES, Japan, and Voluntary Senior Researcher, ISME
Nozomi Oshiro	Head, ISME Secretariat
Mio Kezuka	Researcher

Abbreviations: ISME = International Society for Mangrove Ecosystems in Okinawa, Japan and NIES = National Institute of Environmental Studies in Tsukuba, Japan.

Project Leader

Dr. Joseph Tangah has been appointed the Project Leader (PL) of the collaborative project since its commencement in 2011. His role as the PL is crucial as all communications are done between him representing SFD and the ISME Secretariat headed by Nozomi Oshiro. He draws up all the technical specifications when a planting operation requires a contractor. He is also in charge of all project arrangements and activities e.g. meetings and visits in Sabah. As the PL, he submits reports on the progress of the project annually to ISME, which are revised and translated for submission to Tokio Marine & Nichido Fire Insurance Co., Ltd.

Dr. Joseph Tangah, the Project Leader (left) maintains close communication with Nozomi Oshiro, the Head of ISME Secretariat (right) on all project matters.

Mangrove Task Force

SFD has established a mangrove task force and assigned a four-wheel drive for the project. The Sandakan-based task force is led by Dr. Joseph Tangah (PL) with Dauni Seligi, Jamiss Aribin and Fabian Koret as members. Guided by the PSC, the task force is dedicated to all activities of the project. They include the choice of species, planting method for the different sites, collecting planting materials, monitoring growth and survival, identifying causes of seedling mortality, and conducting initial planting trials. The task force works very closely with the forestry staff in the districts where the project sites are located and with the contractors involved with the planting operations. The task force leader briefs the PSC during its biannual meetings.

(L–R): Dr. Joseph Tangah as the task force leader with Fabian Koret, Dauni Seligi and Jamiss Aribin as members.

The Mangrove Task Force in Sandakan works very closely with forestry staff in the districts and contractors of the project.

Field Visits

Coinciding with each PSC Meeting, officials from SFD and ISME visit the project sites. Such field visits are essential to monitor the progress of planting operations, and to discuss limitations and problems encountered.

ISME and SFD officials visit project sites twice a year during each PSC Meeting.

PSC members at the planting site in Sg. ISME.

Field visits by PSC members.

Silvicultural Procedures

Silvicultural procedures have been developed by the PSC for areas encroached by oil palm, degraded riverine mangroves and areas encroached by shrimp ponds.

The PSC will monitor the effectiveness of these procedures, and will refine them based on lessons learnt and new experiences gained.

Areas encroached by oil palm

Location	Forest Reserve	District
Sg. Lalasun, Sg. Loboh, Sg. ISME & Tg. Pisau	Sg. Gum-Gum & Sg. Loboh FR	Sandakan
Sg. Batang	Sibyte FR	Sandakan
Sg. Mattangar & Samawang	Kuala Bonggaya & Kuala Labuk FR	Beluran & Sandakan

Encroachment into mangrove FR by oil palm planters remains a serious problem in Sabah. SFD has stepped up its vigilance to halt such illegal activities and its enforcement to prosecute the culprits. The process of encroachment is characterised by the construction of bunds to prevent intrusion of brackish water, clear felling of mangrove trees, digging of drainage canals to raise the embankments for subsequent planting of oil palm. The clearing of mangrove trees often leads to dense infestation of *Acrostichum* ferns and other weeds.

Raised embankments intended for illegal oil palm planting.

For oil palm encroached mangrove areas, the following silvicultural approaches have been adopted:

- The project employs different silvicultural techniques depending on site conditions, which will encourage sufficient vegetation cover of mangrove and other coastal species in degraded mangrove areas.

- It is not the intention of the project to establish neat rows of mangrove seedlings in areas encroached by oil palm but to have sufficient numbers of mangrove and other coastal tree species established so that they are able to gradually seed up the remaining areas through natural regeneration. Planting of mangroves is not based on fixed spacing along lines as in plantations but on habitat selection.

- Wherever necessary and feasible, the project attempts to restore an appropriate hydrological regime with tidal flushing that will enable natural recruitment of water-borne propagules for mangrove establishment. The breaching of bunds at strategic locations may be deem appropriate and necessary.

- Regular monitoring of growth and survival, and identifying causes of seedling mortality are most essential to evaluate the suitability of the silvicultural technique used. Beating up or replanting of propagules and/or seedlings in patches may be necessary where planting has failed.

- In regularly inundated sites such as drainage canals, the planting of mangrove propagules will be the primary technique. Recommended species are *Rhizophora mucronata* and *Rhizophora apiculata*. Other species such as *Avicennia alba*, *Bruguiera cylindrica* and *Ceriops tagal* can also be planted on a trial basis to gain experience and necessary information for future planting. These activities will form the research component of the project.

- In interior sites infested with *Acrostichum* ferns and mud-lobster mounds, site preparation may not be necessary. Intermittent planting of propagules in between the ferns and mounds is recommended. It is anticipated that the propagules of *Rhizophora* with their elongated hypocotyls are an advantage in such sites. When established, their canopy will gradually shade out the light-demanding ferns.

- The top of bunds, which are not inundated by tides and with soils already hardened and compacted, nursery-raised seedlings or cuttings of suitable coastal species such as *Terminalia cattapa* and *Hibiscus tiliaceus* can be sparsely planted. These species are known to be hardy, fast growing and able to regenerate naturally. The objective of planting on the bunds is to create some vegetation cover and shade.

- Potted seedlings of coastal species available from the SFD nursery at Sibyte FR in Sandakan have been used. This avoids the need for nursery establishment and waiting time of 4–6 months for sowing of seeds and raising of seedlings.

- For project sites in Sandakan, planting operations are carried out by the Special Task Force and not contracted out. This provides the task force members with valuable experience to plant in other areas.

Interior sites are often infested with *Acrostichum* ferns (top left). In detected encroached areas, oil palm trees were felled and disposed (bottom left). Mangrove soils are only marginally suitable for planting oil palm as initial growth is generally poor (right).

Degraded riverine mangroves

Location	Forest Reserve	District
Sg. Garama & Sg. Klias	Padas Damit FR	Beaufort

These two areas on the west coast of Sabah were chosen for the project because the river systems of Sungai Garama and Sungai Klias are important habitats for the proboscis monkeys (*Nasalis larvatus*), silvered langurs (*Trachypithecus cristata*) and fireflies (*Pteroptyx* spp.). Riverine mangroves fringe the riverbanks with degraded sites infested with *Acrostichum* ferns. Extensive grassland of mainly sedges such as *Scleria sumatrensis* interspersed with some shrubs occur in the inland areas. The spongy nature of the substrate suggests that the original vegetation is peat swamp forest.

Planting within the degraded sites of the fringing mangrove is not a serious problem. It is planting in the extensive peaty grassland that poses the most challenging task for the project, as the substrate is no longer suitable for mangrove species and the habitat is prone to periodic wildfire outbreaks.

In view of the existing problems at Sungai Garama and Sungai Klias, the project has adopted the following precautionary approaches to rehabilitation:

- Reduce the width of the planting belt from an initial plan of 150 m to 50 m on both banks of Sungai Garama and Sungai Klias so that the planting efforts are confined to the fringing mangroves and less in the grassland.
- Test the feasibility of cluster planting of large seedlings (up to a metre in height) of various species. The concept is to establish intermittent plant populations, which can serve as possible seed sources to regenerate the degraded area progressively.
- Use fresh stem cuttings of *Hibiscus tiliaceus* for planting as initial attempts of using stored cuttings were not successful with poor rate of coppicing.

One of the project sites at Sg. Garama with degraded riverine mangroves.

- The feasibility of planting seeds of *Nypa fruticans* is tested on a trial basis with moderate success. The species can produce plantlets from their subterranean stems and is therefore suitable for colonising open degraded sites.

- The planting operations are carried out by contractors employed and supervised by SFD, with technical advice from ISME. Local residents are employed in the project activities including the cutting of planting lines, collection of planting materials and planting.

Extensive grassland (top right) with scattered shrubs (bottom left) and pockets of forest (bottom right) occurring in the inland areas at Sg. Garama.

A peatland fire broke out at Sg. Garama in March 2013. (Photo by M. Kainuma)

Areas encroached by shrimp ponds

Location	Forest Reserve	District
Pangkalan Madai & Pangi Ujung	Kuala Tingkayu FR	Kunak

Although the total area of mangroves encroached by shrimp ponds is not as extensive as that encroached by oil palm, district offices of SFD continue their vigilance of any illegal aquaculture activities. The process of encroachment involves clearing the mangrove vegetation, site excavation to construct the ponds and heaping the dug out soil to build the bunds with sluice gates to control the amount of tidal water inside the ponds.

For mangrove areas encroached by illegal shrimp ponds, the following strategic approaches for rehabilitation have been adopted:

- Plant *Rhizophora mucronata* propagules with their long and viviparous hypocotyls are an advantage in view of the soft and deep muddy substrate in the pond sites.
- Dig drainage canals at strategic locations of the pond bunds to facilitate tidal flow, reduce the problems associated with acid sulphate soils and enable the recruitment of water-borne propagules such as those of *Avicennia* spp.
- Test the feasibility of broadcasting *Avicennia* propagules and planting *Nypa fruticans* seeds within the pond sites to speed up the process of natural regeneration.

Illegal clearing of mangrove vegetation and excavation for construction of shrimp ponds at Pangkalan Madai.

Case Studies

Three case studies are presented in this book. They include project sites at Sungai Lalasun & Sungai ISME in Sandakan, Sungai Mattangar in Beluran, Sungai Garama & Sungai Klias in Beaufort, and Pangkalan Madai & Pangi Ujung in Kunak.

Sungai Lalasun and Sungai ISME

Some 26.5 ha of mangroves encroached by oil palm in six locations have been rehabilitated in Sandakan by staff of SFD and volunteers. Planting was most extensive at Sungai Lalasun (12 ha) followed by Sungai Batang (5.5 ha) and Tanjung Pisau (4.5 ha). At Sungai ISME, 2 ha of mangroves were planted. Planting intensity was the highest at Sungai Lalasun (2,145 plants/ha) and Sungai ISME (2,100 plants/ha). For these areas, seedlings raised in the Sibyte FR nursery were used as planting material.

At Sungai Lalasun, after resolving the initial problem of browsing by livestock such as cows and goats, planting

Mangrove propagules and seedlings planted in Sandakan.

Location	Area (ha)	Species	Number	Year
Sg. Lalasun	12	*Rhizophora apiculata*	18,100 S & P	2011
		Rhizophora mucronata	5,500 P	
		Ceriops tagal	1,400 S	
		Terminalia catappa	500 S	
		Avicennia alba	250 S	
			25,750	
Sg. Batang	5.5	*Rhizophora apiculata*	5,000 S & P	2011
			5,000	
Tg. Pisau	4.5	*Rhizophora apiculata*	1,500 P	2012
		Rhizophora apiculata	2,000 P	2013
		Rhizophora mucronata	800 P	
		Terminalia catappa	200 S	
			4,500	
Sg. ISME	2.0	*Rhizophora apiculata*	3,200 S & P	2012
		Rhizophora mucronata	500 P	
		Ceriops tagal	200 S	
		Terminalia catappa	180 S	
		Avicennia alba	100 S	
		Bruguiera cylindrica	20 S	
			4,200	
Samawang	2.0	*Terminalia catappa*	500 S	2011
		Rhizophora apiculata	250 S	
		Avicennia alba	50 S	
			800	
Sg. Loboh	0.5	*Rhizophora apiculata*	580 S & P	2011
		Terminalia catappa	20 S	
			600	
Sandakan	**26.5**		**40,850**	

Abbreviations: Sg. = Sungai (River), Tg. = Tanjung (Promontory), P = propagules and S = seedlings.


Seedlings raised in the nursery at Sibyte FR were used as planting material (left) and temporary nurseries were set-up along the riverbank at Sibyte FR to raise additional seedlings.



Planting seedlings on the top of bunds required pre-dug holes (top). *Terminalia cattapa* seedlings were planted on the top of bunds (bottom left) and *Rhizophora apiculata* seedlings on the bund slopes (bottom right).

started in 2011 with 95% survival rate. *Rhizophora mucronata* planted in the drainage canals and on their banks flourished. Some of the individuals planted in early 2011 started to flower in December 2013.

Other mangrove species planted were *Rhizophora apiculata*, *Ceriops tagal*, *Avicennia alba* and *Bruguiera cylindrica*. On the top of bunds, planted *Terminalia cattapa* has established. To facilitate tidal flow, several locations of the bunds were breached.

With the voluntary involvement of several international groups including participants of the ISME General Assembly in August 2011, students of the Ritsumeikan Uji High School from Kyoto in March 2012, and high school teachers and university students from Tokyo in August 2014 in the planting programs, Sungai Lalasun serves as the demonstration area of the project.

The project site at Sg. Lalasun. (Photo by T. Inoue)

Growth of *Rhizophora* seedlings at Sg. Lalasun from 2011–2013. *Rhizophora mucronata* started precocious flowering three years after planting (bottom right).

Growth of *Rhizophora* seedlings at Sg. Lalasun in 2013 (top) and 2014 (bottom row).

Terminalia cattapa seedlings grew well on the top of bunds.
Some were more than two metres tall a year after planting (bottom left).

A tributary of Sungai Loboh was officially named Sungai ISME by SFD honouring the involvement of the society in Sabah. The 1.5 km river is located near Kampung Padas in the district of Sandakan. At Sungai ISME, planting efforts were by the staff of Tokio Marine & Nichido Fire Insurance Co., Ltd. from 5–7 September 2012. They planted two hectares with 4,200 propagules and seedlings. In 2013, seedlings planted in regularly inundated channels displayed luxuriant growth.

The signboard and planting site at Sg. ISME.

Map of the Sg. Gum-Gum & Sg. Loboh FR showing Sg. ISME, a tributary of Sg. Loboh (left).
The signboard of Sg. ISME (top right) and the river during low tide (bottom right).

Growth of *Rhizophora* seedlings planted at Sg. ISME from 2012–2014.

Luxuriant growth of planted seedlings in regularly inundated channels.

Rhizophora seedlings planted at Sg. ISME in 2012 were measured in 2014 even during the high tide.

Sungai Mattangar

An area of 22 ha encroached by oil palm at Sungai Mattangar in Beluran was rehabilitated by contract in 2013. The original vegetation of the mixed mangrove and peat swamp type was totally cleared. Ferns of *Stenochlaena* and *Acrostichum*, and sedges form the dominant vegetation.

Planting was carried out by a contractor employed and supervised by SFD with technical advice from ISME. Local residents including fishermen were employed in the project activities involving the cutting of thickets to create planting lines, collection of planting materials and planting.

Major species planted were *Rhizophora apiculata* and *Rhizophora mucronata*. Seedlings of *Hibiscus tiliaceus* and *Terminalia catappa* were planted on top of the bunds. Other species planted were *Ceriops tagal*, *Avicennia alba* and *Bruguiera cylindrica*.

Some challenges of rehabilitation of the area are the dense fern thickets, requiring the creation of planting lines, which have to be manually cut as the use of herbicides is prohibited. The poor drainage resulted in the formation of stagnant puddles of water with slime and rust-coloured ferric oxide due to the leaching of acid water from acid sulphate soils. All these factors are detrimental to plant growth. The success of the project in Sungai Mattangar relies strongly on the creation of planting lines and the effectiveness of bund breaching to facilitate tidal flow.

Mangrove propagules and seedlings planted in Beluran.

Location	Area (ha)	Species	Number	Year
Sg. Mattangar	22	*Rhizophora apiculata*	16,800 S & P	2013
		Rhizophora mucronata	7,500 S & P	
		Terminalia catappa	2,218 S	
		Ceriops tagal	150 S & P	
		Avicennia alba	100 S	
		Hibiscus tiliaceus	20 S & C	
		Bruguiera cylindrica	12 S	
Beluran	**22**		**26,800**	

Abbreviations: Sg. = Sungai (River), P = propagules, S = seedlings and C = cuttings.

The signboard of the planting site at Sg. Mattangar (left) and there is a need to create planting lines due to the dense fern cover (right).

At the time of planting, stagnant puddles of water with slime and rust-coloured iron oxide caused by acid sulphate soils were evident.

The bunds were breached at several locations to facilitate tidal flow.

With tidal flushing, *Rhizophora apiculata* (right) started to grow well with *Terminalia cattapa* (left) showing outstanding growth.

Sungai Garama and Sungai Klias

In Beaufort, 60 ha of degraded mangroves were planted along Sungai Garama in 2012, with another 37 ha along Sungai Klias in 2012 and 2014 by contractors. Initial planting trials had poor survival due to crab attack on propagules of *Rhizophora* and insect infestation on seedlings of *Avicennia*. Browsing by deer was an additional problem for species planted in the interior peaty grassland. In view of the various problems, the initial distance of 150 m from the riverbank planned for rehabilitation was reduced to 50 m. This is to avoid planting in the grassland as much as possible, which experiences periodic outbreaks of wildfire particularly during the dry season. The main species planted were *Hibiscus tiliaceus*, *Rhizophora apiculata* and *Rhizophora mucronata*. Other species planted included *Avicennia alba*, *Xylocarpus granatum* and *Aglaia cucullata*. Planting of *Rhizophora apiculata* among the *Acrostichum* ferns along cut lines was promising.

Due to the harsh site conditions, most of planting material used for the restoration was derived from fresh cuttings of *Hibiscus tiliaceus*, which occur naturally in the area. The overall survival rate was estimated at 60%. Cluster planting of large seedlings of *Xylocarpus granatum*, *Ceriops tagal*, *Avicennia alba* and *Aglaia cucullata* was tested by the SFD staff with some success. *Avicennia alba* and *Aglaia cucullata* had the highest survival rate of >95% eight months after planting.

Mangrove propagules, seedlings, seeds and cuttings planted in Beaufort.

Location	Area (ha)	Species	Number	Year
Sg. Garama 1	30	*Hibiscus tiliaceus*	19,000 C	2012
		Rhizophora apiculata	12,000 S & P	
		Xylocarpus granatum	200 S *	
		Ceriops tagal	180 S *	
		Avicennia alba	150 S *	
		Aglaia cucullata	60 S *	
		Terminalia catappa	10 S	
			31,600	
Sg. Garama 2	30	*Hibiscus tiliaceus*	20,500 C	2012
		Rhizophora mucronata	7,500 S & P	
		Rhizophora apiculata	3,500 S & P	
			31,500	
Sg. Klias 1 ◦	15	*Hibiscus tiliaceus*	9,000 C	2012
		Rhizophora mucronata	3,000 S & P	
		Rhizophora apiculata	2,000 S & P	
		Ceriops tagal	800 S	
			14,800	
Sg. Klias 2	22	*Nypa fruticans*	18,500 •	2014
		Hibiscus tiliaceus	12,000 C	
		Rhizophora mucronata	2,600 P	
		Cratoxylum arborescens	1,000 S	
			34,100	
Beaufort	**97**		**112,000**	

Abbreviations and symbols: Sg. = Sungai (River), P = propagules, S = seedlings, C = cuttings, • = seeds, * = cluster planting and ◦ = planted by SFD staff.

The nettle caterpillar infesting seedlings of *Avicennia alba* was identified as *Thosea vetusta*. The polyphagous caterpillar feeds on a wide range of plants including oil palm, banana and tea. It has not been reported feeding on *Avicennia alba*, a new host plant record.

At Sungai Klias, fruits of *Nypa fruticans* were collected from nearby forests and their seeds extracted for planting in 2014. Most of the planted seeds successfully germinated without any pest problems encountered. On a trial basis, seedlings of *Cratoxylum arborescens* were also planted with moderate success.

Signboards of project sites at Sg. Garama (top right) and Sg. Klias (bottom left).
SFD has a checking station near the confluence of Sg. Klias and Sg. Garama (bottom right).

Nettle caterpillars defoliating leaves of *Avicennia alba* seedlings (left), sesarmid crabs feeding on *Rhizophora* propagules (middle) and browsing of propagules by deer (right).

A temporary nursery has been established to raise *Rhizophora* seedlings for planting at Sg. Garama.

Rhizophora apiculata seedlings planted in blank patches (top left) at Sg. Garama, seedlings planted in patches (bottom left) and as clusters along cut lines (right) grew well a year later.

At Sg. Garama, seedlings of *Avicennia alba* planted along cut lines and in clusters grew well with good height growth and high survival rate.


Seeds of *Nypa fruticans* (left) planted at Sg. Klias started to establish (right).

Cuttings of *Hibiscus tiliaceus* were freshly collected for planting (left) to ensure higher survival rate. Plants established from seedlings (middle) and from cuttings (right).



Planted seedlings of *Aglaia cucullata* at Sg. Garama (left) and *Cratoxylum arborescens* at Sg. Klias (right) survived.

Pangkalan Madai and Pangi Ujung

An area of 6 ha of mangrove forest at Pangkalan Madai and Pangi Ujung in Kunak was encroached by shrimp farmers in 2002. Eight shrimp ponds, the size of a football field each, were constructed. In 2007, SFD planted mangroves in parts of the pond sites. Through the present SFD-ISME project, the remaining sites were planted in 2013 with beating-up operations wherever necessary. Breaching the pond bunds was carried out in October and November 2013. It was found that the construction of fewer openings at strategic locations was preferred. Greater flow velocity was generated with scouring but less siltation, and this will encourage the recruitment of water-borne propagules into the ponds. The conventional line-planting method was carried out by the field staff of SFD using propagules of *Rhizophora apiculata*, *Rhizophora mucronata* and *Ceriops tagal*, and seedlings of *Avicennia alba*. Seedlings planted in 2007 were measured in 2013.

Mangrove propagules and seedlings planted in Kunak.

Location	Area (ha)	Species	Number	Year
Pangkalan Madai	2.5	*Rhizophora mucronata*	4,800 P	2013
		Rhizophora apiculata	3,500 P	
		Ceriops tagal	500 P	
			8,800	
Pangi Ujung	3.5	*Rhizophora mucronata*	800 P	2013
		Rhizophora apiculata	500 P	
		Ceriops tagal	100 P	
		Avicennia alba	20 S	
			1,420	
Kunak	**6.0**		**10,220**	

Abbreviations: P = propagules and S = seedlings.

Carting mangrove propagules to the pond site for planting using a wheelbarrow can be fun (left) and planting is no fun when you have to wade in the deep pond mud (right).

Digging drainage canals at strategic locations of the pond bunds to facilitate tidal flow was tedious and backbreaking.

Mangrove seedlings planted by SFD in 2007 at Pangi Ujung were measured in 2013.

Overall Performance

On completion of the first phase of the SFD-ISME project (2011–2014), a total area of 151.5 ha of degraded mangroves in 14 project sites located in five forest reserves of four forestry districts were rehabilitated. Nearly 190,000 plants (propagules, cuttings, seedlings and seeds) belonging to 11 species, 10 genera and seven families were planted.

Species planted and planting materials used in the project sites.

Species	Family	Local Name	Material	Project Site	District
Aglaia cucullata	Meliaceae	Bekak	S	Sg. Garama	Beaufort
Avicennia alba	Avicenniaceae	Api-Api	S	Sg. Lalasun, Samawang & Sg. ISME	Sandakan
			S	Sg. Mattangar	Beluran
			S	Sg. Garama	Beaufort
			S	Pangi Ujung	Kunak
Bruguiera cylindrica	Rhizophoraceae	Beus	S	Sg. Mattangar	Beluran
			S	Sg. ISME	Sandakan
Ceriops tagal	Rhizophoraceae	Tengar	S	Sg. Lalasun & Sg. ISME	Sandakan
			P, S	Sg. Mattangar	Beluran
			S	Sg. Garama & Sg. Klias	Beaufort
			P	Pangkalan Madai & Pangi Ujung	Kunak
Cratoxylum arborescens	Guttiferae	Serungan	S	Sg. Klias	Beaufort
Hibiscus tiliaceus	Malvaceae	Baru-Baru	C, S	Sg. Mattangar	Beluran
			C	Sg. Garama & Sg. Klias	Beaufort
Nypa fruticans	Palmae	Nipah	Seeds	Sg. Klias	Beaufort
Rhizophora apiculata	Rhizophoraceae	Bakau minyak	P, S	Sg. Lalasun, Sg. Loboh, Samawang, Sg. Batang, Sg. ISME & Tg. Pisau	Sandakan
			P, S	Sg. Mattangar	Beluran
			P, S	Sg. Garama & Sg. Klias	Beaufort
			P	Pangkalan Madai & Pangi Ujung	Kunak
Rhizophora mucronata	Rhizophoraceae	Bakau kurap	P	Sg. Lalasun, Sg. ISME & Tg. Pisau	Sandakan
			P, S	Sg. Mattangar	Beluran
			P, S	Sg. Garama & Sg. Klias	Beaufort
			P	Pangkalan Madai & Pangi Ujung	Kunak
Terminalia catappa	Combretaceae	Ketapang	S	Sg. Lalasun, Sg. Loboh, Samawang, Sg. ISME & Tg. Pisau	Sandakan
			S	Sg. Mattangar	Beluran
			S	Sg. Garama	Beaufort
Xylocarpus granatum	Meliaceae	Nyireh bunga	S	Sg. Garama	Beaufort

Abbreviations: Sg. = Sungai (River), Tg. = Tanjung (Promontory), P = propagules, S = seedlings and C = cuttings.

Achievements and Benefits

Besides achieving the annual target of rehabilitating 50 ha of degraded mangroves within forest reserves in Sabah, the SFD-ISME collaborative project (2011–2014) has generated tangible benefits for SFD and ISME. They included:

Recognition and Publicity

The SFD-ISME project has gained international recognition. Examples were the mangrove planting activities by participants of the Eighth ISME General Assembly in September 2011, students of Ritsumeikan Uji High School, Kyoto in March 2012, staff of Tokio Marine & Nichido Fire Insurance Co., Ltd. in September 2012, and high school teachers and university students from Tokyo in August 2014. The Japan Society for Mangroves has invited Dr. Joseph Tangah (Senior Research Officer from SFD) as guest speaker at its annual meeting at the Tokyo University of Agriculture in November 2014. In conjunction with the World Environment Day, the Scouts Association of Sandakan voluntarily planted 2,000 mangrove propagules and seedlings at Sungai Lalasun in February and March 2012. For the records, SFD is the only forestry department in Malaysia that is continuing with the mangrove rehabilitation work carried out from 2006–2010 under the Ninth Malaysia Plan. The project has also received positive publicity in Sabah as reflected by the number of articles published in the local newspapers.

Local English newspapers such as the Star Online, New Sabah Times, Borneo Post Online and Daily Express, and Chinese newspapers such as See Hua Daily News, Asia Times (Malaysia), Sin Chew Jit Poh, Guang Ming and China Press have written about the SFD-ISME collaborative project on mangrove rehabilitation in Sabah. The following are titles of online articles of English newspapers from 2010–2014 in reverse chronological order:

2014

- The Star Online (17 August 2014)- *Sabah rehabilitating 250 ha of degraded mangroves*
- Borneo Post Online (6 March 2014)- *151.5 hectares of mangroves rehabilitated in Sabah*
- New Sabah Times (5 March 2014)- *Towards greener mangroves*

2012

- New Sabah Times (7 September 2012)- *Marine, fire insurers come to Sabah to plant mangroves*
- Borneo Post Online (16 March 2012)- *Japanese students plant mangroves to support rehabilitation*
- Daily Express (16 March 2012)- *Sabah mangrove rehab project*

2011

- Daily Express (14 September 2011)- *326,000 ha Sabah mangroves gazetted*

2010

- The Star Online (15 November 2010)- *Restoring the mangroves*
- Borneo Post Online (11 November 2010)- *Collaboration in restoring Sabah mangroves*
- The Star Online (15 September 2010)- *Sustainable mangrove management*

Conservation Awareness

SFD strives to improve on its mangrove outreach program through environmental education by constructing observation towers, interpretive boardwalks, training courses, public talks and other activities that bring people together into direct contact with the mangrove ecosystems. In recent years, the Kota Marudu District Forest Office and District Office have jointly organised awareness campaigns on the importance of mangrove conservation during the Marudu Bay Carnival. The target groups were students and local communities. During the carnival, activities such as oral presentation and poster exhibition on mangrove conservation as well as field visits and planting of mangroves were organised.

School students participating in the awareness campaigns on the importance of mangroves during the Marudu Bay Carnival.

Mangrove Protection and Conservation

While seeking new and additional planting sites for the project, SFD has discovered some encroachments such as shrimp ponds and oil palm cultivation into the mangrove FR during the ground-truthing surveys. Appropriate actions have been taken by the department to halt further encroachments and the culprits prosecuted. In this project, more than 150 ha have been restored. The sites included those encroached by oil palm (47 ha), shrimp ponds (6 ha) and degraded riverine mangroves (97 ha).

Google Earth
Satellite image (2002) of an oil palm encroachment at Sg. Lalasun.

Capacity Building of SFD

Not all planting activities were contracted out. Some activities such as monitoring of growth and mortality, identification of pest problems, carrying out of initial planting trials, and replanting of smaller areas of degraded mangrove were implemented by the field staff of SFD led by the Sandakan task force. This project presents a great opportunity for SFD to strengthen its capacity in mangrove rehabilitation. SFD is confident that harnessing the technical support from mangrove experts of ISME is the right strategy towards successful rehabilitation of degraded mangrove forests within the forest reserves throughout Sabah.

Involvement of Local Communities

The project creates incentives for local communities to collect and supply planting materials, which they will be paid by the amount supplied and thereby generating some income. Through this arrangement, contractors do not need to employ full-time workers for gathering mangrove propagules and seedlings. With community participation in the project activities, there is greater awareness that mangroves are important ecosystems that need to be restored.

Initiation of the SFD-TBRC Project

The close working relationship between SFD and ISME has led to the launching of the International Exchange Program on Coastal Resources, a collaborative project between SFD and the Tropical Biosphere Research Center (TBRC) of University of the Ryukyus. Key researchers are Prof. Kazuhiko Sakai as Director of TBRC, Assoc. Prof. Shin Watanabe and Asst. Prof. Tohru Naruse from the Iriomote Station of TBRC. Dr. Joseph Tangah is the local counterpart and the Mangrove Task Force provides assistance in the field.

The Tropical Biosphere Research Center (TBRC) of University of the Ryukyus featuring its Center of Molecular Biosciences (COMB).

Cooperation and Friendship

Signing the MoU for the second phase is only a formal arrangement to continue the project for the next five years. The success of the first phase was largely due to the spirit of cooperation and friendship between SFD and ISME, which will continue to strengthen into the second phase. The relationship started in September 2007, when a delegation of government officials from Sabah led by SFD visited the mangroves of Okinawa, Ishigaki and Iriomote Islands in Japan. The purpose of the fact-finding mission was to enhance capacity building and awareness on the conservation of mangroves and other coastal ecosystems in Japan. During the trip from Okinawa to Ishigaki, the delegates had a life-threatening experience as their very turbulent flight was in the direct path of Typhoon Wipha, second strongest typhoon (wind speed up to 237 km/h) in the history of Iriomote. Since then, mutual friendship has established between SFD and ISME officials.

Katsuhiko Sato (left) and Fidelis Edwin Bajau (right) first met in Sandakan in September 2011, and here they meet again in Okinawa exactly two years later. True friendship has developed between SFD and ISME during the first phase of the project.

Second Phase of the SFD-ISME Project

Due to the successful implementation of project activities (2011–2014), Tokio Marine & Nichido Fire Insurance Co., Ltd. has committed additional funds to support the SFD-ISME project for another five years (2014–2019) with an annual target of 40 ha. The MoU signing ceremony for the second phase was held at the SFD Headquarters, and was signed by Datuk Sam Mannan, the Director of SFD on behalf of the State Government, and Prof. Shigeyuki Baba, the Executive Director of ISME.

Signing ceremony for second phase of the SFD-ISME project. Prof. Shigeyuki Baba (left) and Fidelis Edwin Bajau, Deputy Director of SFD (right).

Press Release

SFD-ISME Inked Second Phase Collaboration on Mangrove Rehabilitation, Sandakan, Sabah, 13 August 2014

The MoU between the State Government of Sabah and the International Society for Mangrove Ecosystems (ISME) on Mangrove Rehabilitation has been extended for another five years funded by Tokio Marine & Nichido Fire Insurance Co., Ltd. (Tokio Marine & Nichido) through ISME, following the expiration of its first phase, a 3-year collaboration, in August 2014. The signing ceremony was held at the Sabah Forestry Department Headquarters and was signed by Datuk Sam Mannan, Director of Forestry on behalf of the State Government, and Prof. Shigeyuki Baba, Executive Director of the International Society for Mangrove Ecosystems (ISME). A cheque being the first annual disbursement was presented to the Sabah Forestry Department to kick start the project implementation. Also present at the ceremony were three high school teachers, five university students and staff of the ISME Secretariat, from the Tokyo and Okinawa regions of Japan. They collectively handed over a generous donation of JPY100,000 (~RM3,000) to the Sabah Forestry Department in support of the Mangrove Rehabilitation Project, and will also participate in mangrove planting activities at Sungai Lalasun, Sandakan, one of the project sites for this collaboration. Within the next five years (2014–2019), donation campaigns and seeking volunteers would be promoted in Japan to raise the needed funds and resources to restore degraded mangrove forests throughout the State. The first phase of the SFD/ISME project, which was funded by Tokio Marine & Nichido, has successfully restored a total of 151.5 hectares of degraded mangrove forests involving six forest reserves in four districts in Sabah from February 2011 until June 2014.

Nature Education

For students, volunteers and delegates visiting Sandakan to plant mangroves under the SFD-ISME project, nature education is an essential part of the program. Field excursions are organised for them to visit the Rainforest Discovery Centre (RDC), Orang Utan Rehabilitation Centre and Bornean Sun Bear Conservation Centre in Sepilok, and the Proboscis Monkey Sanctuary at Labuk Bay. For the students, Prof. Shigeyuki Baba would conduct botany classes in the field.

Students from Ritsumeikan Uji High School in Kyoto had a botany class on *Nypa fruticans* after planting mangroves.

University students from Tokyo encountered trees of *Xylocarpus granatum* in fruit. A fruit was opened to count the number of seeds and to test their buoyancy.

Cultural Exchange

When students from Japan come to Sandakan under the SFD-ISME project, cultural exchange programs are organised for them. High school students and teacher Saori Matsuoka from Ritsumeikan Uji High School in Kyoto, Japan visited SMK Muhibbah (Muhibbah National Secondary School) in Sandakan on 15 March 2012. Among the activities were a briefing by the School Principal Lily Lim, exhibitions, and cultural performances by students from both schools. The visit was organised by Phylesia Jill Rama and Cecilia Lolin from the Rainforest Discovery Centre (RDC) of SFD. The high school students had the opportunity to spent an evening with SFD staff and their families. On 15 August 2014, university students from Tokyo performed "Soran-bushi," a Japanese traditional dance of fishermen in Hokkaido during an annual function of SFD.

Group photo of high school students from Kyoto with the principal (standing in the front row, fourth from the right), teachers and students of SMK Muhibbah in Sandakan on 15 March 2012.
(Photo by SMK Muhibbah)


The high school students were fascinated by the exhibits (left) and angklung musical performance (right) of the secondary school. (Photos by SMK Muhibbah)

The high school students and teacher (kneeling in the front row) joined the secondary school choir for a group photo. (Photo by SMK Muhibbah)

The high school students, some clad in local traditional costumes, spent an evening with SFD staff and their families.

Calendar of Activities

July 2010

ISME delegation visited SFD in Sandakan

From 11–12 July 2010, an ISME delegation led by Prof. Shigeyuki Baba, and accompanied by Dr. Chan Hung Tuck and Nozomi Oshiro visited SFD in Sandakan to discuss on the implementation of a mangrove rehabilitation project in Sabah. During the visit, a special powerboat trip to the beautiful island of Lankayan (15 km northeast of Sandakan) was organised by the host. The visit by ISME led to the signing of a MoU between the two organisations.

Lankayan Island of Sabah: A priceless tropical jewel of unspeakable beauty in the Sulu Sea.

White sandy beaches in harmony with the clear blue sea and sky make Lankayan a tropical island paradise that one can only fantasize.

November 2010

Signing of the project MoU and visit of project sites

The signing ceremony between SFD and ISME was held in Kota Kinabalu on 10 November 2010 and witnessed by Hironari Iwakuma, the Executive Director of Tokio Marine Insurans (Malaysia) Berhad. Also present at the signing ceremony was a delegation from Tokio Marine & Nichido Fire Insurance Co., Ltd., headed by Keiko Fujita.

The delegation from Tokio Marine & Nichido Fire Insurance Co., Ltd. subsequently visited projects sites in Sandakan.

(L–R): Fidelis Edwin Bajau, Datuk Sam Mannan, Hironari Iwakuma, Prof. Shigeyuki Baba and Dr. Chan Hung Tuck.

Signing of the MoU between Datuk Sam Mannan of SFD (left) and Prof. Shigeyuki Baba of ISME (right).

Visit to Sg. Lalasun by delegation from Tokio Marine & Nichido Fire Insurance Co., Ltd. (left), accompanied by the Mangrove Task Force (right).

April 2011

First PSC Meeting

The First PSC Meeting was held at the Forestry Department HQ in Sandakan on 7 April 2011 and chaired by Datuk Sam Mannan. The meeting discussed possible project sites and strategies to meet the annual planting target of 50 ha per year with the allocated budget. It was agreed that the PSC will meet twice a year, Prof. Shigeyuki Baba will serve as the Co-Chairman, and Dr. Joseph Tangah will be the Secretary and Project Leader.

September 2011

Second PSC Meeting, Eighth ISME General Assembly and Mangrove Workshop

The Second PSC Meeting was held at the Forestry Department HQ in Sandakan on 12 September 2011 and chaired by Datuk Sam Mannan.

The Eighth General Assembly (GA) of ISME was held at the Rainforest Discovery Centre in Sepilok in the morning of 13 September 2011. The Honourable Datuk Peter Pang (Minister of Youth and Sports, Sabah) graced the occasion the GA and presented the Opening Address. Among the highlights of the GA were the Announcement of the Executive Committee (2011-2014), Activities and Finance, Revision of the Statutes and Award Ceremony. SFD was honoured an Honorary Institutional Membership from ISME during the GA. The honorary membership was the first of its kind awarded by ISME to an organisation in recognition of its conservation effort and wise utilisation of mangroves. The GA was attended by participants from Malaysia, Thailand, Senegal, Australia, France, Japan and India.

In the afternoon of 13 September 2011, the ISME-SFD Mangrove Workshop was held in the same venue. Six papers were presented at the workshop, chaired by Prof. Sanit Aksornkoae, the President of ISME.

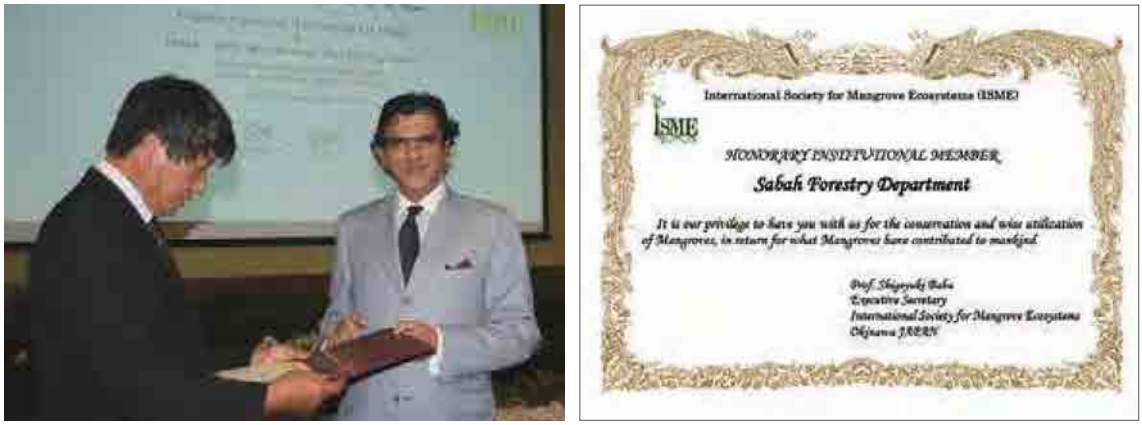
The Eighth ISME General Assembly.

Participants of the Eighth ISME General Assembly.

Seated (L–R): Prof. Sanit Aksornkoae, Prof. Salif Diop, Datuk Peter Pang (Minister of Youth and Sports, Sabah), Datuk Sam Mannan and Prof. Shigeyuki Baba.

Papers presented at the ISME-SFD Workshop.

Title	Presenter
• Management of mangrove forest reserves in Sabah: issues and challenges	Fidelis Edwin Bajau, Joseph Tangah & Werfred Jilimin
• Current research projects on mangroves in Australia	Norman Duke
• Recent hazards and their impacts on mangroves in the Bay of Bengal	François Blasco
• Planting of mangroves for coastal protection	Shigeyuki Baba
• ISME-ITTO small project on mangroves	Chan Hung Tuck
• Highlights of the world atlas on mangroves	Mami Kainuma



Datuk Sam Mannan (Director of SFD) receiving the Honorary Institutional Membership from Prof. Shigeyuki Baba (Executive Director of ISME).

Group photo of participants of the Eighth General Assembly at Sg. Lalasun before the commemorative planting of mangroves.

February 2012

Mangrove planting by Sandakan Scouts Association

On the invitation of SFD, the Scouts Association of Sandakan planted 2,000 mangrove propagules and seedlings at Sungai Lalasun in conjunction with the World Environment Day.

The Sandakan scouts gathered at Sg. Lalasun to plant mangroves.

March 2012

Third PSC Meeting and visit by students from Ritsumeikan Uji High School

The Third PSC Meeting was held at the Forestry Department HQ in Sandakan on 15 March 2012 and chaired by Datuk Sam Mannan. Coinciding with the meeting, nine students and teacher from Ritsumeikan Uji High School, Kyoto, Japan visited Sandakan.

The high school students raised RM3,000 as donation to SFD in support of mangrove rehabilitation in Sabah.

The students planted mangroves in Sg. Lalasun on 16 March 2012.

It was great fun when planting was completed.

Climbing the prop roots of a large *Rhizophora apiculata* tree to pose for this group photo was the highlight of the day for the students (left). The students had some of the most adventurous mangrove-related activities that included log balancing, log riding and log carrying (right column).

September 2012

Fourth PSC Meeting and visit by staff of Tokio Marine & Nichido Fire Insurance Co., Ltd.

The Fourth PSC Meeting was held at the Kota Kinabalu District Forestry Office in Lok Kawi on 4 September and chaired by Datuk Sam Mannan.

From 5–7 September 2012, 26 staff members of Tokio Marine & Nichido Fire Insurance Co., Ltd. from three countries (Japan, USA and Malaysia) planted 2 ha of mangroves in Sungai ISME. Kouji Iwai and Kazumasa Fukada (Managing Directors) headed the team, and a filming crew documented the planting operations.

Wearing their attractive blue caps, staff of Tokio Marine & Nichido Fire Insurance Co., Ltd. planted 2 ha of mangroves in Sg. ISME from 5–7 September 2012.

November 2012

Signing of MoU for SFD-TBRC Collaboration

The SFD-TBRC Collaboration was initiated with signing of the MoU in Kota Kinabalu on 6 November 2012. The occasion was witnessed by Datuk Dr. Yee Moh Chai, the Deputy Chief Minister of Sabah.

The MoU was signed by Prof. Hirosuke Oku, Executive Director of TBRC (left) and Datuk Sam Mannan, Director of SFD (right).

March 2013

Fifth PSC Meeting and ISME-ITTO Mangrove Book Launch & Seminar

The Fifth PSC Meeting was held at the Forestry Department HQ in Sandakan on 11 March 2013 and chaired by Datuk Sam Mannan.

The ISME-ITTO book launching ceremony and seminar was held at the Rainforest Discovery Centre in Sepilok, Sandakan on 12 March 2013. The books were *Continuing the Journey Amongst Mangroves* by Barry Clough; *Structure, Function and Management of Mangrove Ecosystems* by Jin Eong Ong & Wooi Khoon Gong; and *Useful Products from Mangrove and other Coastal Plants* by Shigeyuki Baba, Hung Tuck Chan & Sanit Aksornkoae. The book series were outputs of ITTO-ISME project entitled Production of an Educational Book Series on Mangroves for Sustainable Management and Utilization of Mangrove Ecosystems funded by ITTO and the Government of Japan. The occasion was also to commemorate the retirement of Prof. Shigeyuki Baba from University of the Ryukyus in Okinawa, Japan.

The Fifth PSC Meeting in session at the Forestry Department HQ.

The three ISME-ITTO Mangrove Educational Books launched.

Participants of the Book Launching Ceremony and Seminar.

Seated (L–R): Fidelis Edwin Bajau, Prof. Sanit Aksornkoae, Datuk Sam Mannan, Dr. Steve Johnson (Project Manager from ITTO) and Prof. Shigeyuki Baba.

Prof. Shigeyuki Baba (left), Datuk Sam Mannan (middle) and Prof. Sanit Aksornkoae (right) addressing the Book Launching Ceremony.

Signing of the books by officials from ISME and ITTO (left top), and by authors of Book 3 (left bottom) and Seminar Presentation of ISME-ITTO Mangrove Educational Books as gifts to SFD (right).

September 2013

SFD delegation visited Okinawa and Kyoto

The program of the SFD delegation visit to Okinawa from 2–9 September 2013 included the Sixth PSC Meeting, the SFD, ISME & TBRC Joint Seminar on Mangrove Management in Sabah and Biodiversity in the Ryukyu Islands, and the First SFD-TBRC Meeting. The Sixth PSC Meeting was held at the 50th Anniversary Memorial Hall, University of the Ryukyus on 3 September 2013 and chaired by Prof. Shigeyuki Baba.

From 3–4 September 2013, the delegation visited Shuri Castle, Manko Waterbird & Wetland Center, Tropical Dream Center and Churaumi Aquarium. The Joint Seminar and SFD-TBRC Meeting were held in University of the Ryukyus in the morning and afternoon of 5 September 2013, respectively. A courtesy call on the President of University of the Ryukyus was also made on 5 September 2013. On 6 September 2013, the SFD delegates visited the Sesoko Station of TBRC and the enchantingly beautiful Yambaru Forest in Okinawa. Before their departure, the SFD delegates visited Downtown Kyoto, Golden Pavilion and Kiyomizu-Dera on 8 September 2013.

The SFD delegation to Okinawa from 2-9 September 2013

Head	
Fidelis Edwin Bajau	Deputy Director (Development)
Members	
Dr. Lee Ying Fah	Deputy Director (Research & Development)
Werfred Jilimin	Head of Enforcement & Investigation
Dr. Joseph Tangah	Senior Research Officer and Project Leader
Hj. Mohd. Salleh Abbas	Senior Planning Officer
Hj. Fadzil Yahya	District Forest Officer (Sandakan)
George Angampun	District Forest Officer (Beaufort)
Petin Kilou	District Forest Officer (Beluran)
Eddie Bungkoris	District Forest Officer (Kalabakan)
Peter Jack	District Forest Officer (Tongod)
Shafie Abu	Research Officer
Donatus Loisang	Investigation Officer

The Sixth PSC Meeting

Participants of the Sixth PSC Meeting.

Front row (L–R): Mio Kezuka, Eddie Bungkoris, Dr. Joseph Tangah, Dr. Mami Kainuma, Nozomi Oshiro,Fidelis Edwin Bajau (Head of SFD delegation), Werfred Jilimin, Hj. Mohd. Salleh Abbas, George Angampun, Petin Kilou and Hj. Fadzil Yahya.
Back row (L–R): Prof. Shigeyuki Baba (Chairman), Dr. Chan Hung Tuck, Dr. Lee Ying Fah and Shafie Abu.

The Joint Seminar

Fidelis Edwin Bajau (top left) and Prof. Hirosuke Oku (top right) addressing the seminar, and question and answer session (bottom row).

Participants of the Joint Seminar.

Front row (L–R): Petin Kilou, Nozomi Oshiro, Eddie Bungkoris, Postgraduate Student, George Angampun, Hj. Mohd. Salleh Abbas, Fidelis Edwin Bajau (Head of SFD delegation), Dr. Joseph Tangah, Asst. Prof. Tohru Naruse, Hj. Fadzil Yahya, Postgraduate Student and Dr. Mami Kainuma. Back row (L–R): Peter Jack, Postgraduate Student, Dr. Chan Hung Tuck, Dr. Lee Ying Fah, Prof. Hirosuke Oku, Prof. Shigeyuki Baba, Werfred Jilimin, Shafie Abu and Postgraduate Student.

The First SFD-TBRC Meeting was held in the Center of Molecular Biosciences (COMB) of TBRC in University of the Ryukyus

Courtesy call on Prof. Hajime Oshiro, President of University of the Ryukyus on 5 September 2013

Attractions in Okinawa visited by SFD delegates from 3–4 September 2013


Tropical Dream Center


Manko Waterbird & Wetland Center


Churaumi Aquarium (left) and Shuri Castle (right)

Attractions in Okinawa visited by SFD delegates on 6 September 2013


Sesoko Station of TBRC


Yambaru forest


Climax vegetation of Yambaru forest

Attractions in Kyoto visited by SFD delegates on 8 September 2013


Golden Pavilion (left) and Downtown Kyoto (right)


Kiyomizu-Dera (Temple)

March 2014

Seventh PSC Meeting, Second SFD-TBRC Meeting and visit to the Trusan Kinabatangan FR

The Seventh PSC Meeting and Second SFD-TBRC Meeting, chaired by Datuk Sam Mannan, were held concurrently at the Forestry Department HQ in Sandakan on 3 March 2014 (right). The next day, a field excursion was organised to visit the Trusan Kinabatangan FR.

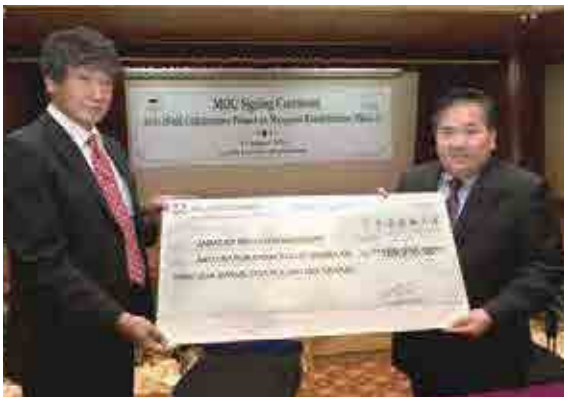
The magnificent mangrove forests (left) and picturesque fishing villages (right) of the Trusan Kinabatangan FR.

August 2014

Eighth PSC Meeting, visit by teachers and students from Tokyo and signing of MoU for second phase of the project

The Eighth PSC Meeting was held at the Forestry Department HQ in Sandakan on 12 August 2013 and chaired by Fidelis Edwin Bajau on behalf of Datuk Sam Mannan. Coinciding with the meeting, three high school teachers and five university students from Tokyo, Japan visited Sandakan.

Following the MoU signing ceremony for second phase of the project at the Forestry Department HQ in Sandakan on 13 August 2014, a mock cheque was presented by ISME to SFD as the 2014–2015 budget. The university students handed over RM3,000, a collective donation of the ISME Secretariat, students and teachers to the project.



ISME presented a mock cheque to SFD as the 2014–2015 budget.

The university students handed over a collective donation of RM3,000 to SFD.

Participants of the SFD-ISME Second Phase MoU signing ceremony.

Seated (L–R): Dr. Joseph Tangah, Dr. Lee Ying Fah, Fidelis Edwin Bajau, Prof. Shigeyuki Baba, Frederick Kugan, Dr. Chan Hung Tuck and Albert Radin.

The high school teachers and university students from Tokyo planted mangroves at Sg. Lalasun on 14 August 2014. Planting had to be done swiftly as the tide was rising (top row). The group was relieved when the task was completed (bottom).

November 2014

Annual Meeting of Japan Society for Mangroves

The Japan Society for Mangroves kindly invited a representative from SFD as guest speaker for its annual meeting at the Tokyo University of Agriculture with approximately 120 participants in Tokyo from 22–23 November 2014. SFD was represented by Dr. Joseph Tangah, and from ISME, Prof. Shigeyuki Baba, Dr. Tomomi Inoue, Karin Baba and Mio Kezuka attended the meeting. Also present were Masaaki Nagamura and Yoshiyuki Shimamoto from Tokio Marine & Nichido Fire Insurance Co., Ltd.

Prof. Shigeyuki Baba introducing the invited speaker.

Dr. Joseph Tangah addressing the meeting (left) and Karin Baba served as the translator (right).

Question and answer session (left). Tokio Marine & Nichido, SFD and ISME group photo (right).

References

Abbas, S., Yahya, F. & Abu, S. (2013). Update of mangrove management under National Plan Project – Sabah, Malaysia. Paper presented at the *SFD, ISME and TBRC Joint Seminar on Mangrove Management in Sabah and Biodiversity in Ryukyu Islands*, 5 September 2013, Faculty of Agriculture, University of the Ryukyus, Okinawa, Japan.

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).

Chung, A.Y.C. & Tangah, J. (2013). New host plant record for nettle caterpillar, *Thosea vetusta* on *Avicennia alba*. Poster presented at the *National Seminar on Coastal Forest Conservation*, 11–12 June 2013, Universiti Malaysia Terengganu, Terengganu, Malaysia.

Clough, B. (2013). *Continuing the Journey Amongst Mangroves*. ISME Mangrove Educational Book Series No. 1. International Society for Mangrove Ecosystems (ISME), Okinawa, Japan, and International Tropical Timber Organization (ITTO), Yokohama, Japan.

Giesen, W., Wulffraat, S., Zieren, M. & Scholten, L. (2007). *Mangrove Guidebook for Southeast Asia*. Food and Agriculture Organization of the United Nations (FAO) and Wetlands International.

Nilus, R., Chung, A.Y.C., Pereira, J.T., Sugau, J.B., Tangah, J., Sabran, S. & Chong, R.F.Y. (2010). *Mangroves of Sabah: An Introduction to the Flora and Fauna*. Sabah Forestry Department.

SFD (2011). *Fact Sheets of Forest Reserves in Sabah*. Sabah Forestry Department (SFD), Sandakan, Sabah, Malaysia.

SFD (2013). *Towards Greener Mangroves: An initiative between Sabah Forestry Department and International Society for Mangrove Ecosystems (ISME)*. A Special Report of the Sabah Forestry Department (SFD), Sandakan, Sabah, Malaysia.

Tangah, J. (2013). Current status and research activities under the SFD-ISME Mangrove Rehabilitation Project in Sabah. Paper presented at the *SFD, ISME and TBRC Joint Seminar on Mangrove Management in Sabah and Biodiversity in Ryukyu Islands*, 5 September 2013, Faculty of Agriculture, University of the Ryukyus, Okinawa, Japan.

Tangah, J. (2014). Rehabilitation of mangroves in Sabah – The SFD-ISME collaboration. Address delivered at the *Annual Meeting of the Japan Society for Mangroves*, 22 November 2014, Tokyo University of Agriculture, Tokyo, Japan.

Tangah, J., Baba, S. & Chan, H.T. (2012). Cluster planting of mangroves along Sungai Garama, Beaufort, Sabah, Malaysia. *ISME-GLOMIS Electronic Journal*, 10(6), 16–18.

Tangah, J., Baba, S., Chan, H.T. & Chung, A.Y.C. (2013). Cluster planting trial at Sg. Garama, Beaufort, Sabah. Paper presented at the *National Seminar on Coastal Forest Conservation*, 11–12 June 2013, Universiti Malaysia Terengganu, Terengganu, Malaysia.

Tangah, J., Kugan, F., Junaidi, R. & Chung, A.Y.C. (2011). The challenges of mangrove forest conservation and rehabilitation in Sabah, Malaysia. Paper presented at the *Asian Wetland Symposium on Integrated Biodiversity Conservation: Linking Forests and Wetlands*, 18–20 July 2011, Kota Kinabalu, Sabah, Malaysia.

Tangah, J., Roslan, M.J., Miskon, S. & Abu, S. (2010). Some notes on mangrove restoration in Sabah. *Sepilok Bulletin*, 12, 63–66.

In Sabah,
there is no greater
comfort and joy
than to be part of
the global effort
to rehabilitate
mangroves
for a greener
tomorrow.

Joseph Tangah,
Fidelis Edwin Bajau,
Werfred Jilimin,
Shigeyuki Baba,
Hung Tuck Chan
& Mio Kezuka

Sabah Forestry Department

ISME *International Society for Mangrove Ecosystems*

TOKIO MARINE NICHIDO Tokio Marine & Nichido Fire Insurance Co.,Ltd