Moving Forward

The **Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)** is one of the regional research and training centers of the Southeast Asian Ministers of Education Organization (SEAMEO), an intergovernmental body founded in 1965 to promote cooperation among Southeast Asian nations through activities in education, science, and culture. SEARCA's programmes are designed to strengthen institutional capacities in agricultural and rural development in Southeast Asia through graduate education, short-term training, research, and knowledge exchange.

SEARCA is hosted by the Philippine Government on the campus of the University of the Philippines Los Baños, which is based in Los Baños, Laguna, Philippines. It is supported by donations from SEAMEO member and associate member states, other governments, and various international donor agencies.

The **Institute of Southeast Asian Studies (ISEAS**) was established as an autonomous organisation in 1968. It is a regional centre dedicated to the study of socio-political, security and economic trends and developments in Southeast Asia and its whole geostrategic and economic development.

The Institute's research programmes are the Regional Economic Studies (RES, including ASEAN and APEC), Regional Strategic and Political Studies (RSPS), and Regional Social and Cultural Studies (RSCS).

ISEAS Publishing, an established academic press, has issued more than 2,000 books and journals. It is the largest scholarly publisher of research about Southeast Asia from within the region. ISEAS Publishing works with many other academic and trade publishers and distributors to disseminate important research and analyses from and about Southeast Asia to the rest of the world.

Moving Forward
Southeast Asian Perspectives on Climate Change and Biodiversity

Percy E. Sajise
Mariliza V. Ticsay
Gil C. Saguiguit, Jr.
Editors

SEAMEO SEARCA
SOUTHEAST ASIAN REGIONAL CENTER FOR GRADUATE STUDY AND RESEARCH IN AGRICULTURE
Laguna, Philippines

ISEAS
INSTITUTE OF SOUTHEAST ASIAN STUDIES
Singapore

First published in Singapore in 2010 by
ISEAS Publishing
Institute of Southeast Asian Studies
30 Heng Mui Keng Terrace
Pasir Panjang, Singapore 119614
E-mail: publish@iseas.edu.sg
Website: http://bookshop.iseas.edu.sg

and

Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)
College, Los Baños, Laguna, Philippines 4031
E-mail: post@agri.searca.org

ISEAS Library Cataloguing-in-Publication Data

Moving forward : Southeast Asian perspectives on climate change and biodiversity / edited by Percy E. Sajise, Mariliza V. Ticsay, Gil C. Saguiguit, Jr.

1. Climate changes—Southeast Asia—Congresses..
2. Biodiversity—Southeast Asia—Congresses.
3. Biodiversity—Climatic factors—Congresses.

I. Sajise, Percy E.
II. Ticsay, Mariliza V.
II. Saguiguit, Gil C., Jr.
III. International Conference-Workshop on Biodiversity and Climate Change in Southeast Asia : Adaptation and Mitigation, (2008 : Manila, Philippines)

QC903.2 A9M93 2010

ISEAS: ISBN 978-981-230-977-8 (soft cover)
ISBN 978-981-230-978-5 (hard cover)
ISBN 978-981-230-979-2 (E-book PDF)

Photo credits: Edwin Robert A. Cortes and Eric John F. Azucena for the book cover; photo on p. 57 was taken from the coverpage of *Forest lives: Lessons on Sustaining Communities and Forests from the Small Grants Programme for Operations to Promote Tropical Forests*, a joint publication of EU, UNDP, SEARCA, RECOFTC and AFN.
Copyeditor, Desktop Artist, and Cover Designer: Leah P. Arboleda
Printed in Singapore by Utopia Press Pte Ltd

Contents

Tables

Figures

Foreword

Climate change is not just a buzz word. It is real. In fact, an overwhelming amount of scientific evidence supports this. Across the globe, we are beginning to experience the effects of climate change.

For the most part, climate change is man-made, mostly by industrialised countries. Since the advent of the industrial era, the rate of increase in temperature has been increasing. Because it is man-made, there is optimism that climate change can be managed. Managing it, however, requires nothing less than a concerted global action.

There has been much media coverage on the more dramatic threats and consequences of climate change, such as tsunamis, forest fires, floods, severe droughts, and other such calamities.

Meanwhile, what needs greater attention are the less dramatic, yet potentially more widespread and long-term consequences of climate change, such as decreasing agricultural yields, increasing water stress, continuing spread of infectious diseases, and persistent changes in the natural ecosystems. All of these consequences threaten the earth's biological species.

The tropics, which holds most of the world's biodiversity, has been identified as being the most vulnerable to climate change. While the projected negative impacts on biodiversity are well articulated, the contributions of biological resources in reducing the impacts of climate change on people and agricultural production have not been fully appreciated.

To address this gap, the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), in partnership with the ASEAN Center for Biodiversity, World Agroforestry Centre, Bioversity International, and Silliman University, organised a conference in Pasay City, Philippines on February 2008. This conference aimed at establishing the link between climate change and biodiversity in the context of agriculture and food security. The conference informed us on how different countries have adopted and mitigated

the effects of climate change, and how parallel efforts on biodiversity conservation play an important role in this whole effort.

As a regional center for agricultural and rural development, SEARCA is keenly interested in knowing how Southeast Asian countries, particularly their rural communities, are coping with the effects of climate change. Such information will help SEARCA to be of better service to the region, particularly its agriculture sector.

SEARCA's foremost concern is that vulnerability to climate change is unequally distributed. The Human Development Report (2007/2008) indicates that it is "the poor who bear the brunt of climate change."

In developing countries, high levels of poverty and low levels of human development limit the capacity of poor households, especially in the rural areas, to manage climate-related risks. With low incomes and meager assets, as well as limited access to formal insurance and safety nets, poor households have to deal with climate-related shocks under highly constrained conditions. The limited strategies for coping with such shocks reinforce deprivation.

To promote greater understanding of this multifaceted climate change-biodiversity-agricultural development nexus, we are pleased to present this book containing a number of papers presented at the abovementioned conference in the Philippines. It also includes papers contributed by well-recognised scientists and researchers. We hope that this book will become a useful and handy reference material for policy makers and students of development who seek to better understand the interrelated topic of biodiversity and climate change.

Lastly, we are grateful to our conference partners for their continued and unstinting cooperation in the production of this book. We also owe a lot of gratitude to the government of The Netherlands, which, through its Ministry of Development Cooperation (DGIS), worked with SEARCA for more than five years to implement the Biodiversity Research Programme (BRP) for Development in Mt. Malindang, Mindanao.

BRP showcased the *research-for-development* theme. The programme was implemented by Dutch and Filipino scientists/researchers who jointly conducted researches aimed at contributing to the biodiversity conservation efforts in Mt. Malindang. It has underscored the lesson that the problem of biodiversity conservation must not be taken in isolation from other emerging threats, such as climate change, as well as the overarching problems of poverty,

lack of technical and financial capacities, government policies and regulations, and many others. It is this rich experience in conducting BRP that gave SEARCA the impetus to convene the conference, which was likewise financially supported by the Dutch government.

Arsenio M. Balisacan
Director, SEARCA

Preface

Climate change is a global phenomenon that is manifested by significant changes in weather parameters. These changes are mainly due to human activities which significantly increased greenhouse gases (GHGs) in the atmosphere over many years.

Past and current trends of weather parameters were measured using 21 global climate models. These models were based on atmospheric science, chemistry, physics, biology, and at times astrology. They were run using past and present scenarios of GHG emissions.

Climate change is inevitable. It will continue to happen even if current emissions of GHGs are stopped. Some areas will become hotter and drier, while other areas will have more rains than usual. There are still changes happening in other places, even in Southeast Asia, but most of these are not documented properly.

Some of the predicted changes or manifestations of climate change are increased water availability in most tropics and high latitude areas, and decreased water availability and drought in mid- and low-latitude areas. Global temperatures are likely to increase by 1.1-6.4 ^{o}C from 1990 to 2100, with best estimates of 1.8-5.4 ^{o}C. Sea level is expected to rise by 22-34 cm between 1990 and 2080. The most revealing demonstration of this effect is in the island atolls of the Pacific. Extreme events will likely manifest such as tropical cyclones, typhoons, and hurricanes, with larger peak wind speeds and heavier precipitation.

THE CONCERN FOR CLIMATE CHANGE

Climate change is considered a major constraint in the attainment of the Millennium Development Goals (MDGs) especially if the global community is not prepared for it. Climate change will increase the existing risks and vulnerability of people and ecosystems. The most vulnerable sector will be the

least developed countries in the tropics and sub-tropics, especially the impoverished communities.

The 2007 report of the Intergovernmental Panel on Climate Change (IPCC) indicated evidences that show the decline of mountain glaciers and snow cover in both hemispheres. This decline is contributing to the rise in sea levels, especially in the Pacific island atolls and other coastal areas of small islands. Sea levels rose at an average of 1.8 mm per year from 1961 to 2003. Long-term precipitation trends from 1900 to 2005 also indicated significant increases in the eastern parts of North and South America, Northern Europe, and Northern and Central Asia.

The projected impact on agriculture will vary over time and across locations. For example, climate change is predicted to cause shifts in areas that are suitable for the cultivation of many crops, i.e., Northern USA, Canada and most of Europe will have more areas for crop cultivation. On the other hand, Sub-Saharan Africa and the Caribbean will lose lands suitable for cultivating crops.

Countries that will have the least capacity to cope with these drastic changes in the ability to grow food and generate other food needs will suffer most from climate change. There will be significant losses of genetic resources in several regions, especially for less mobile and tolerant animals, plants, and aquatic species. In other words, climate change will have losers and gainers at the local, regional, and global scales.

By using models, it is projected that 23 crops will likely suffer from the significant decreases in the suitable areas for growth, e.g. typical cold weather crops such as strawberry, wheat, rye, apple, and oats. However, 20 crops will gain more favorable areas for growth, e.g. pearl millet, sunflower, common millet, chickpea, and soya bean. Many of the gains in crop cultivation areas will occur in regions where these crops are currently not integral components of food security. This would mean significant changes in the exchange of germplasm. These changes need to take place for the crops to cope with climate change. In addition, these changes will create consequent modifications in the food preferences of consumers.

The other significant implication of these projected changes that are associated with climate change is the need to broaden the food base, which is very narrow at present. To attain this goal, there is a need to bring in more of the currently underutilised food species into the global food security basket. This means more intensified collection, characterization, conservation, and

utilization of these neglected species, i.e. plants, animals, fishes, arthropods and other useful biological materials. There is also the need to document all indigenous knowledge systems associated with the underutilized food crops and their uses. Documentation should likewise cover local knowledge, social networking schemes, and institutional arrangements being used by local communities to cope and mitigate risks that are associated with climate change.

Lovell et al. (2008) strongly suggests that governments should not only proactively invest in producing new and climate-buffered crops, especially for countries in regions that are projected to have the greatest impact on food security due to climate change, e.g. wheat for South Asia, rice for Southeast Asia, and maize for South Africa. These efforts should be complemented by investments to secure water which is projected to become erratic in terms of supply. These tasks are urgent for the global community and it is a race against time! The climate change phenomenon will force humanity to think and take care of the global environment whilst not forgetting that the ultimate challenge will be how to adjust and act locally but also collectively at the national, regional, and global scales.

THE CLIMATE CHANGE AND BIODIVERSITY LINK

Climate change will have great impacts on biodiversity in terms of reduction and loss. On the other hand, biodiversity can be used to enhance the mitigation and adaptation of people and environments to climate change.

Biodiversity have provisioning, regulating, supporting, and cultural functions. Hence, the kind of biodiversity to must be promoted should be designed to minimize the negative impacts of climate change on any or a combination of these impaired functions, while considering time and spatial scales. Such type and kind of biodiversity that should be part of a technology or process that reduces resource inputs and emission per unit of output.

Meanwhile, when used to enhance adaptation, the type and kind of biodiversity to be deployed should consider human and institutional arrangements, including the knowledge systems associated with it. These support mechanisms would moderate or harness beneficial opportunities in response to the actual or expected risks involved in climate change.

Several countries in Southeast Asia are considered megabiodiversity centers as well as biodiversity hotspots. Hence, the pressures on resource use

would further exacerbate the impact of climate change and the inherent vulnerability of the coastal zones and small islands in the archipelagic countries in the region. Moreover, the projected intensification of typhoons and other extreme weather conditions will affect the coastal zones and human communities dependent on them, including the countries connected by major river systems, e.g. the Mekong and Irrawady river systems. These high-risk areas must be identified. National strategies must be developed for these areas to cope with the predicted impacts of climate change.

Meanwhile, biodiversity that is needed for food and nutritional security, as well as in promoting ecosystem functions, must be collected, characterised, evaluated, and sustainably used and deployed. National, regional, and global platforms for promoting exchanges of these valuable germplasms, based on accepted access and benefit-sharing arrangements, must be promoted and supported. The relationships of poverty, economic growth, and access and benefit-sharing regimes of these valuable biodiversity must be studied and well understood. These relationships must be provided with the policy and institutional environments which will promote the synergy needed towards enhancing mitigation and adaptation to climate change, while taking into account the high-risk areas and the most vulnerable segment of human society.

THE BOOK'S RELEVANCE

This book is a discourse on the general phenomenon of climate change, the importance of biodiversity, and how these two are linked and related.

Chapter 1 generally describes the climate change phenomenon, how the prediction of weather changes was obtained, the role of biodiversity in climate change mitigation and adaptation, and the need for partnership and collaboration.

Chapters 2, 3 and 4 elucidate on the regional perspectives and cross-cutting issues of climate change and biodiversity. The chapters cite the multifunctional role of ecosystems, with both natural and modified biodiversities, and how climate change has affected this role. They also discuss the role of biodiversity and ecosystems in mitigating and enhancing adaptation to climate change. The concept of *sustainagility* as a complement to sustainability is also introduced in these chapters. *Sustainagility* is defined as the ability of the system to support future changes.

Chapters 5 to 10 are country papers from Cambodia, Malaysia, Singapore, Philippines, Thailand, and Vietnam. These papers describe the various monitored weather parameters that are associated with climate change over a long period of time, the predicted changes in various parts of the countries, and the national strategies that are being formulated and implemented to mitigate and adapt to climate change.

Chapters 8 and 9, papers from the Philippines and Thailand, describe the kind of research that are presently being undertaken to provide the information needed to formulate a national program and serve as basis for best practices in climate change mitigation and adaptation.

Chapter 11 is a specific research on biodiversity which is directly linked to development. The approach and methods used to bring this about is described and related to development issues including climate change.

Chapter 12 is a synthesis of lessons learned and research gaps. This information can serve as inputs in determining the national and regional priorities for research – i.e. the geographical and social sectors that are most vulnerable to climate change, the areas in Southeast Asia that need more attention because of climate change, and many more.

This book is particularly useful for policy makers, scientists, researchers, academicians, students and people who are at the forefront of climate change mitigation and adaptation, and biodiversity conservation. Information is relevant not only in identifying future research areas and setting the policy agenda, but more importantly in implementing critical actions at all levels. All these are required for people, communities, governments, and sectors to move forward in terms of becoming more aware, informed, prepared, and proactive in strengthening the link between climate change mitigation and adaptation and biodiversity conservation.

Percy E. Sajise
Senior Fellow, SEARCA and
Honorary Research Fellow, Bioversity International

Contributors

DR. AMNAT CHIDTHAISONG is an Assistant Professor at the Joint Graduate School of Energy and Environment (JGSEE), King's Mongkut University of Technology Thonburi, an international graduate education and research consortium of five institutions in Thailand. Dr. Amnat holds a PhD degree in Applied Bioscience and Biotechnology from Mie University in Japan. His post-doctoral researches were on microbial ecology at the Max-Planck Institute for Microbial Ecology in Germany, and stable isotope biogeochemistry at the University of California in Irvine, USA. His research fields include carbon cycle greenhouse gas biogeochemistry, and climate change.

DR. CHOU LOKE MING is a Professor at the Department of Biological Sciences, National University of Singapore (NUS). He is a coral reef biologist and has focused more on coastal management and reef restoration. He has also been involved with many regional initiatives dealing with the marine environment, including consultancy services to international and regional agencies, such as the United Nations Environment Program-Coordinating Body on the Seas of East Asia (UNEP-COBSEA). Dr. Chou is a member of the Scientific Advisory Committee of the Global Coral Reef Monitoring Network of the International Coral Reef Initiative since it was formed in 1996. He served as Chairman of the network from 2003 to 2005.

PROF. DATUK DR. MOHD. NOH DALIMIN is a Professor at the Institute for Tropical Biology and Conservation, School of Science and Technology, Universiti Malaysia Sabah (UMS), Malaysia. Prof. Noh specialises in Solid State Physics and Renewable Energy (Photovoltaic Systems), and his current research focuses on conservation and global climatic changes in relation to the use of renewable energy in tropical ecosystems. Prof. Noh obtained his Master of Science degree from Bedford College, University of London, and his PhD degree from Imperial College, University of London**.** Prof. Datuk Dr. Mohd. Noh Dalimin served as Vice-Chancellor of UMS from March 2005 to June 2008.

DR. AHMED DJOGHLAF is the Executive Secretary of the UN Convention on Biological Diversity based in Montreal, Canada. He holds the rank of Minister Plenipotentiary of the Ministry of Foreign Affairs of Algeria, and Assistant Secretary General of the United Nations. Dr. Djoghlaf served as General Rapporteur of the Preparatory Committee of the UN Conference on Environment and Development (UNCED), better known as the Rio Summit, as former Vice-Chair of the Eleventh Session of the Intergovernmental Committee on Science and Technology for Development, as Vice-President of the Negotiating Committee on the Framework Convention on Climate Change, and Chair of one of two negotiating committees of the Convention to Combat Desertification. Dr. Djoghlaf holds a PhD degree from the University of Nancy, France, as well as four other post-graduate degrees, including Master of Arts in Government and Politics from St. John's University, New York and a Law Degree from the University of Algiers.

MR. RODRIGO U. FUENTES is the current Executive Director of the ASEAN Centre for Biodiversity (ACB) based in Los Baños, Laguna, Philippines. Mr. Fuentes has been working in the field of environment and natural resources for the last 26 years, as consultant and/technical advisor to different intergovernmental and multi-lateral organizations such as the ASEAN, the Asian Development Bank, the United Nations agencies, and the World Bank. Mr. Fuentes holds a Forestry degree and a Masteral degree in Urban and Regional Planning which were both obtained from the University of the Philippines. He specialises in environmental program design and project development, policy and institutional assessment, environmental monitoring, and capacity development. His previous undertakings at the regional and subregional levels included the provision of assistance to governments in complying with the commitments to global agreements, such as the implementation of Agenda 21, the UN Framework Convention for Climate Change (UNFCCC), and the UN Convention on Biological Diversity. He is also credited for developing the Regional Framework program for implementing the UN Convention to Combat Desertification (UNCCD) and the Regional Action programmes for the Asian region.

DR. DELFIN J. GANAPIN, JR. is a forest ecologist trained at the College of Forestry, University of the Philippines Los Baños (UPLB). He obtained his PhD degree in Environmental Planning and Policy from the State University of New York and Syracuse University in 1987 as a United Nations University and Ford Foundation fellow. He served the Philippine government as the Director of the Environmental Management Bureau of the Department of Environment and Natural Resources (DENR), and then as Assistant Secretary and concurrent OIC-Undersecretary for Environment and Research of the Department. He later served as Undersecretary for Environment and Program Development. Dr. Ganapin was involved in the negotiations for biodiversity and climate change conventions. He was also the leading senior Philippine environment official to the Earth Summit and succeeding UN Conventions for Sustainable Development. Dr. Ganapin is currently the Global Coordinator of the UN Global Environment Facility (GEF) Small Grants Programme (SGP) based in New York City, USA.

DR. RODEL D. LASCO is the Philippine Country Coordinator of the World Agroforestry Centre (formerly the International Centre for Research in Agroforestry or ICRAF), and a Professor of the School of Environment and Management of the University of the Philippines Los Baños (UPLB). He is a Convening Lead Author of Working Group II of the Intergovernmental Panel on Climate Change (IPCC). He holds a PhD degree in Forestry from UPLB, with specialisation on Silviculture and Forest Influences. In 1998, he pioneered forest and climate change researches in the Philippines.

MS. ALONA CUEVAS LINATOC is a PhD Candidate and a researcher at the Institute for Tropical Biology and Conservation at Universiti Malaysia Sabah, Malaysia. She holds a Master of Science degree in Forest Botany from Universiti Putra Malaysia. Her current research focuses on the biogenic volatile organic compounds emission in Malaysian landscapes and its implications to the global carbon cycle. Prior to her work in Malaysia, Ms. Linatoc was a Science Research Specialist/Ecosystem Management Specialist at the ASEAN Regional Centre for Biodiversity Conservation (ARCBC), and a Forester in the Laguna Community Environment and Natural Resources Office (CENRO) of the Philippine Department of Environment and Natural Resources (DENR). She is a co-author of Climate Change and the Energy Challenge (2008).

MS. CAO THI PHUONG LY is a Researcher at the Center for Environment Research, Education and Development (CERED) in Hanoi, Vietnam. She obtained a Master of Science degree in Environmental Sciences from the Vietnam National University, and is currently involved in climate change adaptation projects that are related to policy linkages and poverty reduction in two provinces in Vietnam. Her other research interest is on the economic valuation of coastal habitats. She has co-authored "A Survey on the Resource Use and Economic Valuation of the Coral Reefs and Sea Grass Beds of Phu Quoc, Vietnam."

PROF. DATIN DR. MARYATI MOHAMED is the Dean of the Centre for Postgraduate Studies, Universiti Malaysia Sabah. Prof. Maryati obtained her Bachelor of Science degree in Biology from Universitas Gadjah Mada, Indonesia and a PhD degree in Insect (Aphid) Taxonomy and Ecology at the Queen Elizabeth College, University of London. Her current research interests are on the ant-insect group, covering the conservation, traditional knowledge, and ethics aspects. Prof. Maryati is a founding member of BioNET International, based in the UK, and was a member of DIVERSITAS (Montreal). She pioneered the Bornean Biodiversity and Ecosystem Conservation (BBEC) Programme, and was the Founding Director of the Institute for Tropical Biology and Conservation (ITBC), Universiti Malaysia Sabah from June 1996 to May 2008.

DR. NGUYEN HUU NINH is the Chairman of the Center for Environment Research, Education and Development (CERED) in Hanoi, Vietnam, a Senior Lecturer of the Vietnam National University, and also the Coordinator of the Indochina Climate Change Network. He holds a PhD degree in Biology from the Hungarian Academy of Sciences, and is a recipient of different international and national awards, including an Honorary Doctor of Science from the University of East Anglia in Norwich, United Kingdom, and the Campaign Medal for Achievement in Education Development from the Vietnam National University. He is the Lead Author Member of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, which was a recipient of the 2007 Nobel Peace Prize. An author and co-author of various local and international reports and publications, Dr. Huu Ninh has a wide variety of professional experiences related to climate change, especially with UN organizations.

MR. BUNTHAN NGO is the Vice-Rector of the Royal University of Agriculture (RUA) for Academic Affairs and International Cooperation. Mr. Ngo obtained his degree in Agricultural Engineering from the Asian Institute of Technology (AIT) in Thailand. He is actively involved in the modernization of the agricultural curricula of RUA. Through his efforts, numerous international cooperation activities have been established with the University, which provided opportunities to lecturers and researchers to study contemporary issues in agriculture.

DR. MEINE VAN NOORDWIJK is an ecologist trained at Utrecht and Wageningen, The Netherlands. He has worked in Southeast Asia since 1993 and is the Regional Coordinator of the Southeast Asian Programme of the World Agroforestry Centre based in Bogor, Indonesia. His work on biodiversity, watersheds, and carbon provides links between the biophysical environment with the policy domains.

DR. FLORENCIA B. PULHIN is a Researcher at the Forestry Development Center, Environmental Forestry Programme of the University of the Philippines Los Baños College of Forestry and Natural Resources (UPLB-CFNR). She holds a PhD degree in Forestry from UPLB. Her research involvements for the last 10 years focused on tropical forests and climate change.

DR. GIL C. SAGUIGUIT, JR. is the Deputy Director responsible for the administration and financial management of SEARCA. He holds a degree in Rural Economics from the Universite de Montpellier I France. His fields of interest, expertise, and experiences include project management and implementation, rural development and extension, participatory and community-based approaches, and multidisciplinary research. Dr. Saguiguit also served as SEARCA's Research and Development (R&D) Manager, before he assumed the position of Deputy Director. Dr. Saguiguit has written and co-authored a number of publications on community-based natural resource management, North-south collaborative research, and agriculture and rural development.

DR. PERCY E. SAJISE is now a Senior Fellow at SEARCA, while at the same time serving as an Honorary Research Fellow of Bioversity International and Adjunct Professor at the School of Environmental Science and Management of the University of the Philippines Los Baños. Trained as a plant ecologist at

Cornell University, he has more than 25 years of experience as a scientist who specializes in interdisciplinary work on natural resource management and ecological studies in the uplands of Southeast and South Asia. He spearheaded several regional networks such as the Southeast Asian Universities Agroecosystem Network (SUAN), Asian Association of Agricultural Colleges and Universities (AAACU) and a national network on Environmental Education in the Philippines (EENP). He has been a member of the Executive Committee of the Asia Pacific Association of Forest Research Institutions (APAFRI), and a Board Member of the World Center on Forestry (CIFOR). He was the former Director of SEARCA and the Regional Director for Asia and the Pacific of Bioversity International (formerly the International Plant Genetic Resources Institute). He is a member of the World Academy of Arts and Science.

DR. VATHANA SANN is concurrently the Deputy Secretary General of the Council for Agricultural and Rural Development (CARD), Council of the Ministers of Russian Federation, and the Coordinator of the Master of Science Program at the Royal University of Agriculture (RUA) in Cambodia. He obtained his PhD degree in International Agriculture, specializing in Animal Science, from Georg-August University of Goettingen in Germany in 2006. As a lecturer and a researcher in the field of livestock production system, Dr. Vathana Sann's main research interest is on animal genetic conservation and tropical animal welfare. He has published three papers on the characterization of poultry genetic resources in Cambodia, and has caught the attention of the research community because of his researches on the contribution of the livestock sector on greenhouse gas emission and its impacts on climate change.

DR. MARILIZA V. TICSAY is a plant-wildlife ecologist trained at the University of the Philippines Los Baños. For more than 15 years, she had served as Manager for a number of foreign-funded environmental projects in the Philippines, including The Conditions of Biodiversity Maintenance in Asia Project, the Environmental and Security Management Programme (ESMP), The Institutional Context of Biodiversity Conservation in Southeast Asia Project, and the Biodiversity Research Programme (BRP0 for Development in Mindanao. She currently works as the Knowledge Management Specialist at ACB, and a Technical Consultant for Programme Development and Implementation at SEARCA, and ACB.

DR. DAVID E. THOMAS is currently a consultant and Country Coordinator for the World Agroforestry Centre, based in Chiang Mai, Thailand. He has a PhD degree on Wildland Resource Science from the University of California, Berkeley, as well as a Masters degree in Pomology, and Bachelor degrees in political science, and soil science and plant nutrition. He has been living in Southeast Asia and working on natural resource management, agriculture, and rural development issues for more than 30 years. He has actively supported the development of MMSEA concepts and the implementation of collaborative research during his 12 years of service as Senior Policy Analyst for the World Agroforestry Centre, and from previous work with the Ford Foundation, the East-West Center, and other organizations. Recent MMSEA research projects, in which he has collaborated in, have been supported by the US National Science Foundation, the Rockefeller Foundation, and various other donors.

MS. LE THI THUYET is a Researcher at the Climate Change Section of CERED in Hanoi, Vietnam. Ms. Thi Thuyet obtained her Bachelor of Science degree in Geology from the Hanoi University of Science in 2007. She is currently working at the Integrated Water Resource Management Project in Nam Dinh, Vietnam.

DR. WILFREDO H. UY obtained his Master of Science degree in Marine Science from the University of the Philippines Diliman, and his PhD degree in Aquatic Ecology at IHE-Delft and Wageningen University in The Netherlands. Dr. Uy is involved in several research programs in Mindanao, southern Philippines. These include the Marine Protected Area (MPA) Networking and Integrating Fisheries Management Initiatives in Zamboanga del Sur – Iliana Bay, and the Fisheries Assessment for Sustainable Management in Lake Mainit, Surigao del Norte. He was also the Study Leader of the Coastal Component of the Biodiversity Research Programme (BRP) for Mt. Malindang, Misamis Occidental, Mindanao, Philippines.

DR. JIAN CHU XU is an ethno-ecologist by training. He has more than 20 years of extensive field experience in mainland Southeast Asia, South Asia and Southwest China. He is a Senior Scientist and the Country Representative of the World Agroforestry Centre, China Program, Beijing, as well as a Professor at the Kunming Institute of Botany, Chinese Academy of Science. He worked as a Program Manager at the International Centre for Integrated Mountain Development (ICIMOD) in Nepal. He was also the Director of the Center for Biodiversity and Indigenous

Knowledge, an NGO, based in Southwest China, that works with indigenous people for cultural survival, forest management, land-use transition, community livelihood, and watershed governance. He also served as a member of the Board of Trustees of the Regional Community Forestry Training Center for Asia and the Pacific, and the scientific steering committee of the Land-Use and Land-Cover Change, International Geosphere-Biosphere Program and International Human Dimension Program of Global Change Program (LUCC-IGBP/IHDP).

Acronyms

A&D	- alienable and disposable
A/R CDM	- Afforestation/Reforestation Clean Development Mechanism
AAACU	- Asian Association of Agricultural Colleges and Universities
ACB	- ASEAN Centre for Biodiversity
ADB	- Asian Development Bank
AGR	- animal genetic resource
AIT	- Asian Institute of Technology
AMP	- Aquatic Ecosystems Master Project
AMS	- ASEAN Member States
APN	- Asia-Pacific Network on Climate Study
AR4	- Fourth Assessment Report
ARCBC	- ASEAN Regional Center for Biodiversity Conservation
ASEAN	- Association of Southeast Asian Nations
B	- billion
BBEC	- Bornean Biodiversity and Ecosystem Cooperation
BITEC	- National Center for Genetic Engineering and Biotechnology
BRP	- Philippine-Netherlands Biodiversity Research Programme (BRP) for Development in Mindanao: Focus on Mt. Malindang and its Environs
BVOCS	- Biogenic Volatile Organic Compounds
CARD	- Council for Agricultural and Rural Development
CBD	- Convention on Biological Diversity
CBFM	- community-based forest management
CCB	- climate, community and biodiversity
CCC	- Canadian Climate Center
CCEAP	- Climate Change Enabling Activity Project
CDM	- Clean Development Mechanism

CENRO	- Community Environment and Natural Resources Office
CERED	- Center for Environment Research, Education and Development
CGIAR	- Consultative Group on International Agricultural Research
CH_4	- methane
CI	- Conservation International
CIFOR	- Wolrd Center on Forestry
CNRCC	- China National Report on Climate Change
CO_2	- carbon dioxide
COP	- Conference of Parties
CRED	- creditable reductions of emission for deforestation
CTI	- Coral Triangle Initiative
DAO	- DENR Administrative Order
DENR	- Department of Environment and Natural Resources
DGIS	- Netherlands Ministry of Development Cooperation
DOST	- Department of Science and Technology
EENP	- Environmental Education in the Philippines
EFP	- ecological footprint
EIA	- environmental impact assessment
ENRTP	- Environment and Sustainable Management of Natural Resources Programme
ENSO	- El Niño Southern Oscillation
EO	- Executive Order
ESMP	- Environmental and Security Management Programme
ET	- Emission Trading
EU	- European Union
FAO	- Food and Agriculture Organization of the United Nations
GCMs	- General Circulation Models
GDP	- gross domestic product
GEF	- Global Environment Facility
GHG/s	- greenhouse gas/gasses
GIS	- Geographic Information Systems
GLOF/s	- glacial lake outburst floods
GTZ	- Deutsche Gesellschaft für Technishe Zusammenarbeit
GWP	- Global Warming Potential

ha	- hectares
HDI	- human development index
ICIMOD	- International Centre for Integrated Mountain Development
ICRAF	- World Agroforestry Centre (formerly the International Centre for Research in Agroforestry)
ICRAN	- International Coral Reef Action Network
ICZM	- Integrated Coastal Zone Management
IEC	- information, education and communication
IKS	- indigenous knowledge systems
IMAGE	- Integrated Model to Assess the Greenhouse Effect
INFAPRO	- Innoprise-Face Foundation Rainforest Rehabilitation Project
IOD	- Indian Ocean Dipole
IPCC	- Intergovernmental Panel on Climate Change
IPGRI	- International Plant Genetic Resources Institute (now Bioversity International)
IPR	- intellectual property rights
ITBC	- Institute for Tropical Biology and Conservation
ITPGRFA	- International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	- International Union for the Conservation of Nature
JGSEE	- Joint Graduate School of Energy and the Environment
JI	- Joint Implementation
JICA	- Japan International Cooperation Agency
JLG	- Joint Liaison Group
kph	- kilometers per hour
LGUs	- local government units
LTER	- Long-term Ecological Research
LUCC-IGBP/IHDP	- Land-Use and Land Cover Change – International Geosphere-Biosphere Program and International Human Dimension Program of Global Change Program
LUCF	- land-use change and forestry
LWG	- live weight gain

m	- meters
M	- million
MAP M&E	- Marine Protected Areas Monitoring and Evaluation
MAPSS	- Mapped Atmosphere-Plant-Soil System
MB	- microbial biomass
MDGs	- Millennium Development Goals
MEA	- Millennium Ecosystems Assessment
MinCBio	- Mindanao Consortium for Biodiversity
MMSEA	- Montane Mainland Southeast Asia
MONRE	- Ministry of Natural Resources and Environment
MOSTE	- Ministry of Science, Technology and the Environment
MPA	- Marine Protected Area
MSN	- MPA Support Network
MSU	- Mindanao State University
NCC	- National Climate Center
NCCDM	- National Committee on CDM
NCMS	- National Committee for the Marine Science
NCS	- National Conservation Strategy
NDCC	- National Disaster Coordinating Council
NERCCPB	- Natural Environment Research Council Centre for Population Biology
NFTP/s	- nitrogen-fixing tree product/s
NIPAS	- National Integrated Protected Areas System
NRCT	- National Research Council of Thailand
NSCC	- National Steering Committee on Climate Change
NSO	- National Statistics Office
NTFPs	- non-forest timber products
NUS	- National University of Singapore
NVS	- natural vegetative strips
O_3	- tropospheric ozone
OECD	- Organization for Economic Cooperation and Development
ONEP	- Office of Natural Resources and Environmental Planning
PAGASA	- Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAMS	- Philippine Association of Marine Scientists

PAR	- Philippine Area of Responsibility
PCMARRD	- Philippine Council for Marine and Aquatic Resources Research and Development
PCW	- Pantabangan-Carranglan Watershed
PD	- Presidential Decree
PES	- Payments for Environmental Services
PRA	- Participatory (Rapid) Rural Appraisal
R&D	- research and development
RA	- Republic Act
RAF	- relative agriculture function
RAWOO	- Netherlands Development Research Advisory Council
REDD	- reducing emissions from deforestation and degradation
RED-DC	- reducing emissions from deforestation in developing countries
REF	- relative ecological function
RIL	- Reduced Impact Logging
RUA	- Royal University of Agriculture
SCFA	- short-chain fatty acids
SEA	- Southeast Asia
SEAMEO	- Southeast Asian Ministers of Education Organization
SEARCA	- Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SEC	- Socioeconomic and Cultural Studies
SGP	- Small Grants Programme
SGP PTF	- UNDP Small Grants Program for Tropical Forests for South and Southeast Asia
SKU	- shop keeping unit
SST	- sea surface temperatures
START	- Southeast Asia Regional Vulnerability to Changing Water Resource and Extreme Hydrological Events Due to Climate Change
SU	- Silliman University
SUAN	- Southeast Asian University Agroecosystem Network
TEMP	- Terrestrial Ecosystems Master Project
TLA	- Timber License Agreement
TNA	- Training Needs Assessment
TRF	- Thailand Research Fund

UK	- United Kingdom
UN	- United Nations
UN FAO	- United Nations Food and Agriculture Organization
UNCCC	- United Nations Convention on Climate Change
UNCCD	- United Nations Convention to Combat Desertification
UNCED	- United Nations Conference on Environment and Development
UNDP	- United Nations Development Programme
UNEP	- United Nations Environment Programme
UNEP-COBSEA	- United Nations Environment Program-Coordinating Body on the Seas of Southeast Asia
UNESCAP	- United Nations Economic and Social Commission for Asia and the Pacific
UNFCC	- United Nations Framework on Climate Change
USA	- United State of America
USAID	- United States Agency for International Development
USD	- US dollars
VOCs	- volatile organic compounds
WHO	- World Health Organization