ISBN 978-9962-614-22-7

Mainstreaming Native Species-Based Forest Restoration

July 15-16, 2010
Philippines

Sponsored by
the Environmental Leadership & Training Initiative (ELTI), the Rain Forest Restoration Initiative (RFRI), and the Institute of Biology, University of the Philippines (UP) Diliman

Conference Proceedings

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This is a publication of the Environmental Leadership & Training Initiative (ELTI), a joint program of the Yale School of Forestry & Environmental Studies (F&ES) and the Smithsonian Tropical Research Institute (STRI).

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ELTI-Asia Photo Collection

Suggested citation:

Neidel, J.D., Consunji, H., Labozetta, J., Calle, A. and J. Mateo-Vega, eds. 2012. *Mainstreaming Native Species-Based Forest Restoration.* ELTI Conference Proceedings. New Haven, CT: Yale University; Panama City: Smithsonian Tropical Research Institute.

ISBN 978-9962-614-22-7

Acknowledgements

ELTI recognizes the generosity of the Arcadia Fund, whose funding supports ELTI and helped make this event possible. Additional funding was provided by the Philippine Tropical Forest Conservation Foundation.

List of Acronyms

ANR	Assisted Natural Regeneration
Atty.	Attorney
CBFM	Community-Based Forest Management
CDM	Clean Development Mechanism
CI	Conservation International
CO_2	Carbon Dioxide
DENR	Department of Environment & Natural Resources
FAO	United Nations Food & Agriculture Organization
FMB	Forest Management Bureau
For.	Forester
ELTI	Environmental Leadership & Training Initiative
ha	Hectare(s)
Hon.	Honorable (used for any elected official)
ICRAF	World Agroforestry Centre
LGU	Local Government Unit
MKRNP	Mt. Kitanglad Range Natural Park
m	Meters
NGO	Non-Government Organization
NTFPs	Non-Timber Forest Products
PENRO	Provincial Environment & Natural Resources Office/r
PHP	Philippine Pesos
PO	People’s Organization
PRORENA	Native Species Reforestation Project, Panama (STRI)
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RFRI	Rain Forest Restoration Initiative
STRI	Smithsonian Tropical Research Institute
UP	University of the Philippines
USD	US Dollar
VSU	Visayas State University

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Executive Summary

The *Mainstreaming Native Species-based Forest Restoration* conference was held on July 15-16, 2010, at UP-Diliman. Opening remarks on the first day were provided by Dr. Edwino Fernando (UP-Los Baños), who highlighted the precipitous decline in forest cover in the Philippines over the last century. He also noted that reforestation has not kept up with the rate of deforestation and that most trees planted have been exotics, which fail to provide the whole array of ecosystem services rendered by natural forests. Dr. Fernando called for a national campaign to restore the Philippine forests using native species.

The keynote address was provided by Dr. Mark Ashton from the Yale School of Forestry and Environmental Studies. Dr. Ashton provided a framework through which to understand tropical forest's ecological patterns and processes as a way to think about the management steps needed to restore the forests. Following, Dr. Kazue Fujiwara of Yokohama University introduced the Miyawaki Method, which is a high-density, high-diversity approach to reforestation that has been applied in Japan, Malaysia, and numerous other locations internationally. Dr. Stephen Elliott of Chiang Mai University then presented a framework for understanding degradation based on three-site and three-landscape factors. He also introduced the Framework Species Method, a forest restoration strategy that relies on the planting of 20-30 species of trees as a way to jumpstart natural successional processes.

For the afternoon session, Dr. Paciencia Milan of VSU provided an introduction to Rainforestation, an approach to native species reforestation that was developed in the Philippines, and which seeks to achieve forest restoration for human livelihoods, biodiversity conservation and the provision of ecosystem services. Dr. Jefferson Hall of the STRI then discussed the native species reforestation program in Panama (PRORENA) and the Agua Salud Project, which aims to measure the ecosystem services of different land uses in the Panama Canal Watershed. Next, Dr. Billy Hau of Hong Kong University described the natural succession dynamics in the hilly regions of Hong Kong and his approach to using native species to reforest the area. Finally, Mr. Don Edralin from the World Agroforestry Centre-Philippines discussed research underway on the island of Mindanao to integrate native tree species into highland agroforestry systems.

These presentations were followed by a panel discussion exploring the relative advantages and disadvantages of using native tree species vs. exotics and comparing the different reforestation approaches on economic and ecological grounds. A synthesis of the first day was provided by Dr. Perry Ong (UP-Diliman), where he underlined the importance of changing mindsets, attitudes, and practices (MAPS) in order to achieve the goal of restoring forests.

The second day started with Opening Remarks by Dr. Rex Cruz (UP-Los Baños) who underlined the reasons that past forest restoration programs have not been successful in the Philippines, and what steps need to be taken to improve the outcome of present-day efforts. This was followed by five moderated panels, each focused on the role of one of the following major stakeholder groups to promote better forest restoration practices: RFRI, DENR, LGUs, local communities, and the private sector.

In the first panel, 'Moving Forward with the Rain Forest Restoration Initiative (RFRI)', Dr. David Neidel (ELTI) provided an introduction to RFRI, a network of organizations and institutions working together to promote the use of native species for forest restoration and other land management objectives in the Philippines. He also launched the Rainforestation Information Portal (www.rainforestation.ph), a clearinghouse of information for forest restoration practitioners and other interested stakeholders. Atty. Jose Canivel provided an introduction to the Philippine Tropical Forest Conservation Foundation and discussed the numerous projects that they have funded to promote Rainforestation as a forest restoration strategy. Ms Belinda de la Paz next introduced Haribon Foundation's ROAD to 2020 campaign to reforest one million hectares (ha) through Rain-

forestation. Mr. Villapando then described the Foundation for the Philippine Environment and their grant-giving strategy to promote Rainforestation in key biodiversity areas.

The second panel focused on 'Working with the DENR'. For. Marlo Mendoza, Director of the Forest Management Bureau (FMB) of DENR, gave an introduction to the regulations that apply to reforestation and the use of native species. For. Felix Mirasol then discussed his successful strategy for working with communities, LGUs, and the private sector to implement forest restoration strategies in the Mt. Kitanglad Range Natural Park, on the southern island of Mindanao. For. Mirza Samillano then discussed the history and current implementation of native species reforestation programs in the province of Antique on the island of Panay in the Visayas.

In the third panel, 'Working with LGUs', Mr. Adbula Bansuan discussed the efforts of the Allah Valley Landscape Development Alliance, a consortium of LGUs, government agencies, and NGOs to restore and manage the 252,000 ha Allah Valley watershed which has suffered from flooding, siltation, and riverbank migration on account of widespread deforestation in the uplands. The alliance is working with local communities to restore the uplands using planting schemes that integrate native species. Hon. Eufracio Maratas, Jr., discussed the Rainforestation program underway on the island of Pilar, Camotes, Cebu. Pilar has proven very innovative and successful in implementing their Rainforestation program and linking it to other environmental programs of the local government.

The fourth panel, 'Working with local communities', explored the important role that People's Organizations play in native species reforestation. The first presentation was provided by Mr. Apolinario Cario, who helped organize Pederasyon sa Nagkahlusang mga Mag-uuma nga Nanalipud ug Nagpasig-uli Kinalyahan Inc. & Mt. Talinis People's Organization Federation, Inc. These organizations have successfully established community nurseries and developed Rainforestation sites in the province of Negros Oriental. Mr. Renato Poliquit of the Cienda-San Vicente Farmers Association then described their adoption of Rainforestation in a Community-Based Forest Management (CBFM) area. Cienda is located very close to VSU and was one of the first communities to adopt the approach, which has provided them with numerous social and ecological benefits. The final presentation of this panel was provided by Mr. Dolphy Luib of the Ihawan Spring Stakeholders Association, which has been working with LGUs, the DENR, Tandag Watershed District, and Haribon Foundation to restore a degraded watershed area in Tandag, Surigao del Sur, on the island of Mindanao.

The final panel focused on ‘Working with the private sector’. Mr. Darwin Flores of SMART Communications, a large telecommunications company with over 5,000 employees, introduced their ongoing reforestation program in the Marikina Watershed and 25 other sites around the country. For. Estrella Pasion of CI-Philippines then discussed the development of reforestation projects which rely on financing though the voluntary carbon market. Finally, Mr. Carson Tan of Aquabest and the Water Quality Association of the Philippines provided insights into their company’s reforestation program, which is driven by the recognition that no trees means no water, which means no business.

The conference concluded with inspirational closing remarks by Dr. Nereus Acosta (Asian Institute of Management & Ateneo de Manila University). Dr. Acosta suggested that forest restoration was a very important objective that needs to combine information, involvement, and institutions. He linked many of the failings of the past to the institutional weaknesses of the DENR and hoped that the new political climate following the election of the new president would lead to a more concerted focus on holistic and effective forest restoration in the near future.

Preface

Rainforests have been decimated throughout much of the tropics. Driven by land use policies that favor extractive activities —such as timber, mining, and conversion to agriculture— deforestation and forest degradation have resulted in widespread loss of ecosystem services, including biodiversity maintenance, carbon sequestration, watershed protection, and the provision of forest products to local communities. In some locations, this land use change has also intensified a variety of "natural disasters," including flash floods, water shortages, and landslides, which have major human and economic consequences.

In order to re-establish forest cover and restore the ecosystem services that forests provide, many countries have embarked on large-scale reforestation projects. These reforestation efforts are typically

characterized by the use of a small number of fast-growing, non-native, timber species. Reforestation efforts in the Philippines, for example, are dominated by exotics such as *Gmelina arborea, Albizia falcataria, Acacia mangium, Swietenia macrophylla*, and several *Eucalyptus* species. This use of exotic timber species is driven by the need to generate an economic return on the investment, as well as by a general lack of knowledge about how to cultivate native trees.

A problem with these reforestation efforts, however, is that the exotic trees are often not particularly well-suited to the ecosystem where they are planted, being prone to disease outbreaks and more susceptible to extreme weather events. They also have limited value in terms of biodiversity maintenance and watershed restoration. In response, researchers and conservation organizations have conducted widespread ecological studies on native trees in the tropics, and have been experimenting with the use of these trees for reforestation efforts. Projects of this nature have been established in a range of tropical countries.

The Philippines is one of the countries where pioneering efforts into native species reforestation have been undertaken. Starting in the early 1990s, VSU, together with the German Agency for Technical Cooperation (GIZ), launched "Rainforestation Farming," an agroforestry system that uses native species to rehabilitate degraded land, restore ecosystem services, and generate income for rural communities. Since then, other approaches, known simply as "Rainforestation", have also been developed to rehabilitate lands, including landslide areas, critical watersheds, and denuded portions of protected areas where income generation plays a less important role. Subject to extensive research and experimentation, "Rainforestation" has been refined into a very cost-effective and widely applicable method for reforestation.

While the DENR has endorsed Rainforestation as an official reforestation strategy, implementation of this approach at the provincial level has been limited. Moreover, reforestation with exotics

remains the main school of thought in many of the country's universities. One of the biggest obstacles is the persistent belief that cultivating native species is particularly difficult, which is 'conventional wisdom' that has been challenged and refuted by demonstration plots that have been developed throughout the Philippines. Rainforestation also remains largely unknown to the international scientific community, limiting the possibility for the establishment of cooperative efforts among similar projects that could benefit from each other's expertise and experience.

In order to help address this situation, ELTI in collaboration with other members of RFRI and Institute of Biology, UP-Diliman organized this conference to examine native species reforestation efforts in the Philippines and abroad.

The objectives of the conference were to:

- Increase awareness and build support for native species reforestation in the Philippines;
- Introduce Rainforestation to international researchers and expose Rainforestation advocates to similar efforts that are underway in other parts of the world, so as to facilitate the sharing of scientific data and project management insights; and
- Serve as a forum to strengthen the network of Rainforestation researchers, advocates, and project implementers in the Philippines.

The conference was held over two days at the UP-Diliman campus, with satellite meetings using internet-based simulcasts at UP-Visayas-Cebu in Cebu City and UP-Mindanao in Davao City, thus providing coverage to the three major administrative regions of the country. The first day consisted of a series of presentations about international native species reforestation programs, while the second day consisted of five panels, each focused on working with one of the following stakeholders: RFRI, DENR, LGUs, local communities, and the private sector.

Day 1

Opening Remarks

Dr. Edwino Fernando

Professor,
UP- Los Baños

Dr. Edwino Fernando provided an introduction to the rainforests of the Philippines, which were once some of the richest, most diverse and grandest in the world. Widespread deforestation and forest degradation over the last 100 years, however, have radically altered the country's landscape. Today, the Philippines forests are heavily depleted with the remaining areas being considered of the highest priority for global biodiversity conservation.

Deforestation in the Philippines has a long history dating back to the 16th century when the ruling Spanish colonial forces felled timber for houses, shipbuilding and agriculture. This continued into the 20th century under both Spanish and American colonization, but was dramatically increased with the beginning of mechanized logging in the early 20th century. By the end of World War II the rate of deforestation had reached an average of 221,000 ha per year. Deforestation was highest between 1976 and 1980, when 300,000 ha were lost annually. At roughly the same time, reforestation levels were only about 40,000 ha per year. Between 2000-2005, the deforestation rate remained at over 150,000 ha per year, while only 21,000 ha were reforested each year. Due to the failure of reforestation efforts to keep up with the deforestation rate, forest cover has fallen from a high of 70% in 1876 to a low of less than 20% in 2003, and has only begun to increase over the last decade, in part due to a change in the definition of what constitutes a forest.

Today, only Singapore among the countries of Southeast Asia has a lower percentage of forest cover than the Philippines, where less than 20% of total land area is forested. Relative to its population, the Philippines and Vietnam have the lowest forest cover in the region with only 0.1ha of forest per capita. With the population of the Philippines projected to reach 100 million in the next five years, pressure on the remaining forests will only increase.

Data from the DENR and United Nations Food & Agriculture Organization (FAO) do not indicate what types of trees were planted through reforestation efforts. Based on personal observation, however, it is clear that most reforestation efforts have primarily utilized exotic tree species that are well known for their timber, including mahogany (*Swietenia macrophylla*), *Gmelina*, and *Eucalyptus* species, rather than native tree species that are best adapted to the site conditions of the region.

As an alternative, Dr. Fernando called for a vigorous program to bring about the rebirth of the Philippine rainforests, using native species in order to protect watersheds and freshwater resources, recover and expand forest habitat for threatened plant and animal species, connect forest fragments to link protected areas and natural forests, help mitigate the impacts of climate change, and secure the livelihoods of local people. Many timber species native to the Philippines have higher wood quality, provide a larger range of ecological services, and support wildlife, yet they have not been propagated on a wide-scale. Moreover, experimental efforts have already shown that reforestation with native species is completely feasible, as case studies presented in this conference will show.

Dr. Fernando ended with a quote from Professor E. O. Wilson (The Diversity of Life, 1992): "There can be no purpose more enspiriting than to begin the age of restoration, reweaving the wondrous diversity of life that still surrounds us."

KEYNOTE ADDRESS

The Principles and Techniques for Understanding Degradation and Restoration of Tropical Rainforests, with Special Reference to the Mixed Dipterocarp Forest of Asia

Dr. Mark Ashton

Professor of Silviculture and Forest Ecology, and Director of School Forests
Yale University, USA

In his keynote address, Dr. Ashton discussed the rehabilitation and restoration of mixed dipterocarp forests (i.e. forests dominated by tree species from the Dipterocarpaceae family), which used to be extensive in the Philippines and which are now restricted to only a small number of sites. Dr. Ashton drew upon his many years of experience working in this forest type, primarily in southwest Sri Lanka, as well as the research of his doctoral students and colleagues from Latin America and Africa. His goal was to provide a general framework for understanding the patterns and processes of rainforest dynamics.

Dr. Ashton pointed out that land rehabilitation and forest restoration can in fact be very complex. If you plant, how do you plant? What species do you plant? Why? How do you accommodate a range of different social values? One of the main reasons why people have generally not tried using native species for forest restoration is that it is easier to use readily available and well-known exotic, site-generalist species. Dr. Ashton pointed out that there is nothing wrong with this—indeed it is an important first stage in the educational process about land rehabilitation—but the goal is to move to a more sophisticated approach to forest restoration.

Dr. Ashton's framework consists of a set of principles, with each depending on the other. The primary principles are physical and functional, while the secondary ones are structural and compositional. The benefit of the framework is that it provides an ecological construct upon which to hang a complexity of site-specific social and ecological circumstances through which multiple reforestation pathways can be developed. There are seven guiding principles that build upon each other from basic functional and physical considerations to structural and composition components. Principles are listed in order:

Basic physical and functional considerations

- **Principle 1:** *Site productivity changes across landscapes.*

Rainforest studies have shown that nutrient availability and soil moisture can vary even across small changes in topography. The implication is that a reforestation plan that works at one site may not work at a neighboring site or across a gradient, and, therefore, specific site conditions must be analyzed and understood because they are often counter intuitive.

- ***Principle 2:*** *Disturbances change across a landscape.*

The second principle has to do with disturbance as a natural process in rainforest dynamics. Disturbance is often thought of as a continuous process, but natural disturbances such as fire, droughts, typhoons, and convectional windstorms, are actually strongly episodic and have major impacts on the structure, age-class and composition of forests. Such disturbance processes vary across landscapes, so that trees in a valley will experience different forces to those located on a ridge. The formulation of reforestation strategies that are resilient in the long-term need to account for the type, frequency, and scale of disturbance.

Basic structural and compositional considerations

- ***Principle 3:*** *Initial floristics.*

The third principle deals with the process of initial floristics as an important driver in forest development. The concept of initial floristics states that multiple species start growing on a site together as a cohort, rather than coming in sequentially over time. In other words, after a disturbance clears a patch of forest, a new cohort of different tree species begins to colonize the site together, albeit growing at different rates and dominating the canopy at different times. Initial floristics is in contrast to the classical relay floristic model of succession, where species come in sequentially. Relay floristics is now widely considered to be restricted to only certain sites and disturbance circumstances.

- ***Principle 4:*** *Regeneration Guilds are Diverse.*

Reflecting initial floristics, the trees found in a disturbed site can be divided into six diverse regeneration guilds, which include 1) pioneer species of early successional development; 2) pioneers of stem exclusion; 3) canopy dominants; 4) canopy non-dominants; 5) sub-canopy species; and 6) understory species of late successional forest development. Each guild has its own characteristics in terms of mode of reproduction, dispersal, establishment, and growth morphology. Compared to other forest types, ever-wet rainforests have the greatest diversity of regeneration guilds.

- ***Principle 5:*** *Release of Advance Regeneration.*

The fifth principle concerns regeneration of the canopy dominants, canopy non-dominants, and sub-canopy and understory species that make up the late successional forest, and the diversity of species represented in the forest. Seedling regeneration of these tree species groups can endure the shade of the understory for long periods of time. This is especially true of the dipterocarps. Grouped together their regeneration can be termed "advanced" because their seedlings rely upon being present in the understory before an occurrence of a canopy disturbance that allows for their survival and release.

- ***Principles 6:*** *Site-Restricted versus Generalist Species.*

The sixth principle has to do with the relative abundance of site-restricted species versus site-generalist species. The canopy-dominant species tend to be site-restricted meaning that they will only compete well in a narrow range of site conditions, which are related to factors such as site fertility (e.g. nutrients and soil moisture availability). Studies by Dr. Ashton and his colleagues in Sri Lanka on a 25 hectare plot showed how four different species of the same genus (Shorea) had widely-varied distribution in relation to small topographic changes. Site-restricted species make up 80% of the trees for mixed dipterocarp forests. The canopy non-dominant species, on the other hand, tend to have generalist distributions, the majority being dispersed by wide ranging mammals and birds.

- ***Principles 7:*** *Static and Dynamic Stratification.*

The seventh principle deals with two stratification processes that are happening simultaneously between species and guilds at any given site. Static stratification reflects the growth habit of the late successional guilds, with different guilds occupying different spaces in the forest structure. Even a single-aged cohort can have a complex structure whereby understory trees are beneath sub-canopy and canopy tree species. Dynamic stratification, on the other hand, occurs when species sequentially overtop one another through competition and succession, as when late successional canopy dominant and non-dominant species overtop pioneer species. All of this should be considered for creating compatible and intimate mixtures of species in time and space if the goal is to increase productivity and efficiencies in resource use, restore ecosystem function, and increase complimentary combinations of product and service values demanded by society.

Using these seven underlying principles, one can now consider different types of degradation occurring at specific sites and the types of remedial actions that need to be taken.

Degradation of Structure and Composition

Chronic degradation is often anthropogenic and can be classified as either "bottom-up" or "top-down." An example of bottom-up chronic degradation is the continual weeding of the understory for the cultivation of crops, such as coffee, cacao, or tea. The crops that we care for in the understory inhibit release of potential advance regeneration, which then leads to guild simplification and loss of structural complexity and less canopy stratification over time.

To restore a site in this situation it is sometimes enough to simply protect the site from any further intervention in order to allow the advance of vigorous regeneration (given that there are enough seed sources of late-successional understory, sub-canopy and canopy species). It may be appropriate to cultivate the understory crops for a time, and then relinquish and give the advance regeneration space to grow, and then cultivate again. In this scenario, no planting is required and there is no need to depend on finding sources of native species seedlings. If degradation has eliminated the seed source, enrichment planting may be necessary. Preferential planting of timber and non-timber forest product (NTFPs) species may increase financial value and restoration viability. Methods of enrichment planting with understory NTFP species and advanced regeneration of other canopy tree species, is compatible as many NTFP species are density dependent and require wide spacing. There is a range of planting and release treatments that can be practiced dependent upon the degree of degradation to the understory.

Selective logging, which is an example of "top-down" chronic degradation, has an effect on the top structure of the forest as it breaks down stratification and allows for invasive vines to get a foothold on a site before the release of advance regeneration. By removing the best emergent and canopy trees, the site is simplified with less stratification and species diversity. In the past, this type of site has often been deemed beyond hope and thus converted to crop production, such as oil palm. However, these sites often still have intact spe-

cies composition, functionality, hydrology, and nutrition, and are far from being beyond repair. In order to rehabilitate cut-over forests, the first step is to re-engage the stratification process through initial floristics, the success of which depends on the degree of degradation of the canopy. If the advance regeneration of certain canopy dominant late-successional tree species are missing (for example, dipterocarps), then site-specific enrichment planting can be undertaken, taking individual species site requirements into account. Or, if the site has very heavy vine infestations, the best option may be to clear the remaining canopy that now is broken and uneven in structure, cut all vines overtopping this structure, and encourage the release of the groundstory advance regeneration together with pioneers that would come in after the clearance. It might seem catastrophic, but by doing so you restart the stratification process, sealing the canopy without disruption from vines for the next 30-40 years. It is actually a very efficient way to restore sites that suffer from severe chronic “top-down” degradation.

In addition to chronic degradation there is also acute degradation, a more severe form of disturbance. It can be classified as either sub-lethal or lethal. Acute, sub-lethal disturbance regimes are mostly related to indigenous, local or smallholder forest management practices, such as swidden (i.e., slash and burn) agriculture. These are a traditional practice among many indigenous and rural communities that results in the land being cleared, but in a manner that it retains potential for recovery when practiced on the right sites and given enough time. Examples from Sri Lanka, the Himalayas, and Panama show that these systems can vary significantly in the degree to which the structure and diversity of the forests are restored. In these circumstances the term sub-lethal is used because cultivation of the groundstory is ephemeral and much of the advance regeneration of the original canopy, sub-canopy and understory tree species is allowed to survive. In addition, enrichment planting of valuable tree shrub species and other forms of fallow management, for example, can be used to increase the economic value of the forest over time.

Moving beyond Structure and Composition: Severe Degradation of Functional and Physical Integrity to Site

Moving away from traditional management to modern systems of intensive market agriculture can lead to acute lethal degradation. In such cases, natures' capacity to restore the forest is lost. Lack of seed source and absence of advance regeneration has eradicated nature's ability to restore any semblance of original species composition. Structural degradation has eliminated moderating environmental conditions for establishment of new regenerants. And most importantly soil fertility and sub-surface hydrology has substantially been depleted and altered, respectively, thereby moving to degradation levels that alter the functional and physical integrity of the site. In such cases, these sites move to new ecological states and cannot re-initiate even basic successional processes back to forest.

Invasive grasses and ferns usurp space and self-maintain a fire regime, preventing pioneer establishment of rainforest tree species. In this situation, it may be useful to plant fire-tolerant exotic, pioneer, site generalist tree species to shade out grasses and ferns, and to rebuild the soil infiltration capacity. Exotic species can help restore site functionality, particularly if native species are maladapted to such conditions. Pioneer site generalists (exotic or native) can be planted and based on the concept of relay floristics, can be removed once the natural regeneration or plantings of rain forest tree species have established in the understory and reach a certain stage, resulting in a native generalist forest. Site-specific enrichment planting can then be conducted to re-establish the canopy dominant tree species of the original rain forest (e.g. dipterocarps). An example is the use of Caribbean pine *(Pinus caribaea)* as a nurse tree for enrichment planting in Sri Lanka.

The worst cases of lethal, acute degradation are represented by mining and other similar types of sites where sheet erosion and complete eradication of top soil has rendered ecological stabilization through plantings and seedings hopeless. Such cases require a much greater economic and labor investment. In such sites, the primary challenge is to use engineered structures to stabilize soils and hydrology through contouring, ditching, and terracing. After securing site stabilization, mixtures of nitrogen-fixing legumes can be planted with shade intolerant pioneer species (possibly exotic), followed by native species under-planted once the nurse trees are established. Compatible spatial and temporal mixtures of species can be arranged to create a rainforest analog for the stratification and self-thinning processes that reflect stand development phases of initiation, stem exclusion, understory re-initiation and old growth.

Thirty-seven Years of Restoration Results and Future Prospects for the Miyawaki Method

Dr. Kazue Fujiwara

Professor,
Yokohama City
University,
Japan

Dr. Fujiwara discussed general principles of reforestation ecology to specific examples of reforestation efforts in Japan and elsewhere that have employed the so-called Miyawaki method.

The Miyawaki method aims to address one of the most important challenges in reforestation, namely the restoration of complex, multilayer forests that fulfill the functions of the former natural vegetation in terms of disaster mitigation and environmental protection (air, water, soil, wildlife, climate). The unique feature of the Miyawaki method is the very high density of trees planted —upwards of 12,000 seedlings per hectare. The theory behind the technique, which was developed by Dr. Akira Miyawaki, is that this ultra-high density spacing forces the seedlings to grow faster in height under more intense competition for sunlight.

Dr. Fujiwara emphasized the importance of the trees having a very healthy root system. Investigating the characteristics of the climax species, she found that they are capable of developing a very deep taproot. In one experimental site in Japan, for example, one seven meter (m) high evergreen oak species had a six m deep tap root after 10 years. In Japan, where the availability of land is very limited, this characteristic of climax species has been applied to stabilize roadside slopes and other steep areas, which often have a slope of 30-50 degrees. In such areas, small trees are planted on terraces cut into the hillside, or within a mesh of bamboo. A mulch of rice straw compost is often first applied to minimize evaporation and maintain soil moisture until the trees get bigger.

Native species have also been planted in urban areas of Japan because they not only provide ecosystem services, but also foster a strong sense of place. Native forests have been planted at numerous locations, including Yokohama National University, Yokohama City University, Tsukuba University, Shin Nippon Steel Company, and Honda and Toyota motor factories. The planting designs were based on traditional Shinto shrine forests, like those found at Hama-Rikyu Park and the Kinkakuji Temple. These planted native trees have also proven their ability to survive well in the face of earthquakes. There is also a long history of tree-planting in "Satoyama" or rural landscape areas, where a harmonious balance between production and more natural areas helps maintain biodiversity.

In Japan, this idea of restoring landscapes emerged in the 1970s. Prior to World War II, Japanese society coexisted harmoniously with nature, but after the war there was a strong push to economically develop the Japanese archipelago, including the construction of high-speed train lines, highways, airports and other infrastructure, which had a detrimental impact on the natural environment. In the 1960s, the Japanese started putting into place a nature protection system in response to the rampant degradation occurring. This was around the time that Dr. Miyawaki conducted his studies in Germany, where he adopted the philosophy of his Professor, Reinhold Tuexen, regarding nature conservation and restoration. Upon his return to Japan, Dr. Miyawaki started to use the theory of potential natural vegetation to grow protection forests around factories and on public lands with help from citizen participants.

The importance of restoring forests has been underscored by a series of natural disasters, including the Niigata & Sumatra earthquake and tsunami of 2004, the Pakistan earthquake of 2008, and the Myanmar cyclone and Sichuan earthquake in China in 2008. The mangrove and coastal forests in areas of the tsunami, for example, proved very effective in reducing the size and force of the tsunami wave. Forests are also able to mitigate the impact of earthquake as Dr. Fujiwara showed in the case of the Kobe earthquake in 1995. Given the prevalence of these natural disasters, there is a strong need to be proactive in taking steps to mitigate the threat. Civil engineering technologies are part of the solution, but it is also important that forest restoration is applied to stabilize sites.

Dr. Miyawaki, Dr. Fujiwara and their colleagues have been involved in a number of forest restoration projects. One such project was the establishment of protection forests at Yokohama National

University on the occasion of its 35th Anniversary. These forests were planted on what had been a golf course with no intact forests in 1974, demonstrating that even a highly degraded urban site can be restored. The planted forests, which have attained impressive height growth, have proven effective in absorbing pollution, reducing noise, sequestering carbon, and providing wildlife habitat. They have also had a beneficial impact on neighboring areas of the campus, where the trees have helped mitigate temperature extremes by cooling the campus in the summer and warming it in the winter.

In some urban areas, the importance of tree planting is recognized but the wrong trees are being planted. In Shanghai, for example, an Australian species of tree was planted at great expenses, but had to be covered in the winter to protect if from the cold weather and sometimes in the summer to protect it from heat and pollution. Using this example, Dr. Fujiwara highlighted the importance of planting native trees that are better adapted to the particular environmental conditions of a locale.

The Miyawaki Method has been used on a number of sites in various parts of the world. In a forest restoration site in Kenya, for example, Dr. Fujiwara surveyed the natural forests in order to see what kind of species were available and their preferred types of environmental conditions. Based on study, she selected the species — both rare and common— that would grow best in the site. Having prepared the site, they then planted 2-3 seedlings per square meter. Large numbers of students, government officials and volunteers were involved in the planting giving the project a good level of community support. Another major project has been conducted in Malaysia at the Universiti Putra Malaysia Bintulu campus in Sarawak.

Making sure that the soil is conducive to planting is very important. A site provided by Yokohama Tires in the Philippines, for example, was found to be low in water-holding capacity and depleted of nutrients as a result of volcanic ash. In this case, site preparation required first scrapping the ash and then enhancing the topsoil with

compost and chicken dung. Dr. Edwino Fernando helped choose the species best suited for planting, and was assisted by 900 people from the surrounding communities in the planting process. The trees have shown phenomenal growth in less than two years, with some having grown as tall as 6.5 M.

Dr. Fujiwara ended her talk by highlighting the key findings of her research: 1) very dense plantations promote climax species such as dipterocarps in the tropics and Fagaceae and Lauraceae in the warm temperate and subtropics due to increased competition for light among individual saplings; 2) using a mixture of species is beneficial to promote growth and habitat development since species have different growth strategies; 3) nursery saplings that are well prepared with good root systems have better growth rates; 4) growth rates differ across climatic regions, but restored forests that develop from planted saplings sequester carbon better than natural forest due to the high density planting; 5) species composition recovers as well in planted sites as it does in young natural forests; 6) mitigation effects are high after disturbances; and 7) local people benefit from participating in the reforestation efforts, and environmental education should be incorporated into any restoration strategy.

Restoring Tropical Forests for Biodiversity Recovery: Reconciling Ecological and Economic Considerations

Dr. Stephen Elliott

Senior Scientist,
Forest Research
Restoration Unit,
Chiang Mai University,
Thailand

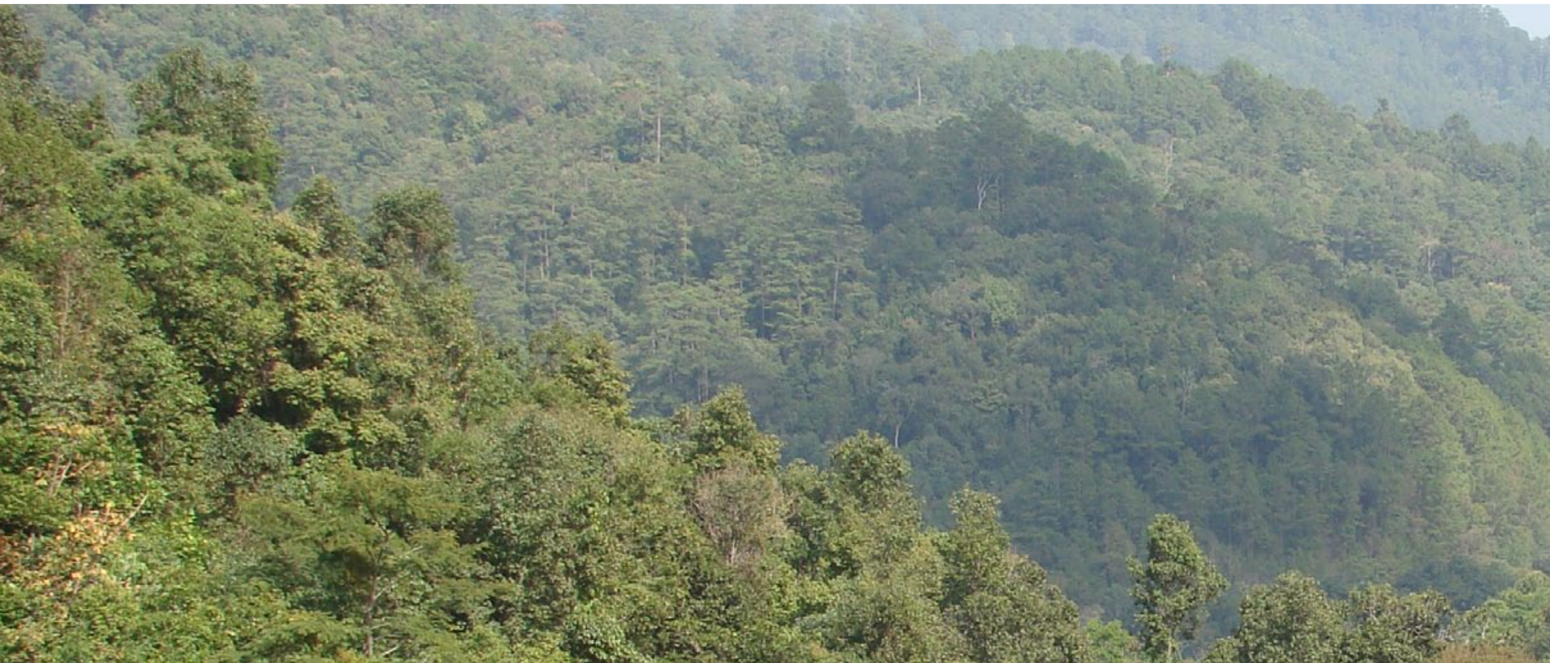
Dr. Elliott introduced another reforestation approach, the Framework Species Method. Originally developed in Australia, the Forest Restoration Research Unit (FORRU) at Chiang Mai University has been adapting the technique for use in northern Thailand since 1994. The overall goal of FORRU is to develop effective methods for restoring natural forest ecosystems for the benefit of biodiversity conservation and environmental protection. Forest restoration is challenging because it is often unknown what exactly the forest ecosystem was like before the forest was degraded. Nevertheless, the aim is to restore original levels of species diversity, as well as restore ecosystem structure and function, some of which can be assessed from remnant primary forest patches in the surrounding landscape.

Dr. Elliott laid out three site factors and three landscape factors that should be considered in determining the most appropriate forest restoration approach for any particular area. The site factors are the presence or absence of sources of advanced regeneration (e.g., seeds, live stumps, seed trees), the degree of dominance by herbaceous plants, and the extent of soil erosion. The landscape factors concern the extent of seed trees within the vicinity of the site, the existence of seed dispersing animals, and the risk of fire. Based on these six levels or factors, Dr. Elliott laid out five stages of degradation, from least to most degraded, each requiring a different restoration approach.

In Stage One, there are still a lot of natural regeneration sources at the site, whether from seeds buried in the soil, saplings growing in the understory, or trees in the surrounding landscape. At this stage, little intervention is required, and the most important step is to protect the existing vegetation from fire, hunting of wildlife, and harvesting of trees.

In Stage Two, more trees have been removed and weeds are beginning to take over the site. Fewer species are represented on site, but there are still sources of regeneration and seed dispersing wildlife. Again, protection (particularly fire prevention) is critical, but additionally Assisted Natural Regeneration (ANR) is also needed to release existing regeneration from suppression by weeds. This involves weeding and applying fertilizer. Relying on ANR exclusively, however, can result in a species-poor "pioneer forest", if advanced regeneration already on the site is inadequate, and therefore some under-planting with shade-tolerant climax species may be beneficial.

By Stage Three, weeds are dominating the site; sources of natural regeneration are insufficient, and fire risk is very high. There are still some remnant trees and some wildlife present to act as seed dispersers. Protection is still critical and ANR can be carried out on the few natural regenerants present, but additional tree planting will be required. This is the stage at which Framework Species come into play. Framework Species are indigenous forest tree species that enhance natural forest regeneration and accelerate biodiversity recovery. To be considered a framework species, species are tested against a set of criteria. They have to survive well when planted in deforested areas, have dense spreading crowns (to shade out weeds), and should also attract seed-dispersing animals by producing fruit, nectar, nesting sites, and perching sites. Finally, if possible, frame-



work species should also be resilient to fire, which is often a big threat to young saplings.

FORRU's results using framework species have been very encouraging. Approximately six years after planting, the structure of the forest can almost be recovered, with stratification of large pioneers and smaller climax species. Species diversity also increases. At a demonstration site, for example, Dr. Elliott's team planted 30 framework tree species that fostered the recruitment of an additional (non-planted) 72 tree species within 8-9 years. Moreover, within three years mammals began to return (pigs, deer) and bird diversity jumped from 30 species before planting to 87 species six years later, representing 63% of the bird community of the nearest natural forest.

At Stage Four, there are no trees as seed sources remaining in the landscape. At this stage one needs to plant the framework trees as well as lots of other trees at high density (e.g., the Miyawaki method). This is an intensive and expensive approach, which makes it mainly applicable to small, urban sites. If this is not an option, conversion to a tree plantation, agroforestry system, or even traditional agriculture should be considered.

At Stage Five, even weeds have a hard time growing, and soil erosion is significant. The soil must be restored and improved before anything else is done. The best strategy is to plant whatever can grow, even exotic species, which will help build the soil. Only then is it possible to revisit Stage 4, 3, and so on, each of which requires less intervention.

So how much does it cost? The costs of restoration increase from stage-1 degradation to stage-5, with an increasing intensity of the methods required. However, very few accounts of the costs of forest restoration have been published. This reflects both the difficulty of carrying out meaningful cost comparisons and perhaps also poor record keeping among forest restoration practitioners and/or unwillingness to disclose financial information. Comparing costs among methods and locations is confounded by fluctuations in exchange rates, inflation and huge variations in the costs of labor and materials. Costs are also highly location- and time-specific.

The costs of forest restoration, though, must be weighed up against the benefits. The potential economic value of the benefits of achieving a climax forest ecosystem, in terms of ecological services and diversity of forest products, is the same, regardless of the starting stage of degradation. The Economics of Ecosystems and Biodiversity study (TEEB, 2009)[1] put the average annual value of fully restored tropical forests at US$ 6,120 USD/ha/yr in 2009, equivalent to 6,747 USD today, allowing for inflation. This includes, foods, medicines, water, carbon storage, ecotourism and so on. Even the most expensive forest restoration methods do not cost more than 10,000 USD/ha, in total, so the value of potential benefits from a restored forest far outweighs the costs of establishment, within very few years after the climax forest condition is achieved.

However, the speed of delivery of those benefits does depend on the initial degradation stage and on the restoration methods used.

1 http://www.teebweb.org/

As the degradation stage increases, the time required to realize the full range of potential benefits increases from a few years to several decades. Therefore, the return on investment is delayed. The full potential benefits of forest restoration, in terms of cash, can only be realized if they are marketed and people are prepared to pay for them. Schemes to market forest products and eco-tourism, sell carbon credits and "payments for environmental services" (PES) all require a great deal of development and upfront investment before the full cash potential of restored forests can be realized.

Ultimately, it may become possible to bundle together credits for a variety of environmental services, such as flood prevention, soil erosion control, pollination of crops, seed supply for forest restoration, NTFPs, ecotourism, and more, and sell them as "environmental credits." Environmental credits would represent a diversified portfolio of services that give the landowner more flexibility and protection against volatility in the market for any single service. As a business model, the elegance of forest restoration is that it generates many different income streams that are shared, in theory at least, amongst a wide range of stakeholders. So, if the market price of one service or product falls, another one can be developed to maintain overall profitability.

Currently, the details of these market mechanisms still need to be worked out. It is not clear who should pay for such credits, or who should get paid, or how those payments should be made. One could argue that corporations, consumers, governments, and developed countries should all pay, since they all receive the benefits. One could also argue about who should benefit, whether the landowner, the workers, the organizations who run the projects, or the local forestry departments. It is also difficult to figure out how to equitably share the benefits, and what payment mechanism is best —whether cash, community development funds, or micro-credit funds. Once these details are worked out, however, it will hopefully become clear that money can indeed grow on trees.

Rainforestation: Paradigm Shift in Forest Restoration and Rehabilitation in the Philippines for Sustainability and Climate Change Mitigation

Dr. Paciencia Milan

Professor,
Visayas State University

Dr. Milan, who is affectionately known as the "Mother of Rainforestation," provided an introduction to Rainforestation, which seeks to rehabilitate degraded lands, restore ecosystem services, and generate income for rural communities through the use of native tree species. Rainforestation was developed as part of a German-Philippines program at VSU starting in 1992 and has since been adopted by many organizations and institutions across the Philippines.

Rainforestation was first developed as an agroforestry system, known as Rainforestation Farming, which sought to expand human food production onto degraded lands. Rainforestation farming was established based on the preliminary working hypothesis that "the closer a farming system in the humid tropics is to its natural ecosystem, the more sustainable it is." Under this system, farmers plant root crops, pineapple and other fruits and vegetables under high value fruit trees, such as durian *(Durio zibethinus)*, mangosteen *(Garcinia mangostana)*, and lanzones *(Lansium domesticum)*, as well as native timber trees. This system gives farmers multiple income streams (e.g., firewood, fruit, food, and timber) and was intended to replace more destructive agricultural practices.

Rainforestation has since been developed into a broader array of approaches, some of which do not include crops. In these other types of Rainforestation, planting typically consists of a two-phase approach that uses native tree species to try to restore the landscape. Pioneer species are often planted in year one, followed by late successional species in year two or three. This technique works to mimic natural succession patterns and create a diverse, stratified forest. Local tree species that do well in full-sun include *Terminalia microcarpa, Melia dubia, Casuarina nodiflora,* and *Vitex parviflora,* among others, while some that prefer shade include *Dipterocarpus gradiflorus, Shorea contorta,* and *Heritiera sylvatica.*

Studies by VSU have shown that Rainforestation has numerous environmental and economic benefits. It results in improved soil chemical properties, soil structure and water holding capacity at the site. It facilitates increased biological activity, including the return of numerous bird and mammal species, including fruit bats and tarsiers. Household economic studies have also indicated that farmers who adopt Rainforestation gain higher net income from a greater diversity of sources. Rainforestation has also increased community involvement in forest management, and public awareness of issues surrounding deforestation and loss of biodiversity.

Although the DENR has signed a Memorandum Circular endorsing the use of Rainforestation for government reforestation initiatives, the usage of exotics species remains prevalent in the Philippines. Official excuses for this often point to the fact that native tree species, especially members of the *dipterocarpacae* family, grow slowly, require shady conditions making them ill-suited for open conditions, and only fruit once every 3-5 years making it difficult to get enough seed for reforestation. While some of this may be true, Dr. Milan pointed out that there are many non-dipterocarp species that can also be used. Also, dipterocarps can be collected as wildlings from the forests, and some dipterocarps, like Bagtikan *(Parashorea plicata)*, grow well in full light conditions.

Unfortunately, the continued usage of exotics for reforestation has led to further destruction of the remaining primary forest because they do not supply the high quality wood that is needed to supply domestic timber needs. The planting of these trees as monocultures also makes them highly vulnerable to pest attacks and other types of disturbance. One final problem is that the short rotations of these monocultures deplete the soil nutrients making it increasingly harder to grow anything on these sites.

Over the last sixteen years of Rainforestation advocacy and implementation, a total of 183.34 ha of demonstration sites have been established. Rainforestation has been carried out as a partnership between NGOs, community-based organizations, LGUs, the DENR, tribal leaders, religious organizations, and others. Rainforestation has also been adopted as a forest restoration strategy in the "Road to

2020" campaign—an ambitious plan that calls for the restoration of one million ha (out of a national total of 30 million ha) in the Philippines by the year 2020.

Dr. Milan ended her presentation by stating that resource extractive practices and shortsighted development have resulted in deforestation and severely degraded landscapes. Natural disasters, such as flooding and landslides continue to befall the Philippines as a result. Decision makers must focus their attention on restoring degraded forests, increasing the productivity of degraded lands, and reducing wasteful land use practices. Communities in risk-prone areas should be involved in development planning from the beginning stages of these initiatives, as is now happening in the Marikina watershed outside of Manila.

Overcoming Knowledge Gaps in the Use of Native Species for Reforestation and Watershed Rehabilitation: Lessons from PRORENA and the Agua Salud Project

Dr. Jefferson Hall

Staff Scientist,
Smithsonian Tropical
Research Institute,
Panama

Dr. Hall discussed a ten-year old, long-term research program on native species in Panama, known as PRORENA, and a newer long-term research program on the effects of deforestation on ecosystem services, known as Agua Salud. When PRORENA started in 2001, the conditions in Panama were not unlike the current state of the Philippines and other tropical countries, with high deforestation rates and a heavy reliance on exotic timber species in restoration efforts. In fact 90% of the trees planted in Panama were exotic with *Tectona grandis* making up 75% percent of that amount. One of the main reasons that people were not planting native species is that they simply did not know enough about their biology and ecology, and it was therefore a big risk to plant without knowing how the trees would perform.

The PRORENA project is a joint effort of the Smithsonian Tropical Research Institute and the Yale School of Forestry and Environmental Studies, and strives to understand biophysical and socioeconomic aspects of native species reforestation. In species screening trials, they planted 70 species over three years, with roughly 50,000 individual trees, at four core research sites distributed along a rainfall gradient and taking soil fertility into account. They collected survivorship and growth data in order to determine which species did best in the various sites. From this focus on species biology, PRORENA expanded to mixed species plantations, exploring reforestation for different values and benefits, including biodiversity timber production, agroforestry and others, and finally the benefits of reforestation for ecosystem services.

Dr. Hall also discussed the Agua Salud project, which is a collaborative effort between Smithsonian Tropical Research Institute, the Panama Canal Authority, Panama's National Environmental Authority, and HSBC's Climate Partnership. The project seeks to understand and quantify the diverse set of ecological, social, and economic services provided by tropical forests in the Panama Canal Watershed. The Panama Canal is an important location for this study being arguably the most important inland commercial waterway in the world with 14,000 ships crossing it every year. With each transit requiring 200,000 cubic meters of water, water is a very important resource, and one for which Panama is receiving a de facto payment for water production. Panama is now opening up a new set of locks for larger ships, meaning that there is a need for additional water.

The Agua Salud project has been in existence for about three years of its expected 20-40 year life span. At the most basic level, the Project seeks to quantify the effects of different land uses on water quality, quantity, and temporal distribution of rainfall, carbon storage and cycling, biodiversity conservation, and usage of the forests by rural populations. This project is being implemented in a landscape that currently consists of a mosaic of different vegetation and land uses, including agriculture, grasslands, forests, and human settlement. The fact that much of the watershed is currently being degraded is deemed a major threat to the canal since too little water can result in ship draft restrictions, as occurred during the El Niño of 1997, whereas too much water can put canal infrastructure at risk.

The research project is focused on the following questions:[2]

- Is there indeed greater groundwater supply under forested land during the dry seasons than under deforested land?
- Do different land uses and/or management strategies such as reforestation promote groundwater storage?
- How do these land uses and management strategies affect timber production and quantifiable ecosystem services such as carbon storage, water quality, and biodiversity?

The project site consists of a number of watersheds, each characterized by a different land use, within a 3000 hectare area including mature forest, areas with 50% forest, pasture, teak plantations, native species plantations, managed forest, and a secondary succession catchment area.

2. Research updates are available at the following site: http://www.stri.si.edu/english/scientific_staff/staff_scientist/

Regarding the first question, the researchers set up a series of weirs to measure how water enters, moves through, and leaves the system, the main goal being to measure infiltration or the "sponge effect" across the different sites. Preliminary data collected during three different dry seasons indicated that there is indeed more water infiltration occurring in forested than partially deforested catchments, providing more water during the dry seasons. They do not have data, however, from their secondary succession or plantations catchments, which are still very young.

Regarding the second question, the project developed a secondary succession chrono-sequence study. The project has found that in 12-year-old secondary forests, the "sponge effect" returns to those levels measured in mature and old secondary forests, suggesting that there is indeed a fairly rapid recovery. The depth of this effect, however, will vary and is probably controlled by soil texture and land use history. The project does not have data yet, however, from native and exotic species plantations.

On the third question, the researchers already know a lot about the growth of native species from the PRORENA project and are designing restoration and plantation projects with different management objectives in order to test hydrology, carbon, and biodiversity at the watershed scale (as well as numerous studies at the stand, neighborhood, and individual tree scale). While it is clear that managed plantations can accumulate carbon more rapidly than secondary succession in this area, data about the teak and native species plantations is still needed.

Dr. Hall ended his presentation by stating that an overarching goal for this project is to develop "proactive" treatments that seek to optimize forest production along with ecosystem services during reforestation. An interesting issue that will be teased out from this is the trade-off between water, biodiversity and carbon.

Using Native Plant Species in Forest Restoration and Slope Rehabilitation in Hong Kong, China

Dr. Billy C.H. Hau

School of Biological Sciences,
Hong Kong University,
China

Dr. Billy Hau discussed his experiences with reforestation in Hong Kong. His research on natural forest succession has resulted in a better understanding of how to approach reforestation. Over the past decade, nineteen million trees were planted in Hong Kong, yet the prevalence of fire has resulted in no net gain in forest cover. After years of research, Dr. Hau is advocating a landscape-level approach to reforestation that is beginning to take hold with the government and NGO community.

Despite enormous urban growth in Hong Kong, only 25% of the land area is developed. Three-quarters of the land of Hong Kong is very hilly and, therefore, unsuitable for development. Deforestation first occurred roughly 500-800 years ago, and then again during the Japanese occupation in World War II. Meanwhile, reforestation efforts began over 200 years ago by the British, who were looking to control soil erosion and hill fires, and maintain a forested watershed for drinking water. Forestry was never important in Hong Kong since it was always cheaper to import timber than grow it domestically.

Government restoration efforts focused on ameliorating landslides have favored exotic species for many of the same reasons already mentioned. Although NGOs have advocated the use of natives since the 1990s, the government has resisted this call claiming that native trees grow slowly, do poorly in exposed areas, and are more expensive. In the early 1990s, some large restoration projects aimed at mitigating damage from construction specified the use of native species, but had to revert back to exotic species due to lack of commercial supply of native tree seedlings.

Hong Kong has 390 native species in 67 families and 192 genera (*Fagaceae* and *Lauraceae* are dominant in existing forests). Up until the 1990s, little was known about the flowering and fruiting phenology, silviculture, and seedling growth conditions for these species in the nursery and in the wild. At that time, however, academic researchers started conducting surveys and experiments, looking at the barriers to natural succession, as well as trying different reforestation efforts. Meanwhile, NGOs, with support from the universities, started to promote native species for restoration projects and to set up nurseries.

The research conducted demonstrated that in moderately degraded areas it takes about ten years for grasslands to morph into a more complicated shrubland, and then another 30-40 years to become a closed-canopy secondary forest. Looking at the barriers to natural regeneration on Tai Mo Shan Mountain, which has some patches of natural forest on the ridges and valley bottom, they found that in many grassland sites the seed bank was lacking and large grazers were missing from the landscape due to the long history of deforestation. However, experiments with seed traps indicate that seed rain in the grassland sites was surprisingly higher than in the shrublands and forests, though only a subset of native trees are dispersed naturally onto the degraded hillsides at varying distance from the natural forest. With birds, especially bulbuls, as the main seed dispersers, seed rain is generally adequate for the development of woody vegetation cover. However, once the seeds arrive at a site, seed predation by rodents is a major problem at some sites, though the level of predation varies significantly across space and time.

In additional studies, 60% of seeds germinated, which was equivalent to nursery rates, and more than 50% of the germinated seedlings survived for at least two years. The growth of species of native trees was then examined for the impact of belowground competition with grasses, seasonal drought, and low soil fertility. It was found that all of the factors affect growth but their relative importance varies among species. All the barriers identified are species specific and therefore should not stop succession.

To address the government's claim that inadequate seed stock of native trees was available, Dr. Hau and colleagues developed a nursery in 1997, where more than 200 native tree species—roughly 50% of the total number—have been successfully propagated. The nursery, which now grows about 200,000 seedlings per year, is used for voluntary, commercial or government reforestation projects, public education programs and research programs (including field and germination trials). The nursery is also used to conduct research on maintaining a high quality stock of mycorrhizal associations, and the nitrogen-fixing ability of different native species to determine which are best for rebuilding the soil.

With the hope of replacing the already established exotic species plantations, Dr. Hau and colleagues studied the natural regeneration of native species occurring in these exotic plantations. Their data shows that little natural seed dispersal is occurring. They then explored the possibility of enrichment planting and direct seeding with natives in these plantations, some of which were previously thinned. Finally, they evaluated the framework species approach for 57 different native species against criteria such as heartiness, attractiveness to wildlife, regenerative ability, architecture, vigor, and dispersal ability.

Over the past decade, nineteen million trees were planted in Hong Kong, mostly on hillsides and for slope stabilization. Despite this planting and forest succession, there has been no overall increase in forest cover during this period. It was finally determined that anthropogenic fires resulting from Chinese grave-sweeping festivals and accidents were the main cause of forest loss. There were more than 1,000 fires between 1993 and 2004 in government parks, for an average of 105 fires per year. The most frequently burned areas were grasslands and shrublands, including newly seeded restoration sites, whereas closed canopy forests generally escaped harm.

Hong Kong University has developed a model for a landscape-level approach to ecological reforestation, as the current reforestation approach on a site-by-site basis simply does not work, regardless of whether one plants native or exotic trees, because of the fires. The University used Geographic Information Systems to map all fires, overlaying them with records on vegetation, topology, man-made structures, and weather to determine the source of the fire. From

there, they are able to design a network of firebreaks to prevent fires from spreading. Only after the firebreaks become effective will they plant trees and allow natural succession to restore native biomass. The approach also calls for adding plant diversity to assist with succession after the firebreak system is established.

The government has started to use more native species in reforestation programs. Yet, despite all of the research and lobbying done by the environmental community, at least half of all species planted are exotics. Still, the government of Hong Kong is helping with large-scale research experiments, including thinning experiments of exotic plantations that would be too expensive for the University to complete alone. In addition, commercial nurseries have recently started to supply a limited number of native species, some of which the government is using for stabilization of roadside slopes. Despite some advances in government policies, a landscape-level approach that integrates firebreaks into reforestation programs, is still lacking in large-scale restoration.

Dr. Hau ended his presentation by pointing out that the lag time between research and government action is about 10 years. He recommended that practitioners continue lobbying the government for new policies on the use of native species in reforestation. It will take a long time to realize change in the public sector, but continued pressure will help them to take action.

Indigenous Trees as Hedgerow Species on Sloping Acid Upland Agroforestry Systems

Don Immanuel A. Edralin (for Dr. Agustin R. Mercado Jr.)

World Agroforestry Centre (ICRAF)

Speaking on behalf of Dr. Agustin Mercado, Jr., Mr. Don Edralin discussed the work of the ICRAF program in Mindanao, Philippines. Their focus is to provide education and outreach to farmers on the use of native tree species in various agroforestry systems in order to increase yields, improve the soil, and provide habitat for wildlife, while also improving incomes for local farmers.

Typical farms in Mindanao are small (1-3 ha), household based, managed for subsistence, and isolated from town centers. The natural forest is often cleared completely under a slash and burn system to make room for planting, and when trees are used in traditional farms they are used sparingly. The soils are acidic and poor in nutrients from overuse, and productivity has generally been declining over the past twenty years, particularly in the upper watersheds where poverty and malnutrition are rampant.

One of the problems that ICRAF is addressing is soil loss. Traditionally, small farmers have plowed up and down steep slopes, resulting in the loss of an average of 350 megagrams of soil per hectare every year. Even contour farming, which is a better method, still results in an average loss of 40 megagrams per hectare per year, when according to ICRAF, the maximum tolerable amount is only 12 megagrams.

Agroforestry is defined as a land use system in which woody perennials (trees, shrubs, palms, bamboos) are deliberately used in the same land management unit as agricultural crops with animals or both, either in some form of spatial arrangement or temporal sequence. Agroforestry systems are not as biologically diverse as forests, but they are ecologically better than conventional agriculture systems. The domestication of indigenous trees within agroforestry systems may reduce pressure on natural forests, as the trees can be used for firewood, mulching, and lumber, while also providing valuable ecosystem services (soil stabilization and improvement, regulation of hydrology, and much more), and improving crop yields.

Historically, there has been an evolution of systems used to control erosion in these upland areas. A pruned hedgerow system, which was widely used in the country between 1970 and 1990, helped control soil erosion, and provided organic fertilizer and fodder for animals. On the downside, farmers found it too laborious and trees were competing with crops for space and resources. During the 1990's, this evolved into the natural vegetative filter strips which were cheap to establish and controlled erosion effectively, but provided no immediate economic advantage to farmers. The most recent approach consists of hedgerow intercropping (or alleycropping) which integrates commercial trees for fruit and timber. This system improves the farms' productivity and profitability, while at the same time enhances sustainability, and environmental services, such as species diversity and carbon sequestration. This tree hedgerow system results in 6.5 megagrams of soil loss per year, more than the grass hedgerow system (i.e., 2.2 megagrams), but sill significantly below the tolerable soil loss level.

Research has also focused on understanding agroforestry-related biophysical processes and how they can lead to greater economic returns, while at the same time enhancing landscape function, diversifying livelihood opportunities, and improving the sustainability of the system. The use of early maturing trees in the hedgerows along with appropriate spacing, for example, can help maximize use of temporal space. Studies showed that while crops planted within six meters of the tree line resulted in stifled yield, spacing from six to sixteen meters boosts yield above what it would be without any trees. Beyond sixteen meters, the average yield is the same as it would have been without trees. Certain combinations of species used, along with the timing of pruning and application of natural fertilizers, can also help decrease or eliminate competition, while the orientation of the tree rows (parallel to the sun) can have an impact on productivity as well. With this kind of data farmers can select crops that perform best in various spatial and temporal combinations

Research by ICRAF in Mindanao has also focused on maximizing the economic benefits of this agroforestry system. Increasing the value of the trees by using indigenous premium-quality timber trees is one way to do this. Incorporating multi-canopy hedgerow systems that mimic stratification in a natural forest by optimizing the vertical use of aboveground resources, such as growing trees, bananas, and plants for forage, is another. Choosing deep-rooted trees can also optimize vertical and horizontal resources belowground, while the use of nitrogen-fixing trees improves the soil.

Some examples of highly productive agroforestry combinations that utilize native tree species include: 1) Lauan *(Shorea contorta)* trees with cassava, and cut flower production; 2) Tindalo *(Afzelia rhomboidea)* trees with banana and grass; 3) Molave *(Vitex parviflora)* trees with banana; 4) Apitong *(Dipterocarpus grandiflorus)* trees with watermelon; 5) Saplungan *(Hopea plagata)* trees with maize; and 6) Kalumpit *(Terminalia microcarpa)* trees with peanut, cassava, and banana. ICRAF has collected growth and survival data on these trees under different conditions.

Mr. Edralin concluded his presentation by endorsing the usage of native tree species in upland agroforestry systems. Native trees increased the economic value of these systems, while reducing the amount of soil erosion and fertilizer loss, and increasing above ground fertility by taking up leached nutrients from below the crop root zone. Many agricultural crops performed well in areas near the trees, attaining higher yields than in treeless plots. In addition to improving the total productivity of these upland farming systems, the trees also served to sequester carbon, and address habitat fragmentation by acting as biodiversity corridors that link patches of remaining forests.

Mainstreaming Native Species-Based Forest Restoration: A Synthesis- The Need to Change MAPs (Mindsets, Attitudes, and Practices)

Dr. Perry S. Ong

Professor,
Institute of Biology,
UP- Diliman

A common theme among all the presentations was that, even if all natural forests are different, varying in terms of species composition, elevation, and other biophysical factors, the basic underlying functional and structural ecological principles and processes remain the same. Nevertheless, there is no one-size-fits-all solution to forest restoration. Solutions must be based on site-specific ecology, biogeography and evolution, as well as take into account the degree of site degradation.

Restoration efforts should be anchored on the use of native species as the default mode, and that exotics should be avoided as much as possible.

Furthermore, it appears that urban areas- the environment in which most people live in now- can support significant forest assemblages that are critical to biodiversity and ecosystem services, yet cities are often overlooked in ecological importance. Hence, in urban areas there is a need for forest restoration practitioners to forge partnerships with non-traditional groups, such as landscape architects, urban and regional planners, and engineers. Scientists cannot combat deforestation by themselves, but rather must reach out to other sectors of society.

The importance of involving local stakeholders in every step of the process to ensure the long-term success of reforestation efforts cannot be overemphasized. People often think that tree-planting alone is enough to combat forest degradation. This type of mindset has to be changed. Furthermore, simply shifting the focus to the use of native species in reforestation by itself is also not enough although it is a necessary prerequisite; a better understanding of the myriad factors and site-specific issues surrounding forest degradation and site stabilization is needed, if we are to ensure that forest restoration activities are sustainable and will lead to the ultimate goal of restoring forests.

To succeed against the growing pressures of development and climate change, peoples' MAPs (Mindsets, Attitudes and Practices) need to be changed. The struggle to incorporate native species-based forest restoration into the mainstream agenda of society is not going to be easy, and no single individual or institution can do this alone.

A vigorous program for the *rebirth* of Tropical Rainforests throughout the world needs to be: native-species based; based on sound functional and structural ecological principles; and undertaken by stakeholders behaving like stockholders.

Only when people from all walks of life and from all disciplines work together in a lasting partnership will the restoration of the rainforests be realized.

DAY 2

Opening Remarks

Dr. Rex Cruz

College of Forestry
and Natural Resources,
UP-Los Baños

Dr. Cruz opened Day Two of the conference by highlighting the climatic, topographic, and physiographic diversity of the Philippine archipelago, which explains the huge number of different plants and animals found in the country. A variety of systems have been developed to classify the different forest types. The general need for forest restoration, though, is clear from the fact that the country has 15.9 million ha of land designated as forest, of which approximately 10.3 million are without forest cover.

Reforestation efforts in the past have suffered from a number of shortcomings, including limited species selection, poor site characterization, poor species-site matching, and low quality of planting materials. The failure to mainstream forest restoration into the local development agenda has also been a significant weakness. As a result, many reforestation programs have lacked sustainability once the initial funding has run out. Most problematic has been the lack of maintenance after the trees have been planted, exacerbated by inadequate public outreach and education efforts. This has resulted in a very low level of appreciation for reforestation and its beneficial impacts.

Prerequisites for successful restoration include the need for a wide selection of available species, intensive site characterization on a wide landscape level, improved species-site matching, and certification of quality planting materials. Intensive public outreach and education is also vital to raise awareness and stimulate long-term commitment. To date, there has been an assumption that people understand how important forests are, both ecologically and economically, but often times this is not the case. This situation needs to change in order to engage and inspire the public to participate in the continuing support of forest restoration projects. Policy guidelines on land use are also needed to clarify the specific goals of restoration, such as production, watershed rehabilitation, or biodiversity conservation, and how forest restoration programs fit into local development plans.

Successful forest restoration requires that we recognize the diverse site characteristics in terms of the degree of degradation, biophysical and socioeconomic conditions, as well as the underlying goals. We must also recognize the variety of strategies and approaches to forest restoration, in terms of selection of species, restoration techniques, and methods for stakeholder engagement. In ending his presentation, Dr. Cruz noted that the variety of actors involved in forest restoration have different needs for information, technology, logistics, and incentives, and that the conference is organized around these different stakeholder groups.

Panel 1:
Moving forward with RFRI

Moderator
Dr. Juliet Ceniza
VSU

Panelists

Dr. J. David Neidel
Asia Training Coordinator, ELTI

Atty. Jose Canivel
Philippine Tropical Forest Conservation Foundation

Belinda de la Paz
Haribon Foundation

Godofredo T. Villapando Jr.
Foundation for the Philippine Environment (FPE)

Dr. Neidel, one of the key organizers of the conference, provided an introduction to the RFRI. RFRI was initiated in 2006 as part of Haribon's ROAD to 2020 Program, which has the goal of restoring one million ha of forests across the country. Having failed to initially take root, RFRI was revitalized in 2009, when a number of organizations and institutions came together to better familiarize each other with their advocacy, site implementation, research, and capacity building on Rainforestation. At that meeting it was agreed that a stronger network was needed, which would allow the member organizations to better coordinate their activities. The main obstacles to the scaling up of rainforestation were identified and an action plan was developed that included, among other things, increasing awareness of the importance of native species reforestation through this conference and creating a website to serve as a clearing house of information for practitioners and other relevant stakeholders.

Dr. Neidel then officially launched the Rainforestation Information Portal—www.rainforestation.ph. The website was developed by ELTI in cooperation with the other RFRI members, including UP-Los Baños College of Forestry & Natural Resources, Foundation for the Philippine Environment, Haribon Foundation, NTFP-Task Force, the Philippine Eagle Foundation, the Philippine Native Plant Conservation Society, Inc., Philippine Tropical Forest Conservation Foundation, and the VSU-Institute of Tropical Ecology. The website includes a brief description of the history of Rainforestation, a graph of the

Rainforestation implementation process, and lists of some of the native species being used. It provides contact information for people who have gone through the VSU-ELTI Rainforestation Trainer's Training Program, a list of native species nurseries, and an interactive map of all the Rainforestation sites known from across the country. The website also provides a biography of Rainforestation-related publications, including PDFs of those document when available.

Dr. Neidel ended his presentation by encouraging all interested parties committed to the usage of native species to contact RFRI about becoming a member of the network. He also invited everyone to visit the website and use it as a resources to help in planning, designing, and implementing forest restoration projects and programs.

Atty. Canivel introduced the Philippine Tropical Forest Conservation Foundation and its vision of "lush and biologically diverse Philippine forests that are sustainably managed and equitably accessible to responsible stakeholders, as a collective responsibility for the greater good." The Foundation works towards that vision by providing grants, facilitating knowledge generation and sharing, and catalyzing action by government and civil society.

The Foundation has implemented over 100 projects since 2005, which have yielded many benefits for forest restoration. For example, Foundation-funded projects have produced over 1.3 million native forest tree seedlings, contributing to counter claims by the DENR about inadequate supply of native planting materials. As a result of this work, new technologies to grow dipterocarp seedlings were developed, thus reducing dependence on wildlings. The Foundation has also promoted the adoption of recovery chambers by practitioners across the country, resulting in much improved survival of transplanted seedlings. In Sablayan, Mindoro, their projects have mapped mother trees and promoted ordinances into the Municipal Environmental Codes for their protection. In Mindanao, they pro-

vided funding to test interplanting of native trees with abaca, showing that in fact abaca grows better with 60% shade, and therefore it can be combined with native trees to provide both ecological and economic benefits.

Atty. Canivel ended his presentation by explaining that the main challenges for mainstreaming native species reforestation are limited availability of seedlings, delay in the economic returns from tree planting, and limited silvicultural information on using native species for reforestation. Atty. Canivel encouraged the submission of research and project proposals to help overcome those obstacles.

Ms. de la Paz began with an overview of forest cover loss in the Philippines over the last century. To help remediate this problem, the Haribon Foundation launched the "ROAD (Rainforestation Organizations and Advocates) to 2020" campaign, which adopted the Rainforestation strategy developed by VSU and GTZ to stop further deforestation and bring back ecological functions. The ROAD to 2020 is a call for the rebirth of the Philippine's rainforests, with the vision of restoring one million ha of forest to recover and conserve biodiversity, optimize the supply of forest benefits and ecosystem services, reduce the risk of natural hazards, and enhance options for the sustainable livelihoods of local people.

The ROAD to 2020 campaign was initiated as a follow-up to the *Boto Para sa Inang Bayan* ("A vote for the Motherland") campaign, which called for a ban on commercial logging and mining in natural forests, and was signed by one million Filipinos. That campaign was a response to the huge landslide in 2004, which resulted in many deaths and injuries. Haribon decided to use the advocacy base of the initial campaign to turn one million signatures into one million ha of restored forest.

The ROAD to 2020 Campaign has forged partnerships between Haribon and LGUs, Peoples' Organizations (POs), NGOs and corporations to develop different forest restoration typologies, delineate restoration areas, integrate restoration into development plans of the LGUs, and implement and monitor sites. Partners have been grouped into geographical clusters to facilitate coordination between those working within the same region. Since 2005, at least 500,000 seedlings have been planted on 270 ha, and an additional 2,400 ha have been allocated for restoration. At least 26 events have been conducted to train more than 700 participants from communities and LGUs, and 56 household and community nurseries have been established.

The National Power Company, for example, dedicated 1000 ha for forest restoration in the Caliraya Watershed, the nearest to Metro Manila. To date 10,000 trees have been planted in Caliraya with a survival rate of 90%. Funding for these and other reforestation activities comes from Haribon's "adopt-a-seedling" campaign, which every year calls for contributions from Haribon's individual and corporate members.

To further raise awareness and build support for the ROAD to 2020 campaign, Haribon lobbies the government to protect the nation's remaining natural forest, and to mainstream native species restoration. One key breakthrough was the issuance of Memorandum Circular 2004-06 by former DENR Secretary Gozun, which integrated the use of Rainforestation in the rehabilitation of open and denuded lands within protected areas and other appropriate forest areas. To raise the profile of the program, they hold an annual Million Hectare Walk to enjoin the public in this cause, and have partnered with the nation's largest television network, GMA7, to develop a series of 30-second public service announcements that garnered them the best NGO-Corporation partnership campaign award.

Finally, Ms. de la Paz also mentioned the challenges Haribon faces in scaling up the ROAD to 2020 campaign. First, they need to continue raising the funds in order to expand their plantings. Second, they need to shift forest policies to favor conservation and restoration over extraction, as well as work with DENR to gain access to land for restoration. And last, they need to continue building buy-in from all stakeholder groups.

Mr. Villapando provided an introduction to the Foundation for the Philippine Environment (FPE), which was founded in 1992 with a USD 22 million Debt-for-Nature Swap between the United States and Philippine governments. FPE is the largest, non-government grant-making institution in the Philippines for environmental causes and sustainable development. Their goal is to reverse the rapid destruction of the Philippine natural resources by initiating programs and activities that strengthen the role of NGOs, POs, and local communities in the responsible management of ecosystems. The foundation has a strong biodiversity focus, and thus funds projects in the country's 24 biodiversity priority areas.

The foundation has been deeply involved in the implementation of Rainforestation throughout the country. FPE hired a forester from VSU who works to disseminate Rainforestation among indigenous peoples communities in their priority areas, and FPE partners have established a number of native species nurseries using the recovery chamber pioneered by VSU. They are also developing Rainforestation sites such as the Philippine Eagle Foundation's Arakan Corridor Project in Cotabato province, which seeks to establish corridors between three important areas of remaining forest. FPE has also developed simple, straightforward manuals and reference materials on topics such as nursery establishment and out-planting in the Tagalog and Bisaya languages.

FPE's work on Rainforestation also focuses on watershed rehabilitation. On September 26, 2009, the heavy rains of Typhoon *Ondoy* flooded a large section of metro Manila, causing millions in damages and claiming innocent lives. The source of much of that water was the Marikina Watershed, which is currently extremely denuded due to the practice of swidden agriculture and the use of tree-based charcoal by communities living in the area. FPE is now working with these communities to help restore the watershed for biodiversity, ecosystem function, and human livelihoods.

Mr. Villapando closed by explaining that FPE provides support ranging from small (less than PHP 200,000) to large (up to 2 million) grants, and stating that FPE is happy to work with NGOs and POs in capacity building, advocacy, research, resource mobilization, environmental defense, and project sites development.

Panel 2:
Working with the DENR

Moderator

For. Marlea Munez

President, Women's Initiatives for Society, Culture, and Environment, Inc.

Panelists

For. Marlo Mendoza

Director, Forest Management Bureau, DENR

Felix S. Mirasol, Jr.

Protected Area Superintendent, Mt. Kitanglad Range Natural Park, Protected Areas Management Board -DENR

Ms. Mirza Samillano

Planning Officer, Provincial Environment and Natural Resources Office, Antique

For. Marlo Mendoza discussed the mandate of the Forest Management Bureau (FMB), which is responsible for policy formulation, policy review, and providing advice to the DENR Secretary and field offices on forest management issues. He clarified that FMB does not directly implement forestry programs. FMB's vision is for "sustainably managed watersheds and forest resources that provide environmental and economic benefits to society, along with globally competitive industries contributing to the national economy for the benefit of upland communities." Guiding laws include the Philippine Constitution, the Revised Forestry Code (Presidential Decree No. 705), *Promoting Sustainable Forest Management* (Executive Order No. 318), and the National Protected Area System (RA 7586). Notably absent is the *Sustainable Forest Management Bill*, which was first presented in Congress in the 1980s but remains a work in progress.

There are multiple DENR policies that relate to the usage of native species:

- Memorandum Circular No. 89-17 *Prioritizing the application of ANR Method in the Development of Watersheds, Protection and Production Forests* mandates the "application of the most economical method in accelerating the reestablishment of vegetative cover that approximates the natural forests, in terms of species diversity and composition."
- DENR Memorandum Circular No. 04-06 *Guidelines in the integration of Rainforestation Farming strategy in the develop-*



ment of open and denuded area within protected areas and other appropriate forest lands provides for "the employment of Rainforestation Farming as an approach in restoring the original vegetation stand in degraded and secondary forest in protected areas and other appropriate forest land, and at the same time promoting and conserving biological diversity in the area by facilitating the natural process of succession. "

- DENR Administrative Order No. 2010-11 *Revised Regulations Governing Forest Tree Seed and Seedling Production, Collection and Disposition.* This order "promotes the use of high quality planting material from identified plus trees within natural stands and plantations in the establishment of tree plantation, tree farms, agroforestry and other forestation activities, and in the rehabilitation of watersheds and coastal areas to promote biodiversity conservation and to ensure sustainable production and supply of wood and other forest products in the country."
- Memorandum dated November 29, 2010 of the DENR Secretary *Guidelines and Procedures on the Planting, Maintenance and Removal of Trees and Other Vegetation in Urban Areas and in Areas Affected by Government Infrastructure Projects.* This memorandum provides, among other things, "the planting of trees and other vegetation in urban and certain other areas as mandated under PD 953 recommending certain indigenous species for this purpose."
- DENR Memorandum Circular 2009-03 *Supplemental Guidelines and Procedures in the Implementation of the Upland Development Program.* This directive provides guidance on the use of indigenous species in protection areas, including the use of wildlings within the natural range of the species to enhance wild populations.
- DENR Memorandum Order No. 2010-05 *Further Amending and Clarifying Certain Provisions of Memo Circular No. 2009-03 entitled Supplemental Guidelines and Procedures in the Implementation of the Upland Development Program.* The memoran-

dum encourages the use of indigenous species in reforestation by increasing the development funds for using those species to PHP 25,770/ha versus PHP 18,570 for fast growing exotic species.

Based on these policies, it should be clear that the program seeks to favor the growth and expansion of natural forests through ANR and enrichment planting, while exotics are oriented towards production areas. Nevertheless, Presidential Decree 705 is very timber oriented, which is why the FMB is advocating a new Sustainable Forestry Bill that recognizes the importance of environmental services from forests.

In order to explain how the existing regulations are operationalized on the ground, For. Mendoza described the Upland Development Scheme, wherein the FMB identified critical watersheds,

delineated production or protection zones, and then prescribed interventions based on the zoning of the area. Areas targeted for rehabilitation are planted with native species, while areas that still contain natural forest, ANR is prescribed with native species. In production zones, the use of exotic species is allowed, and farmers are asked to follow soil and water conservation measures and other environmentally sound practices.

The FMB will continue to promote the Sustainable Forest Management Bill, and to expand natural forest cover through ANR or Rainforestation strategies. They will also work to ensure the genetic conservation of dipterocarps and other native tree species as a source of high quality planting material for restoration, to strengthen collaboration with LGUs and private landowners for the use of Rainforestation in their reforestation initiatives, and to build capacity within the DENR to ensure the ongoing use of native species for forest restoration.

Mr. Mirasol spoke about his experiences conducting forest restoration in the Mt. Kitanglad Range Natural Park (MKRNP), in the Province of Bukidnon on the island of Mindanao. MKRNP covers 47,270 ha, is rich in biodiversity, and is home to many indigenous peoples including the Higaonon, Talaandig, and Bukidnon. As the headwater of three major river systems, Mt. Kitanglad supports the socio-economic development of Bukidnon and the neighboring provinces of Davao, Cotobato and Misamis Oriental.

Following the guidelines laid out by the DENR, Mr. Mirasol and his team developed a management plan for MKRNP identifying areas suitable for restoration with native species. They then marketed their programs to the LGUs, which have funded many of their projects, including Rainforestation establishment and maintenance. Some LGUs have also funded People's Organizations directly to engage in forest restoration within the park.

Mr. Mirasol's team has also been successful in partnering with the private sector. Through the Mt. Kitanglad Water Forum, for example, they secured long-term commitments to support their reforestation efforts from private companies that depend on water from the park. They collaborated with telecommunications companies that maintain communication towers on Mt. Kitanglad to conduct ANR on the mountain slopes. Finally, they have also engaged with various companies, gaining support for Rainforestation and ANR projects though their corporate social responsibility campaigns.

The managers of MKRNP also work closely with other stakeholder groups. They have developed ties with Haribon Foundation, the Philippine Eagle Foundation, and the Philippine Foundation for Environmental Concerns in activities like advocacy, conservation, and restoration. They also work with local communities, including the 11,000 inhabitants of the park itself. The communities have benefited economically through the establishment of nurseries, and involvement in all levels of Park management. The strong community support for the protected area is evidenced by the existence of over 350 guard volunteers, who help with reforestation efforts, maintenance, and the protection of sites and mother trees, as well as assist park inhabitants with the integration of native species into upland farming systems.

Mr. Mirasol cited several reasons for the success of their program. First, they have the full support of LGUs, which they have earned by building the trust of local POs, which then lobby the officials on behalf of the MKRNP management. Second, MKRNP is constantly on the cutting edge of forest restoration efforts in the Philippines through trainings by outside experts, such as the one provided by VSU and ELTI on Rainforestation, which was then echoed to their counterparts at home. Third, the development of their own native species nurseries enables them to respond immediately to requests for tree-planting events from the private sector and other stakeholders. Fourth, through a network of legislators, NGOs, and private companies, and exchange visits with other countries and other districts of the Philippines, they effectively spread their knowledge and learn from others at the same time.

Major challenges at MKRNP have included overcoming widespread prejudices against native species, often considered less desirable than exotics species due their misperceived slower growth rates, lower timber quality, and lower market value. More and better efforts are needed to increase public awareness about the benefits of native species, and to highlight the potential of native species reforestation for the mitigation of environmental and social problems affecting local communities. Lack of technical knowledge on native tree propagation, and shortage of native seeds and adequate storage techniques are also important challenges to overcome. Finally, protected area managers need to work closely with the DENR and LGUs to ensure the sustainability of ongoing reforestation efforts.

Ms. Mirza Samillano discussed the DENR's current reforestation strategy in the Province of Antique on the island of Panay in the Visayas region. Of the 202,000 ha of land in Antique, 47% is considered state forestland but only 28.6% has actual forest cover, part of which falls within the Sibalom Natural Park (SNP) and Northwest Panay Peninsula Natural Park. These parks are important for the preservation of rare and endemic species and the provisioning of water and other ecosystem services.

Between 1957 and 1988, DENR had five reforestation projects aimed at restoring 10,390 ha. Subsequent national reforestation projects targeting 3,130 ha were implemented from 1989 to 1994. However, as in other parts of the country, most of these initial reforestation attempts in Antique involved planting of exotic species.

The shift away from conventional reforestation in Antique started with the executive order to adopt ANR as a reforestation strategy. In 1994, Antique's two CENROs were asked to establish 5-ha pilot

dipterocarp forest plantations. The following year, they implemented a program to identify alternative species for reforestation, which included bamboo, rattan, and *salago (Wikstroemia ovata)*. The real turning point came in 2001, when the Haribon Foundation forged a Memorandum of Agreement with the DENR-Antique and the Provincial Government, creating an Integrated Forest Conservation and Local Governance program in SNP. As part of that program, DENR representatives and other stakeholders participated in a series of educational field trips to VSU, Nueva Viscaya, and Sabah in Malaysian Borneo.

Various projects using native species have been implemented since then. From 2005 to 2008, a project to restore priority watersheds was conducted in partnership with the National Irrigation Administration. Partnering with an NGO and funded by the UNDP Small Grants Programme, another project worked to restore 97 ha of degraded lands in SNP and in forest-edge communities. An Integrated Ecosystem Management project—the Panakuyan River Watershed Rehabilitation Project—was initiated in 2007 and has restored 140 ha. In every commissioned reforestation project, the DENR requires an 80% seedling survival rate before the contractors can turn the project over to community managers. By adopting the VSU growth chamber, the DENR and local communities have been able to achieve 90% survival rates. The success of their strategy has been verified through auditing by the Upland Development Program Assessment.

The main challenges faced by the DENR in Antique are similar to those in the rest of the country. One is appropriate species selection and adequate supply of native quality planting materials. Another stems from the loss of momentum in the projects past their initial development phase, related to the inflow of funding, which results in very low tree survival rates over the long term. Finally, anthropogenic forest fires also threaten the long-term success of many restoration projects.

Panel 3:
Working with the LGUs

Moderator

Atty. Jose Andres Canivel
Executive Director,
Philippine Tropical Forest Conservation Foundation

Panelists

Mr. Abdula Bansuan
Executive Director,
Allah Valley Landscape Development Alliance

Hon. Eufracio Maratas, Jr.
Vice Mayor, Municipal Government of Pilar,
Camotes, Cebu

Mr. Abdula Bansuan discussed the activities of the Allah Valley Landscape Development Alliance (AVLDA), an alliance of LGUs, government agencies, and CSOs in the provinces of South Cotobato and Sultan Kudarat, which is working for the protection and management of the Allah Valley watershed. The Allah Valley watershed supports 20,000 ha of irrigated rice fields, while the mountains and uplands provide habitat for biodiversity and are the ancestral homeland of the T'boli indigenous people. The main concerns of the AVLDA have to do with mitigating the impact of upstream degradation on downstream areas, which include flooding, siltation, riverbank migration, and their subsequent impacts on agricultural production, infrastructure, and social stability.

The Allah Valley watershed comprises an area of 252,000 ha, of which currently 11.2% is covered by primary forest, 9.8 % by secondary forest, and 10.6 % by mixed vegetation. An estimated 31% of the watershed is considered degraded—primarily areas of brushland and grassland— while the remaining lands are mostly agricultural. The watershed faces many challenges, among them an increasing upland population resulting in continuous clearing of forests, limited livelihood opportunities and very low income, lack of food, poor infant health conditions, limited access to clean drinking water and sanitation facilities, inadequate and unproductive farming practices, deficient public infrastructure, lack of effective local governance, risky small-scale extraction of mineral resources, and unclear land tenure.

AVLDA's challenge was to find an effective upland forest management program that was feasible given limited resources. The program needed to be economical, attractive to poor farmers, and compatible with the complex land tenure situation. It also needed to help prevent further slash-and-burn farming, increase vegetation cover across the landscape, and stabilize upstream soils to reduce the impact of downstream flash floods.

In 2006, AVLDA came up with a management program called "Rainforestation and Upland Resource Management", whose goal was to conserve primary forest and aid in the recovery of selected degraded forest and upland areas, while creating natural resources investment opportunities for upland dwellers. The program has developed models combining agroforestry, ANR, and Rainforestation techniques that contribute to increase native species forest cover while providing cash crops, such as coffee and rubber.

Still, the program faces a number of challenges, the biggest of which is how to maintain the project in the communities when financial resources are limited and poverty is severe. Over 50,000 ha need to be restored, so there is also the need to secure additional resources to scale-up the program and build more capacity within the LGUs for project development. The land tenure situation should also be addressed in order to harmonize protected area and ancestral domain management. Finally, the expansion of banana and pineapple plantation companies in the headwater areas is another threat to the project.

In closing his presentation, Mr. Bansuan emphasized that good political leadership is a key factor in sustaining this type of project. In their case, the local head of government had strong motivation to support the project and is therefore leading the efforts to see it through.

Hon. Maratas discussed his municipality's Rainforestation work as a component of an integrated watershed management plan for the small island of Pilar in the Camotes Islands. With an area of under 4,000 ha and a population of 11,000 people, the municipality of Pilar faces issues like water shortage during the dry season, soil degradation, deforestation and biodiversity loss, lack of livelihood opportunities, unsustainable agriculture methods, and conflict in benefit sharing between upstream and downstream communities.

Having implemented an award-winning marine protected area, Pilar had already proven effective in managing its coastal marine resources. However, they had been criticized for not addressing land-based conservation as well. Through their interactions with

VSU, government officials became interested in Rainforestation, which they decided to integrate into their watershed management approach. This combination attracted the support of donors, who considered that an integrated landscape-scale plan had better chances of success. Activities aimed at institutionalizing Rainforestation have contributed to build the capacity of many stakeholders, resulting in increased community participation, and better collaboration between villages in the highlands and lowlands. The project has also been a catalyst for farmers associations to initiate livelihood projects such as tree nurseries and beekeeping. So far, Rainforestation in Pilar has been used as a tool for water, soil and biodiversity conservation, providing strategic direction for an integrated approach to natural resource management in the island.

The vice mayor stressed several factors that have led to their success. First, partnerships between academia, NGOs and LGUs have been a key element, as they have allowed the municipality to receive technical assistance from VSU, ELTI, and others, helping to overcome the limited local capacity, as well as to experiment with various sustainable development approaches. Second, the presence of a strong cooperative farmers' group working closely with the LGU has been essential for the sustainability of the project. Donors are often unwilling to fund LGUs directly, and this cooperative relationship provides access to additional funding sources. Third, the local government has demonstrated creativity to seek funds, and integrity to manage them. Contrary to the common perception, Hon. Maratas believes that there is plenty of funding available for those who know how to package and market their project.

The vice mayor suggested that Rainforestation also makes good politics. While most politicians only interact with rural constituents during election season, concrete projects like Rainforestation require that LGUs and local communities work together. This not only helps to build trust and establish closer relations, but it also lays the foundation for additional actions to be taken.

Panel 4:
Working with Local Communities

Moderator

Mr. Marlito Bande

Instructor and Extension & Training Coordinator, Institute of Tropical Ecology, VSU

Panelists

Mr. Apolinario Cariño

Executive Director, Pederasyon sa Nagkahiusang mga Mag-uuma nga Nanalipud ug Nagpasig-uli Kinaiyahan Inc. & Mt. Talinis People's Organization Federation, Inc.

Mr. Dolphy Luib

Agroforestry Committee Chairman, Ihawan Spring Stakeholders Association (Tandag)

Mr. Renato Poliquit

Chairman, Cienda-San Vicente Farmers' Association (CSVFA), Leyte

Mr. Cariño spoke about his experience as a Rainforestation practitioner and community organizer in the province of Negros Oriental. Only 4% of the island's original forest cover remains, due to a long history of subsistence agriculture, logging, charcoal production, and large-scale plantation agriculture (traditionally sugar cane, and more recently jatropha and cassava). Forest loss on the island is also related to a rapid growth population, which has increased pressures on the remaining forest areas.

In 1994, the Foundation for the Philippine Environment provided funding to begin conserving the remaining forests of the Mt. Talinis area. The Rtn. Ting Matiao Foundation organized local community members of Mt. Talinis into 10 POs and joined them into a federation, MTPOFI. Meanwhile the Siliman University Center for Tropical Studies organized nine POs in communities located around the Balinsasayao Twin Lakes into PENAGMANNAKI network. The DENR worked with these and other communities to conduct a number of reforestation programs, but these approaches largely relied on the planting of exotics.

The shift towards using native species started with in 2005 when Haribon Foundation sponsored Mr. Cariño and four other people from the POs to attend a Rainforestation training at VSU. Following that training, Mr. Rene Vendiola started developing a one-ha demonstration site on his own property, while Mr. Rico Mier worked with a local People's Organization to develop a 15-ha site in the Twin Lakes

area. Mr. Cariño then started a one-ha demonstration site along the Malangwa River in 2008. Through these efforts, they slowly built up native species nurseries by collecting seeds and wildlings from forest patches in remote areas of the uplands. To date, Mr. Cariño and his colleagues have planted 17 threatened dipterocarp species, more than 150 non-dipterocarp species, as well as numerous ornamentals. Through word of mouth about the demonstration farms, the Rainforestation approach has spread around the community.

Mr. Cariño and his colleagues have collected data on potential financial benefits from Rainforestation, showing that the impacts of the program can be significant. For example, in one year a single farmer earned USD 200 from selling ornamental plants and coconuts, USD 525 from lanzones *(Lansium domesticum)*, USD 1,500 from seedlings, and USD100 per person as bird guide for visitors to his farm. Bird populations in the area have increased significantly with the re-establishment of native forest cover, as have those of bats, bees, and butterflies, opening ecotourism opportunities for the communities.

Mr. Cariño has worked closely with LGUs and a number of funders to expand their Rainforestation projects. In 2008 they launched the Valencia Watershed Rehabilitation Project on 70 has and the Baslay/Dauin Rainforestation project on 30 has; in 2009 they expanded their efforts with the Malangwa and Lawigan Watershed Rainforestation Program, consisting of 40,000 seedlings in the upland area of Bacong and at Barangay Mantiquil, Siaton with 20 has. At each of the sites, families raise trees for sale and personal use in their own nurseries.

For Mr. Cariño, the expansion of Rainforestation efforts poses a significant challenge in terms of monitoring and evaluation. Keeping up with the ever-growing amount of documentation needed to report their progress is difficult, but they are working to improve their capacity on this front. He is also aware of the need to further improve and increase education and awareness campaigns to reach out to the communities and keep them excited about the projects.

Mr. Luib spoke about his experience working with local communities through the Ihawan Spring Stakeholders Association, which was founded in 1997 and has 36 members. The Association is currently engaged in protecting and conserving the Ihawan Watershed under a co-management agreement with the DENR and the Tandag Water District . The Ihawan Watershed is extremely important in that it provides drinking water to the city of Tandag. The members have used Rainforestation activities to restore the degraded watershed, establishing native tree nurseries and a wildlings collection program to support tree planting and agroforestry systems. They have been successful in part due to collaboration with various stakeholders including the LGU, DENR, Tandag Watershed District, Haribon Foundation, and others. There have been some challenges, however, with non-observance of environmental laws and ordinances, but the collaboration amongst different agencies and the co-management agreement have been key to success and sustainability.

Mr. Poliquit provided an introduction to the Rainforestation program of the Cienda-San Vicente Farmers' Association. Sitio Cienda is located at the base of Mt. Pagasugan, where Visayas State University (VSU) is situated, near the town of Baybay, Leyte. The population of 636 people has an annual growth rate of 2.6%. The primary source of livelihood is lowland and upland farming, livestock production, and wage labor. Prior to the formation of the farmers' association, some of the villagers were involved in illegal logging as well.

Three hundred has in the region are considered Alienable & Disposable (A&D), while the vast majority is considered state forestland. In 2000, the community was awarded a land grant of 2,236 ha of forestland from the government on which to build a CBFM program focused on the conservation of intact forests and restoration of degraded areas.

Given their close proximity to VSU, the Cienda-San Vincente Farmers' Association has been actively involved in the development of Rainforestation from almost the very beginning of the program. Starting in 1996, they established a one-hectare Rainforestation farm outside the awarded CBFM area, and a 1.4-ha genetic resource bank, where they planted 2,500 forest trees of 50 different species. They have set up a five-hectare orchard plantation comprised of durian, marang and lanzones, and managed a seven-ha ANR site where they planted 5,000 rattan seedlings. They have also established a 32-ha agroforestry Rainforestation site in a multi-use area of the CBFM area where root crops and vegetables were inter-planted with trees, which had the added benefit of stabilizing the soil along riverbanks.

The community nurseries have become a profitable business, enhancing association members' household incomes. Between 1997 and 2009, the association sold over one million pesos worth of native tree seedlings to different agencies such as VSU, the Del Monte Corporation, Haribon Foundation, church groups, and individuals.

Through their involvement with Rainforestation, the farmers and their families have gained practical environmental education, which has led to a real commitment to protect their forestlands. They have started a voluntary group of forest wardens to protect the CBFM area, and each summer they conduct a youth camp that teaches children about nature and the importance of protecting the forest. The association also conducts farmer-to-farmer trainings on Rainforestation farming and nursery production.

The community's involvement with Rainforestation has yielded numerous positive benefits. For the individual members of the association, the Rainforestation project has boosted self-confidence and improved quality of life. For households, it has meant food security, a steady supply of water, a steady source of fuelwood and lumber for house construction, and more. At the community level, the people have control over their own resources, and steady employment. For the greater community, the project has increased forest area and biomass, enhanced biodiversity, regulated water for the lowlands, and improved ecological services.

The association learned valuable lessons from the project and were able to attract significant funding from government and the private sector. They also learned to conduct community organizing processes in cost effective ways. They found that the use of native tree species in restoration was a vital input for successfully protecting the existing natural forest. Finally, providing training and outreach via farmer-to-farmer and family-to-family training exchanges proved to be very successful strategies for adaptability and sustainability of restoration efforts.

Panel 5:
Working with the Private Sector

Moderator

Mr. Blas Tabaranza
Director, Haribon Foundation

Panelists

Mr. Darwin Flores
Senior Manager for Community Partnerships, SMART Communications

For. Estrella Pasion
Protected Area Associate, Conservation International- Philippines

Mr. Carson Tan
CEO & President, Aquabest
President, Water Quality Association of the Philippines

Mr. Flores provided facts and figures about the SMART Communications Company. They currently have over 40 million mobile subscribers, 1.2 million wireless broadband users, 5,000 employees, and provide coverage in all municipalities in the Philippines. As a large company, SMART has considerable influence, and is one of a number of business organizations working toward social progress, environmental conservation, education, and disaster response and recovery.

SMART's reforestation program started off with scattered tree planting initiatives by their mountaineering club, which by 2006 had planted roughly 50,000 trees. In 2007, they participated in the *Trees for Life* campaign, planting 100,000 trees, but the initiative was stalled when they ran out of seedlings. Since then, the company has planted more than 300,000 trees every year.

SMART's tree planting efforts are carried out by their employees, who are granted a community service leave for such purpose, usually on Fridays. On any given Friday, they are able to plant roughly 3,000 seedlings, with the peak season running July through November. At each reforestation site, the company commits to a three-year presence, enough time to allow for trees to stabilize. SMART only plants trees where there is significant community presence to maintain the plantings and/or with previous blessing of the LGU. The company readily acknowledges their lack of technical expertise to implement and evaluate reforestation projects, so they seek the guidance of the DENR and NGOs.

One of their 26 reforestation sites around the country is the 28,000 ha Marikina Watershed Initiative. The watershed requires at least a 54% forest cover to function properly, which will demand an additional 9,000 ha reforested. This project aims to mitigate the effects of another strong typhoon such as the one that devastated the metro area in 2009.

Their reforestation program helps SMART meet the internal mandate to reduce their carbon footprint. While they seek market opportunities and synergies with other companies to achieve this, they rely on communities and NGOs to organize and maintain their reforestation efforts. Among the challenges the company has faced are lack of clarity in environmental policies, and the conflicting priorities among stakeholders, who demand cleaner environment and more livelihood opportunities.

Despite the size of the company, SMART has limited resources for the task at hand, and their primary commitment is to their shareholders. In their view, public projects are the government's responsibility, and they do their part paying corporate taxes. Still, they do this because they think healthy people and a healthy environment make for a healthy business environment.

For. Pasion discussed CI's two forest carbon projects in the Philippines. The strategy with these projects is to focus on key biodiversity areas, where species biodiversity is both high and threatened. To implement the projects, CI collaborates with a variety of partners using participatory approaches. Among the benefits expected from these forest carbon projects are sequestration and storage of carbon, provision of habitat for wildlife, natural resources for people, ecological services, local employment and income, and the maintenance of healthy ecosystems that are resilient to climate change.

The carbon credits generated by forest carbon projects can be sold in two types of markets: the regulated market, largely limited to the

Clean Development Mechanism (CDM), and the voluntary market. Carbon project require a carbon supplier, which can be a community or Peoples' Organizations, and a carbon buyer, often a donor or corporation. One ton of CO2 (or its equivalent in other gases) generates one carbon credit, and the price per credit varies but, is generally higher in the regulated market. Globally, CI is involved in two types of forest carbon projects: those that have to do with Reducing Emissions from Deforestation and Forest Degradation (REDD+), and those dealing with reforestation and agroforestry.

CI's first forest carbon project in the Philippines targeted a very large area. The first project site in Quirino was 13,000 ha but proved too ambitious. While carbon calculations may be impressive on paper, the real viability of the project is a different story. An important lesson from this first experience was the need to think about the long-term sustainability of the project. Since then, CI has refocused their efforts on much smaller projects under 200 ha.

Seeking to attract private investors to fund their carbon projects, CI created small pilot reforestation and agroforestry projects, relying on farmer participant's expertise for species selection. Mahogany and *Gmelina* were consistently preferred, so some convincing was required for them to give native species a chance. Biodiversity impacts, economic benefits, and availability of seedlings were also important criteria for species selection. During verification by an outside auditor, CI was asked to prove that mahogany was not an invasive species; unable to do this, they had to remove mahogany trees from the project.

The Quirino Forest Carbon project consists of 95 farmer participants who have certificates of stewardship, and one large private landowner. Fourty-one of the 177 ha were established in 2009, with the remaining 136 ha scheduled for establishment in 2010. The pilot project was funded by a Japanese music group, who wished to offset their travel-related carbon emissions and therefore, purchased USD 287,000 worth of carbon credits in the voluntary market upfront. Despite CI's previous experience with forest carbon projects, the project failed to pass the first round of validation, proving the difficulty of the process. The project was finally validated after adjustments were made, including the need to discontinue the use of mahogany.

Over its twenty-year life cycle, the Quirino project will sequester an estimated 41,000 tons of carbon dioxide (CO2), generating carbon credits that will provide livelihood opportunities for communities, as well as improving habitat for biodiversity, and enhancing ecological services. Verifications by an external auditor every five years will confirm the fulfillment of the carbon targets. The pilot projects left important lessons about species selection, and provided CI with an opportunity to test and refine their mechanisms for mobilizing the local community, DENR and local LGUs.

Another CI forest carbon project is Peñablanca, where agroforestry and native species are being used to reforest 2,943 ha. The project design earned a Gold-level standard for exceptional biodiversity benefits under the international Climate, Community and Biodiversity (CCB) Alliance Standards, a voluntary market standard that focuses on the ecological and social co-benefits. Toyota Corporation has provided funding for this project as part of their corporate social responsibility mission. In addition to promoting tree planting, the project seeks to increase market access for local products, to increase awareness and engage communities for long term conservation, to combat deforestation by planting easily accessible fuelwood for cooking stoves, and to establish a reforestation fund. The expected net carbon sequestration for this project is 362,920 tons.

Among the key challenges faced in these forest carbon projects are the stringent criteria for site eligibility, which require individual farm lots to be contiguous. Carbon ownership and revenue sharing between the private sector and local communities were also an issue, as the latter felt they were not empowered to become project proponents. Getting farmers on board was also difficult because the concept was so new, and the visible short-term benefits were few given the long time it takes for carbon revenues to accrue. Once the farmers agreed, building capacity to start and maintain the project was also challenging, as new agroforestry and reforestation designs, suited specifically for carbon requirements, needed to be learned and adopted by the farmers.

Created in 1998 with 100 members, the Water Quality Association of the Philippines is a non-profit organization with over 700 members from the water industry. Their mission is to continually provide information on water quality and treatment to help prevent water-borne diseases in the country. The Association's tree planting project is motivated by a common shared value over the public right to clean water.

For the Association, raising the money and buying the seedlings was by far the easiest part of the project; mobilizing volunteers and organizing the plantings have been far more difficult. Their biggest challenge lies in aligning the interests and actions of numerous partners, and their lack of financial and human resources, and technical capacity to carry out reforestation on the ground. Thus, they have partnered with Haribon Foundation and others in order to properly plant and maintain the trees. So far, the Association has planted 1,500 seedlings every year since 1998 as part of Haribon's ROAD to 2020 Campaign, which calls for one million ha reforested in the Philippines.

The Water Quality Association's motivation is simple: no trees means no water, which means no business for them. They absolutely need healthy forests for their industry to survive, so they will continue to plant trees and support the ROAD to 2020 campaign for years to come.

Closing Remarks

Dr. Nereus Acosta

Associate Professor, Asian Institute of Management & Ateneo de Manila University

Dr. Acosta started his closing remarks by citing a saying heard often during the recent presidential campaign trail, which stresses the importance of forests to all of society: "No forests, no watersheds; No watersheds, no water; No water, no rice; and No rice, No society."

In order to move forward with forest restoration, Dr. Acosta suggested that we needed three "I's", namely *Information, Involvement,* and *Institutions*. In order to succeed and move forward, Rainforestation requires a substantial scientific base of *Information,* aided by information technology as exemplified in the new RFRI web site. *Involvement* calls for the meaningful engagement of different sectors and their participation with community-based local governance and private sector initiatives. Last but not least, *Institutions* are important for good governance, from the community to the national level, as they are the ones who can implement sound science-based policies.

In moving forward, there is clearly a need to bridge the gaps of information and involvement with solid institutions that are forward looking, far reaching, sustainable, and able to take corrective measures where necessary. So far, however, many institutional structures have proven inadequate for the challenge. For example, after DENR Secretary Gozun issued a Memorandum Circular supporting Rainforestation as a strategy for environmental conservation, subsequent secretaries have failed to provide sustained support for forest restoration, as needed. Previous failures in reforestation can also be attributed to the high turnover at the top levels of the DENR, which over a period of only nine years have had eight different secretaries.

Other institutional obstacles to forest restoration will also need to be overcome. Despite the constitutional mandate, for example, there is no clear law that enables forest delineation, which should be the backbone of a comprehensive national land-use policy. The law was introduced to congress but did not make it too far, presumably

blocked by the private interests of a prominent politician who happens to be a big real estate developer.

Dr. Acosta called for a renewed emphasis on forest restoration, based on the integration of science and good policy. Increasing understanding of the country's rich biodiversity and ecosystems is a key part of this process because, as a saying goes, "We cannot really love what we do not understand, and we cannot truly protect that which we do not love." Promoting a better understanding of the richness of the country's biodiversity and ecosystems would lead to a greater awareness and determination to protect and restore it.

Dr. Acosta finished his Closing Remarks by paraphrasing President Abraham Lincoln at the height of the Civil War: "The quiet of conventions in the past, are now inadequate for the challenges of a stormy present, so we must think anew, we must build anew, and we must forge forward anew."

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Glossary of Terms

Advanced Regeneration

Trees seedlings or saplings that have become established without human intervention.

Assisted Natural Regeneration

Management steps taken to protect advance regeneration from disturbance, like fires and grazing, while promoting their growth (e.g., with fertilizer or mulch) while suppressing competition from other plants.

Clean Development Mechanism

A mechanism created as part of the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC) that allows Annex 1 countries (i.e., those industrialized countries and countries with economies in transition that have obligations to reduce or minimize their GHG emissions) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries.

Climax Species

Slower-growing, shade-tolerant species that tend to colonize slowly into a disturbed site. Also referred to as "late successional species."

Early Successional Species

Shade-intolerant, fast growing species that colonize quickly after a disturbance. These species are also referred to as "pioneer species."

Floristics

The study of the distribution and relationship between plants in a particular location. See also "initial floristics" and "relay floristics."

Framework Species Method

Method of forest restoration first developed in Queensland, Australia which seeks to restore forest biodiversity and natural succession processes by planting 20-30 tree species that have been identified for their rapid growth, high survivorship, broad dense canopies, ability to resprout after fires, and attract seed-dispersers, which are relied on to bring in additional tree species.

Guild

Groupings of trees based on similar ecological and structural characteristics

Initial Floristics

Forest regeneration (or succession) process in which early successional and late successional species are on the site immediately following disturbance

Late Successional Species

Slower-growing, shade-tolerant species that tend to colonize slowly into a disturbed site. Also referred to as "climax species."

Miyawaki Method

Method of forest restoration developed by Dr. Akira Miyawaki which relies on the high-density plantings of large numbers of species to return the structural, functional, and compositional characteristics of natural forests.

Pioneer Species

Shade-intolerant, fast growing species that colonize quickly after a disturbance. These species are also referred to as "early successional species."

Rainforestation

Native species reforestation approach developed by Visayas State University and GTZ, which initially focused on the integration of native species into agroforestry systems, but which has since become diversified to include the usage of native species for a wide range of management objectives.

Reducing Emissions from Deforestation and Forest Degradation (REDD and REDD+)

REDD is a mechanism to use market or other financial incentives to reduce GHG emissions from deforestation and forest degradation. REDD+ expands the scope of eligible activities to conservation, sustainable management of forests, and enhancement of forest carbon stocks.

Relay Floristics

Forest regeneration process in which pioneer species arrive first after a disturbance. Over time they alter site conditions allowing for the colonization and growth of late successional species.

Environmental Leadership & Training Initiative

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