Society of American Foresters

International Forestry Working Group Newsletter

Working Group B3

In affiliation with the International Society of Tropical Foresters

December 2018

Contributed Articles

HUMAN ACTIVITIES PUT RAINFOREST RESERVE IN SHAMBLES

By: Dr. Edward D. Wiafe
Presbyterian University College, Ghana

The resident primate species of the upper Guinea Forest of West Africa are one of the groups of animals that are under serious threats and the population has been declining within its range as a result of habitat destruction and hunting. The Tano-Offin Forest Reserve (TOFR) falls within the Atwima District of the Ashanti Region of Ghana and is situated between the Kumasi–Wiawso–Tepa and Kumasi–Bibiani roads. It lies between longitude 1º 57' and 2º 17' W and latitude 6º 54' and 6º 35' N. The site comprises much of the Nyinahin hills, which run north-east–south-west, with Aya Bepo (740 m) the highest point, and which serve as the catchment area for several streams, tributaries of the Tano and Offin rivers. The reserve falls within the moist semi-deciduous forest zone and includes 34,100 ha of upland evergreen forest and lies within the Tropical Humid Climatic Zone. Hall and Swaine (1981) described the structure of the original vegetation of being a single high canopy with a sparse woody understory.

Picture 1: Jolting road connecting the adjacent communities and TOFR

Based on the above description of the original forest and other publications, it was suspected that the reserve could habour a number of endangered primates. Hence a primate survey was undertaken to census this taxon as part of the project entitled **'Promoting endangered primate's conservation in three forest reserves in Ghana'** funded by the Critical Ecosystem Partnership Fund (CEPF) through Birdlife International. A total of 100km walks were done on transects.

Picture 2: Team members preparing for transect walk in the TOFR

It was found that the forest vegetation has been mostly converted to farms predominantly plantain and cocoyam; and uncultivated areas have also been burnt through bush fires. Closed forest are left in isolated patches on slopes of the hills and along some valleys.

Picture 3: Plantain and Cocoyam farms within the TOFR

No diurnal primate was encountered i.e., neither sighted, calls heard nor any signs to indicate their presence in the area. No primate was found on any of transects surveyed or other areas outside transects.

Picture 4: Scanning activity by project leader Dr. Wiafe

According to a hunter's accounts when ‘*’he (Douglas Halo) first came to the area in 1975, and at that time there used to be Western Chimpanzee, Black and white colobus, olive colobus, Lowe's and spot-nosed monkeys but it has left with only few Lowe's and spot nosed monkeys, that are very difficult to hear these days’’*.

The major threats identified to affect primates in TOFR were as follows: Farms, chainsaw activities, hunters, hunting camps, and empty cartridges. Chainsaw lumber operation activities are also very rampant and species that are left scattered are being harvested by chainsaw operators. The chainsaw operations are massively ongoing without any fear. As the woods are being split into lumber, trucks were also ready to convey the lumber to the market centers.

Figure 5: Illegal logging activities within the TOFR

Picture 6: Hunting house and some cartridges sighted inside the TOFR

The survey team met a lot of hunters during the period and they all indicated that the rate of the vegetation degradation demands that they must clear all the animals before the forest gets finished totally.

Picture 7: Dr. Wiafe (right) interacting with some hunters during the survey

Mining activities were also found to cause a destruction to the forest. Even the forest has been earmarked as a bauxite mining concession to a mining company to mine bauxite and illegal gold miners (galamsay) were also operating at the remote parts of the reserve.

Picture 8: Mining activities ongoing at the TOFR

To give way to further farming, the farmers intentionally set fire and burn the natural forest to degrade it so as to give way to further farming. The hunters, farmers and other gathers depend on old mining camp as a resting place for their activities. They also depend on the bauxite mining road to cart their farm products and chainsaw lumber. It must be noted the government has permitted a company (Exton Cubic Company) to mine bauxite in the forest and this has given the impression to the inhabitants of the fringe communities that the mining will destroy the forest so they better utilize it for farming.

The accelerated massive rate of natural habitat destruction does not support primate existence in the reserve.

Picture 9: Cleared land cover of some part of the TOFR

There are no strategies to control, deter or arrest the people who are involved in these activities. The sign posts (informing encroachers to keep off) at the north of TOFR are not deterrent enough to farmers, hunters and/or chainsaw operators as they usually park their goods close to it.

Picture 10: Sign post located North of TOFR does not serve the deterrent purpose.

All hope is not lost yet, strategies to promote natural regeneration of the degraded forest must be designed and implemented with all seriousness.

CRITICAL ECOSYSTEM PARTNERSHIP FUND

Guinean Forests of West Africa Regional Implementation Team

GFWA GUINEAN FORESTS OF WEST AFRICA

BirdLife INTERNATIONAL

DISCIPLINE IN LEADERSHIP

Issued by
Communications
PUCG-Endangered Primate Conservation Project

Follow us: https://web.facebook.com/primateconservationprojectGhana/

Cooperation between foresters from Cambodia and the Czech Republic

Hana Habrová[1], Monin Von[2], Petr Němec[1], Petr Maděra[1]
1/ Mendel University in Brno, Faculty of Forestry and Wood Technology, Zemedelska 3, Brno, Czech Republic;
2/ Royal University of Agriculture, Faculty of Forestry Science, Phnom Penh, Cambodia

During 2017-2018, a project called "Strengthening of Practical Education, Field Research and Scientific Publication on Faculty of Forestry, Royal University of Agriculture, Cambodia" has been implemented by Mendel University in Brno in the frame of "Placement of Czech Teachers to Developing Countries" programme granted by Czech Development Agency.

The aim of this project was to increase the expertise and level of higher education and research. Thus, the project aimed to support the development of scientific publishing activities at the Faculty of Forestry at the Royal University of Agriculture, especially through the support of inter-university cooperation with the Faculty of Forestry and Wood Technology of Mendel University in Brno. The project was focused on the quality of education at the RUA´s Faculty of Forestry by implementing multidisciplinary practical education, purchasing relevant literature and establishing several research experiments.

Research activities were principally held in Mondulkiri province, where experimental plots were established inside coffee plantations. The aim was to evaluate the effect of shade on Robusta coffee yields towards observation differences in coffee plants grown under shade and on a direct sun, evaluation of coffee quality and economical value of shade trees. All research was carried out by local students of the Faculty of Forestry who were also trained in operations with suitable equipment for measurements. A productivity and berries quality of coffee plants growing under shade trees were compared with those of coffee plants growing under direct sunlight. The results show that shade-grown coffee has comparable yields with the monoculture plantations.

Secondly, the project focused on providing field excursions. Presentations about field research methodology, important software and equipment took place prior to the field excursions. They were located directly on the Faculty of Forestry Science in Phnom Penh. Afterward, the students and teachers of the Faculty of Forestry Science of RUA were traveling around 7 provinces, to various commercial companies, or community organizations, the Province Departments of Agriculture, Forestry and Fisheries, the Province Departments of Environment, and various Protected Areas including National Parks. A part of the students was also taken to the field to take part in field floristic research.

As a result, some of the students decided to write selected topic as their final theses. The support of the Czech Development Agency enabled Cambodian students to overcome problems more easily in their thesis writing which could yield more fruitful results. In the research fieldwork program, the students were exposed to the practical environment with Czech lecturers and could learn the new technologies on how to collect data in a modern way. It was an eye-opening opportunity for them to learn new techniques on site. Apart from receiving an alternative practical education, students received different cultural experience and created a social bond.

HURRICANES AND THE FUTURE OF EL YUNQUE NATIONAL FOREST, PUERTO RICO

Nick Brokaw, Sheila Ward, and Hervé Chevalier
nvbrokaw@ites.upr.edu; *sheila.emily.ward@gmail.com*; *hercheve@yahoo.fr*

Hurricane María struck El Yunque National Forest, Puerto Rico, in September 2017. The storm changed the subtropical wet forests of El Yunque from a closed-canopy forest to a landscape of downed trees, bare poles of delimbed and defoliated trees, and an understory mosaic of debris and open groundlayer. It appeared to be a catastrophe.

But ecologists in the Luquillo Long-Term Ecological Research Program, who have worked at El Yunque since 1988 and earlier, had seen this "catastrophe" before, when Hurricane Hugo had similar impacts in 1989. Since Hugo, the bare trees had resprouted limbs and leaves, advance regeneration had grown into the subcanopy, and thousands of seeds had germinated and become established trees. In the 28 years before Hurricane María the forest had nearly recovered its pre-Hurricane Hugo structure and composition. It will recover after Hurricane María also.

That is, if climate change allows it to recover. After Hurricane Hugo it was calculated from historical records that the average interval between impacts from such strong storms at El Yunque was 50-60 years (an average, including longer and shorter intervals). But after María (and moderately strong Hurricane Georges in 1998) the average interval between strong storms is calculated as 39-44 years. This shorter interval concurs with climate model predictions that there will be more, strong Caribbean hurricanes in the future. In fact, including Hurricanes Hugo, Georges, and María there have been three strong storms in just 28 years.

A shorter interval between strong hurricanes could have many effects on plants, animals, and biogeochemistry of the forest. More strong hurricanes might produce a shorter forest of especially hurricane-resistant, smaller tree species, creating understory conditions that favor regeneration of a new and more limited set of tree species. A shorter forest may have a shorter gradient of niche space that supports a more limited set of other plant species and animals. For example, epiphytes sort themselves out on a gradient from near ground level to canopies in tropical forests, as do insects and thus the animals that eat insects. These groups may be less diverse in the future forest. As for biogeochemistry, a shorter forest of changed trees composition would likely have a different hydrology and water chemistry, because precipitation throughfall amount and impact, stemflow amount, and chemical leaching to throughfall and stemflow from leaves and stems would change.

Other changes are likely, such as carbon storage, but a sad change really stands out. It will be both a functional and esthetic loss if "charismatic megaflora", the especially big trees, are lost from the forest.

(*The Luquillo Long-Term Ecological Research Program is supported by the U.S. National Science Foundation, the University of Puerto Rico, and the USDA International Institute of Tropical Forestry*.)

Forest Harvest: much more than simply cutting down trees

A 30-minute efficiency increase per day per machine, depending on the number of machines and operators, can generate a cost reduction estimated at millions of reais

Artur Barbarioli Goncalves

Brazil has always been a country with a powerful agribusiness sector, especially in the forest area. In recent years, much has changed in relation to awareness-raising, adoption of public policies and the new practices that foster a more sustainable forest management.

In the management of renewable forests, the first stage to be considered is the selection of the most suitable species and genetic material for each region, according to the production objective and the specificities of climate, soil and relief, since obtaining a higher productive return depends on the choice of the species. After the definition of the species begin the processes of seedlings production, soil preparation, planting, forest maintenance until the harvesting, which marks the end of the cycle of a sustainable forest planting, thus allowing another cycle to get started on the same ground.

Since the 1990s, with the opening of the market for imports and the entry of foreign companies in Brazil, there has been a significant increase in investments in mechanization of harvesting processes, which has led to a strong growth in this sector.

Large forestry companies around the world are now using large machines with high capacity in their operations. In this regard, the high investments in mechanization, made it necessary to use management tools that help companies to make the best possible use of these resources.

In the mechanized harvesting process, factors such as terrain declivity are considered a major problem for the operation due to the risk involved in using these machines on very winding terrain. Another important issue is how to extract the felled wood from the hillsides. Harvesting in such areas imposes challenges not only with regard to the machinery to be used in the operation, but also in the harvesting planning for these areas with strategies for the transport of the harvested wood.

In many regions in Brazil, the planting of renewable forests is done in predominantly flat areas, facilitating the whole process of planting, harvesting and transport, reducing risks, costs and increasing the operation productivity. However, both in Brazil and in other countries, it is also necessary to make plantations in hilly areas.

Growth cycle of the forest species

Another relevant factor which can influence the harvest planning is the timespan of the forest growth cycle. The large forest-based companies in Brazil have eucalyptus plantations, a species that, thanks to climate, soil and other factors, finds favorable conditions. The growth cycle takes

thus 6 to 7 years on average. Another species group − pinus − is more adapted to colder climates and has a slightly larger cycle. Of course, the cycle depends on several factors, including the purpose of the use of the timber. When the timber is to be used for industrial processes, e.g., cellulose industries, MDF manufacture or even carbonization for power generation, there is no need for thick logs, which enables the cycle reduction. In turn, when the purpose of the timber is for milling, regardless of the species, there is of course a need for a longer cycle so that the trees have time to grow.

In Portugal, however, even with the planting of eucalyptus, the average cycle is 12 years, which is almost twice as much as the Brazilian average, which is mainly due to climatic factors. In Chile, which has a rigorous winter, there is a strong timber market with focus on pine trees and the cycle can reach up to 24 years. Within all this time, what is being harvested today was planted under very different planning conditions and technologies.

In this regard, the time factor becomes very relevant, because elements such as road planning according to the adopted harvest technology are critical for the coming harvest. How to plan and build roads also takes time, therefore, companies need to anticipate their concerns about harvesting, preparing themselves up to three years before starting the operation. This period is necessary to carry out the most optimized road construction planning. Factors such as the release of permits, compliance with legal and environmental requirements and the preparation of the area where the timber will be kept for later transport will also require a lot of attention.

When the areas are predominantly flat, the roadside itself becomes a place for keeping the timber (Figure 1).

However, building large roads enough to support the timber in high declivity terrains becomes very expensive, and it is necessary to plan timber depots (Figure 2).

In this image it is possible to observe a set of roads and some points that represent these depots. The depots are usually planned considering: the best location, in order to optimize the construction cost (of the depot and road) and also the range of the harvesting machines. Also commonly used are tower yarders with cables to collect fallen trees in sloping areas. In these areas with the longest harvest cycle, it is common to take advantage of the road constructed areas for post-harvest planting.

The planning of the next cycle is carried out only after 24 years, taking into account the conditions and harvesting equipment by that time.

In the face of all these challenges, harvest planning managers use reliable information management tools to solve complex problems and support their decisions.

In the United States, for instance, there are other challenges, as there is a great variability of tree species in the farms and, without physical boundaries such as roads, planning is carried out considering the spatial occupation. In this case, it is necessary to use more specialized tools to plan the entries and/or greater human effort to carry out the timber harvesting and transport planning.

Efficiency and productivity of machines

After overcoming the challenges of planning, companies begin to focus on achieving efficiency and productivity in the execution of the harvest itself.

Today, many technological innovations are being incorporated into machines and equipment to maximize productivity and minimize risks and costs. With the possibility of greater use of IoT (Internet of Things), companies capture data generated by the machines (the machine itself and also its heads) to evaluate the reasons for downtime, the time that the equipment is turned on or off, among other aspects. These analyses help companies identify opportunities for increased efficiency. A 30-minute efficiency increase per day per machine, depending on the number of machines and operators, can generate a cost reduction estimated at millions of reais.

There are numerous challenges that need to be overcome in the day-to-day business of forest companies in order to achieve operational excellence. Specifically in the harvesting process, it is important that managers can count on a good management system to support all stages of the activity, starting with a planning with reliable, structured and fast information to support better decision-making, and, during the execution of the harvest, with the information captured from the machines, be possible to perform the quality control of the operations and the continuous process improvement.

https://www.inflor.com.br/en/forest-harvest-much-more-than-simply-cutting-down-trees/

Haiti Reforestation Opportunity

By
Stanford T. Hovey

In a previous ISTF Newsletter article, I wrote a plea for a collaborative effort by all groups interested in Haiti's reforestation future to begin working together. Since then I have been contacted by Mr. Calherbe Monel, who has emigrated from Haiti 27years ago and working with numerous organizations both in Haiti and the US, to bring sustainable solutions to the many challenges that Haiti faces. Mr. Monel holds a very unique position in Haiti. He is currently serving as Special Advisor to Mr. Rosny Cadet, the President of the Youth Government of Haiti; reporting directly to Mr. Cadet and the President of Haiti. We met in Hampton, VA on November 6, 2018 and established an initial plan to begin a collaborative effort to "ENGAGE THE CHILDREN OF HAITI" in a nationwide reforestation program. This is not the only long-term way the Haitian children and youth will be energized to serve their country, but is one of the best ways to quickly orient this precious human resource where they can see the fruits of their labors to benefit their own future—any enjoy them!

The crux of a vision explains Monel is to launch a "1,000,000/100/10 Campaign" (1million/100/10) with the Youth Government of Haiti. The "1,000,000/100/10/ Campaign" (1million/100/10) is set to have 1million youth to volunteer 100hours per year for 10years to plant and maintain tree growth in Haiti. The campaign is set to have a series of strategic efforts to mobilize the youth, create partnerships, raise funds, and manage the campaign.

To date, this has been coordinated with a group of volunteers in the US and the staff of the Youth Government in Haiti and received with enthusiastic support from the official government of Haiti.

The next steps are to create strategic partnerships with individuals and organizations in the US. One of the ideas I am suggesting, is that the ISTF establish a chapter in Haiti as soon as possible. This will allow us to encourage the various Haitian agronomists and various NGOs to link with the ISTF in Haiti to work with the Youth Government of Haiti to help provide needed technical expertise throughout the NGO and government schools in the country. We are exploring having a major planning meeting in Haiti during 2019 with the ISTF playing a significant role during its planning, conduct and follow-up. Also, further information about this overall program would be greatly facilitated via future ISTF articles. During this period of "ISTF Re-establishment" while membership fees are zero is a very opportune time to recruit Haitian ISTF Chapter members. The bottom line is, "We know what to do, we only need the will to do it!" Contact me at sshovey@verizon.net or write to me at 218 Nimcock Road, Urbanna, VA 23175 if you are interested in possibly collaborating on this initiative.

A Tour in Oaxaca

Doug Turner

In the marvelous country of Mexico, a nation of natural beauty, lies a gem of culture and natural history – the state of Oaxaca. The landscape from sea level at the Pacific Ocean to its highest mountain, Cerro Quiexobra, which reaches 12,300 feet (3,750 meters). The variation in elevation is partly responsible for the placement of nine vegetation zones. They are:

1. Savanna, the smallest of the zones, is found in the center of the state. It surrounds the city of Oaxaca. The natural vegetation here is mostly grasses and palms, but the area has been turned into agricultural fields. One of the important trees is the gourd tree, or Calabaza (*Crescentia alata)*. These structures grow from the tree's trunk. Since the times of the Aztecs, the gourds have been used as vessels for food and drink.

Two gourds.

2. Tropical deciduous forest lies in a narrow strip, perhaps 20 miles (32 kilometers) wide, along the Pacific coast. This area is also known as a "short tree" forest. Flowering trees such as the poinsettia (*Euphorbia pulcherrima)* are common. *Mata ratón* (*Gliricidia sepium),* also known as "rat killer," is an unusual a tree, the bark of which can be mixed with maize to manufacture a rat poison.

3. Pine-oak Forest is the largest of the vegetation zones, covering much of the state. The elevation of this zone is about 5,000 feet (1,500 meters). Over time, much of this area has been converted to agricultural use. However, there remain significant oak-covered areas on the lower slopes. Interestingly, there is an evergreen oak known as *encino* (*Quercus hypoleuca)* and a deciduous one called *roble.* (In some places *roble* is a generic term for oaks.)

Above the oak populated areas, there is a mixture of pines including Aztec (*Pinus teocote)*, Montezuma (*Pinus montezumae)*, and Mexican white pines (*Pinus ayacahuite)*. A famous botanical resident of this zone is *El Tule,* a tourist site akin to Paris' Eiffel Tower in that all tourists visit it. It is a *Sabino/ahuehuete* (*Taxodium mucronatum),* Mexico's national tree. This specimen, located in Santa Maria del Tule, is said to have the stoutest trunk of any tree in the world. This tree's trunk has a circumference of 137.8 feet (42 meters) and a diameter of 46.1 feet (14.05 meters); its crown is approximately 116 feet (35.4 meters) in diameter. It was previously thought that *El Tule* was several trunks, but DNA testing has proven it to be a single tree.

Views of "El Tule" from a distance and up close

4. Tropical rain forest is a band adjacent to the state of Veracruz. It is about 20 miles (32 kilometers) in width. Heavy rains help the trees here grow to at least 200 feet (60 meters). Important trees here are mahogany (*Swietenia macrophylla)*, very valuable to furniture makers, as well as the chocolate tree (*Theobroma cacao)*, the rubber tree (*Castilla elastica)*, and the *chicle* or chewing gum tree (*Achras zapota)*.

5. Tropical evergreen forest runs parallel to the tropical rain forest. In this rainy area, we find large trees and climbing plants such as *coriman* or *pinanona (Monstera deliciosa),* the fruit of which is edible. The "strangler fig," aka *mata palo (Ficus cotinifolia)*, is the notorious vine that, once started in a tree's bole, slowly kills its host and takes its place in the woods. On the plus side, however, is the shade of the new over-story. Native coffee (*Coffea arabica)* grows in the densely shaded forest. The wild plants are very difficult to find. Farmers harvest the red berries, which are processed into coffee beans.

6. High coniferous forest is located on Oaxaca's highest mountains. As the name implies, there are pines, firs, and junipers. These woods are not easily accessible, as there are no roads on these mountains that rise to 10,000 feet (3,300 meters).

7. Cloud forest is also found at these heights. Half way up the mountains there are plants and animals rarely seen elsewhere, including tree ferns, bromeliads, and orchids.


A native orchid.

8. Dry tropical shrub is in the northwest corner of the state. It is a region of cacti. One group, the *nopal,* is conspicuous and economically valuable. The red flowers on the plant's tops – *tunas* – are eaten, as are the leaves of some *nopal* plants. Another important feature of some *nopales* is that they support an insect called cochineal (*Dactylopius coccus)*. The females are harvested from the prickly pear plants, dried, ground, and mixed with salts of calcium or aluminum, then boiled in water. This process yields cochineal crystals, which are a deep crimson color. The resulting dye has been desired by artists and consumers (it is used in many food products) since the Spanish conquest. Much history has been written starring the cochineal beetle.


Nopal Cactus with Cochineal Beetles

Oaxaca's growing mescal industry relies upon the agave cactus. Agave crowns are smoked prior to being processed.

*** *** ***

During a visit to Oaxaca in October 2018, I toured the Jardín Etnobotánico (Ethnobotanical Garden). The garden was designed by the artist Francisco Toledo and his colleague, Luis Várete, in 1998. Access is allowed via guided tour only. Tours are offered in several languages, including English, and are two hours in duration.

The garden is 5.8 acres (2.32 hectares) in size, 5.3 acres (2.1hectares) of which are planted to both dry and well-watered species. There are 118 plant families, 472 genera, and 950 species represented by the 7,500 plants in the garden.

In the arid plant section, many species of cacti are on display. Occasionally, a practical use of these plants is demonstrated.

The ethnobotanical garden.

A live fence of cactus.

On the garden premises there are a nursery (*vivero*), seed bank, a herbarium, and a library featuring floras, ecology, and natural history in general. More information on the flora of Mexico, and of Oaxaca specifically, can be found in *Meet Flora Mexicana* by M. Walter Pesman and in *Handbook of Mexican Roadside Flora* by Charles T. Mason Jr. And Patricia B. Mason.

Spiny Surface of a Kapok Tree.

ESTIMATION OF LEAF AREA INDEX (LAI) USING TREE CANOPY ANALYSER IN AGROFORESTRY PLANTATIONS OF FOREST COLLEGE AND RESEARCH INSTITUTE, TAMIL NADU, INDIA

N.Krishnakumar* S.Radhakrishnan and K.T.Parthiban*****
*Research Scholar, Forest College and Research Institute, TNAU, Mettupalayam
Email: krishna.forest@gmail.com, Mobile: 9443796166
**Assistant Professor, Forest College and Research Institute, TNAU, Mettupalayam
*** Professor and Head, Forest College and Research Institute, TNAU, Mettupalayam

Abstract

The leaf area index plays a major role in light interception, transpiration, and biomass production respectively. The leaf Area Index was estimated among the species the average index of LAI was recorded as 2.43. *Pongamia pinnata* (3.81) recorded maximum significant LAI and the minimum index of LAI was present in the Casuarina MTP 2 (1.39).
Keywords: leaf area index, tree canopy analyser, plantation, canopy density

Introduction

Crown architecture and canopy density in trees are intimately related to stand productivity. Crown architecture determines leaf displays, leaf distribution and canopy density and therefore, influences light interception, foliage temperature, transpiration, water and nutrient distribution and subsequent carbon assimilation and distribution (Zimmermann, 1983). Leaves are an important part of plants. Leaves help in the process of photosynthesis, transpiration, respiration. Which an influences the biomass production respectively. Tree leaf orientation plays on important role in canopy architecture and has a marked effect on the growth rate. The display of leaf within the canopy affects the light penetration and interception and its repartitioning between different levels or layers of leaf at different depths (Sprugel, 1989).

Leaf Area Index (LAI) is the total one-sided area of leaf tissue per unit ground surface area (Watson *et al.,* 1947).This variable represents the amount of leaf material in ecosystems and controls the links between biosphere and atmosphere through various processes such as photosynthesis, respiration, transpiration and rain interception, Based on the above facts a study pertaining to canopy comparison of plantation is carried with the following objective

- To compare the canopies of different plantation type for their light interception and productivity.

Methods and materials

This study was carried out in various plantations in Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam (11º19`N, 76º56`E), 300 m.a.m.s.l., 800 mm, pH 7.1) of Tamil Nadu during the month of September 2014.

Tree canopy analyzer - Leaf Area Index

Leaf Area Index play a vital role in forest canopy cover, light interception, transpirstion, maintaining of microclimate in forest floor. LAI of trees or crop either forest canopy were measured using plant canopy analyzer, and also calculated by manually. For the manuval calculation of LAI formula is

$$\text{Leaf Area Index} = \frac{\text{Leaf Area}}{\text{Ground surface area}}$$

Statistical analysis

The data obtained were subjected for statistical analysis to evaluate the possible relationship between the different parameters and analysis of variance employing statistical methods described by Panse *et al.* (1985). The data were analysed using AGRES software developed by Tamil Nadu Agricultural University.

Results and discussion

The aim of this study is to determine the leaf area index of the various tree plantations.

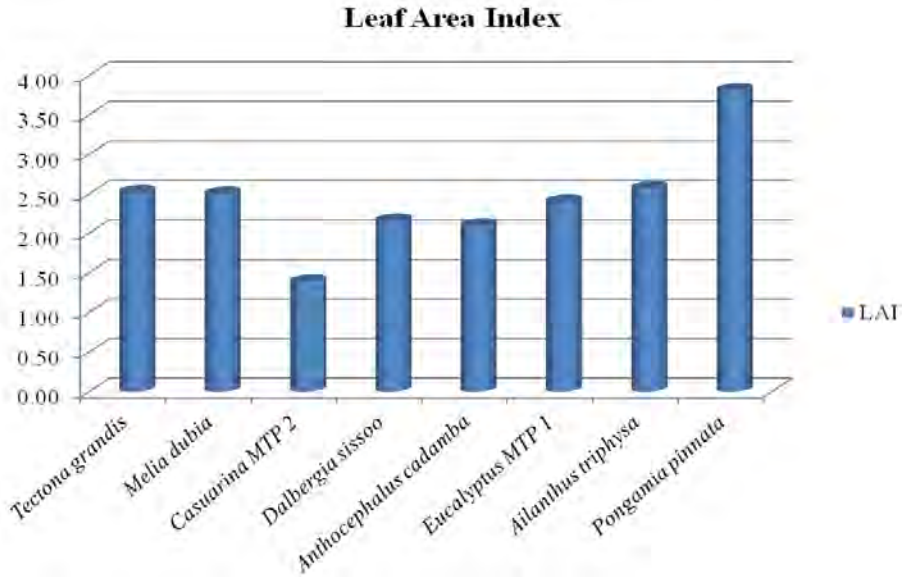
Table 1. Leaf Area Index of different plantation in FC & RI campus

Plantations	**Leaf Area Index**
Tectona grandis	2.52
Melia dubia	2.50
Casuarina MTP 2	1.39
Dalbergia sissoo	2.16
Anthocephalus cadamba	2.10
Eucalyptus MTP 1	2.40
Ailanthus triphysa	2.57
Pongamia pinnata	3.81**
Mean	**2.43**
SEd	0.22
CD (.05)	0.49
CD (.01)	0.68

Rodriguez (2001) founded the canopy photosynthesis increase based on the Leaf Area Index. In Forest College and research institute the Leaf Area Index of various was estimated as

given in the table 1. *Pongamia pinnata* (3.81) recorded maximum significant LAI followed by *Ailanthus triphysa* (2.57), *Tectona grandis* (2.52), *Melia dubia* (2.50), Eucalyptus MTP 1 (2.40), *Dalbergia sissoo* (2.16), *Anthocephalus cadamba* (2.10) and the minimum index of LAI was present in the Casuarina MTP 2 (1.39). Among the species the average index of LAI was recorded as 2.43 (Table 1).

A superfluity of workers reported the existence of significant differences and superiority of few seed sources, progenies and provenances in various tree species like *Acacia nilotica* (Padmini and Banerjee, 1986), *Eucalyptus tereticornis* (Otegbeye, 1990), *Santalum album* (Bagchi and Veerendra, 1991), *Tecomella undulate* (Jindal et al., 1991), *Terminalia arjuna* (Srivastava et al., 1993) Lagerstroemia spp. (Jamaludheen et al., 1995), *Gmelina arborea* (Kumar and Paramathma, 2005), *Dalbergia sissoo* (Rawat and Nautiyal, 2007). Based on above result compare the canopies of different plantation type for their light interception and productivity in only based on the canopy density. Density of the leaf size is very high that records the highest LAI and the high canopy density, Where as decrease in leaf size that records the lowest LAI and the less canopy density. At the present study, deals with decrease in the size of leaf the intensity of the tree crop also decrease.



References

1. Zimmermann, M.H. 1983. Xylem Structure and the Ascent of Sap. **Spriger- Verlag**, Berlin, New York, 143pp.
2. Sprugel, D.G., 1989. The relationship of evergreenness, crown architecture, and leaf size. **Amer.Natur**., 133,465- 479.
3. Watson DJ. 1947. Comparative physiological studies in the growth of field crops of Variation in net assimilation rate and leaf area between species and varieties, and within and between years. **Annals of Botany,** 11, 41-76.

4. Rodriguez D, Ewert F, Goudriaan J, Manderscheid R, Burkart S, Weigel HJ.2001.Modelling the response of wheat canopy assimilation to atmospheric CO2 concentrations. **New Phytologist**, 150: 337-346.
5. Padmini, S. and A. C. Banerjee. 1986. Provenance trails of *Acacia nilotica*. **J. Tree Sci**., 5: 53-56.
6. Otegbeye, G. O. and I. Samarawira. 1992. Genetics of growth and quality characteristics of *E. camaldulensis*. **Silvae Genet.,** 4(4-5): 249-252.
7. Bagchi, S. K. and H. C. Sindhu Veerendra. 1991. Variation and relationship in developmental growth phases of *Santalum album* after pruning. **Indian Forester**, 117: 1053-1058.
8. Jindal, S.K., Manjit Singh, K.R. Solanki and N.L. Kachar. 1991. Variability and change in genetic parameter of height in juvenile progenies of *Tecomella undulata* (Sm.). **J. Tree Sci.,** 10(1): 25-28.
9. Srivastava, D.P., P.K. Srivastav, A.K. Goel and K. Thangavelu. 1993. Correlation and path coefficient studies in *Terminalia arjuna*. **Ann. For.,** (1): 178-181.
10. Jamaludheen, V., K. Gopikumar and K. Sudhakara. 1995. Variability studies in Lagerstroemia (*Lagerstroemia speciosa* Pers.). **Indian Forester**, 121(2): 137-141.
11. Kumar, A. and M. Paramathma. 2005. Correlation and path coefficient studies in *Casuarina equisetifolia* L. Johnson. **Indian Forester,** 131(1): 47-55.
12. Rawat, R. S. and S. Nautiyal, 2007. Genotype-Site Interactions in Growth, Physiological and Biochemical Parameters in Clones of *Dalbergia Sissoo* Roxb. **Silvae Genetica,** 56: 201-206.

Guam Trip Sept. 2018

Report prepared by Phil Cannon

From Sept. 15-22 the author traveled to and from Guam and spent five full days in the Pacific Regional Invasive Species Committee (RISC) meeting. During this meeting the author gave a presentation on *Phellinus noxius, Austropuccinia psidii* and *Ceratocystis spp.* and participated appropriately in many of the meeting's discussions. James Stanford, the recently appointed coordinator of this committee took excellent notes. These notes are being provided separately.

Not much additional information will be noted about invasive species in the Pacific, however, it could be noted that aside from the Brown Tree Snake (BTS), the Coconut Rhinoceros beetle (CRB) and the Little Fire Ant (LFA) (which are all very serious problems) no other pests or pathogens or invasive plants, and no invasive marine organisms, are currently on the radar of any agricultural quarantine organization in any jurisdiction.

Besides participating in the RISC meeting, 22 additional Forest Health Activities were conducted by the author during this trip. In continuation, these are each briefly described.

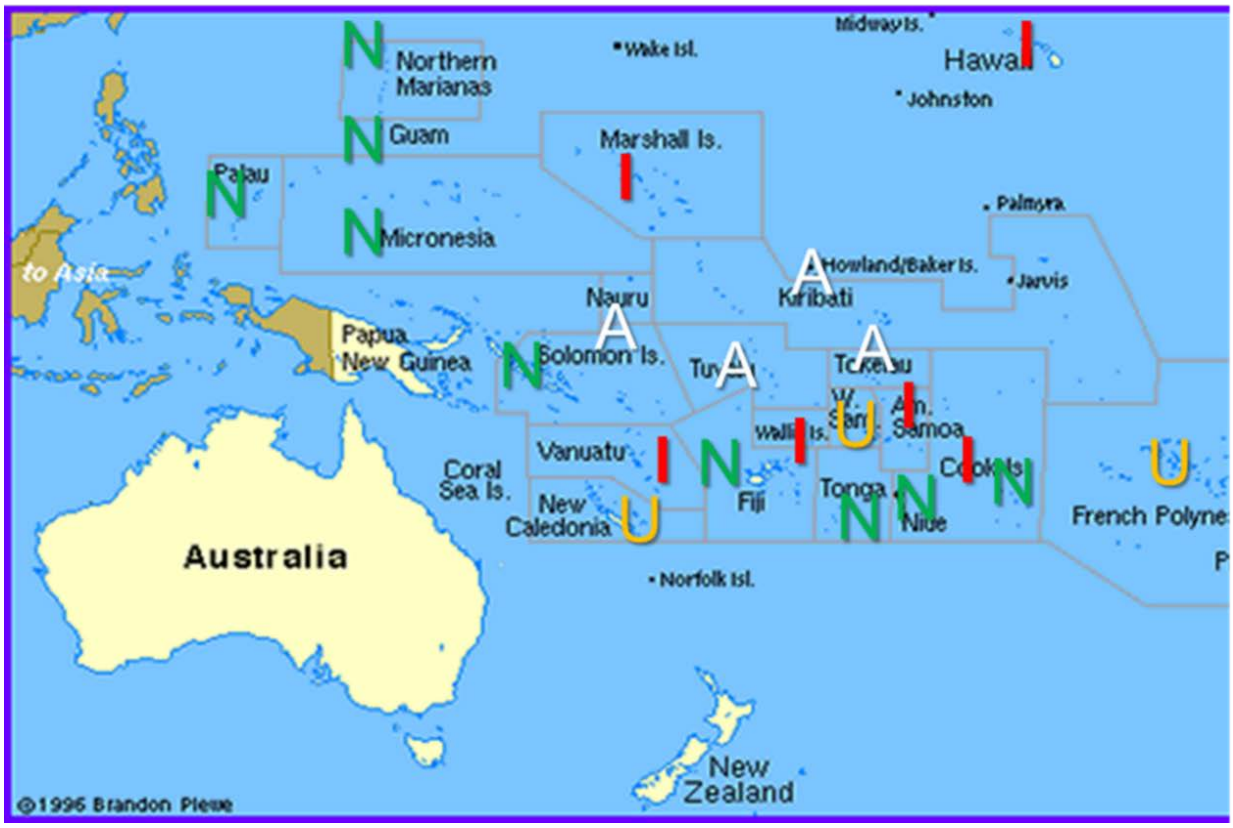


Figure 1. *Merremia is probably the most aggressive vine in the Pacific and occupies between 1 and 60% of the land area of many islands in many of the jurisdictions across the Pacific. It does not do well in the shade of a rainforest, but as soon as overstory trees are removed (often by farming or from typhoon damage) it can quickly colonize and take over that open space and spread from there to cover the rest of the forest and even entire neighborhoods. Molecular genetics have shown merremia to be native (N) to many islands in the Pacific (the other letters in this diagram are I, for invasive, A for absent and U for unknown). Where merremia is native, neither bio-controls nor herbicides can be used to control it. This figure was provided by of David Moberly.*

Other Activities Conducted While at the RISC Meeting

1) The author hung out with Phil Andreozzi and David Moverly one evening and discussed the challenges, function and future of RISC and also future activities of the US New Zealand Invasive Species Committee. Phil A. also had some information to provide about the early days of the Cetti Bay reforestation project on Guam. This information would have been useful 10 years earlier when the author was sent to evaluate that project.
2) The author had a conversation with Jaokim Wasan of Chu uck. After the author had made his presentation on *Phellinus noxius*, Jaokim had approached him and said that he had seen this fungus on Udot Island which is due west from Weno across the Chu uck Lagoon. The author had not visited this island on his previous visit and had not seen the fungus on the other islands (Weno and Tenowas) that he had visited. Arrangements were

made to go get specimens from Udot Island the next time the author ventures to Chu uck (it looks like it will be a 20 gallon trip (four jerry cans of gas)).

3) The author met with Noah Burrell who runs the quarantine program for the US Armed Forces in Guam. Noah had good programs to report on for the BTS the CRB and the LFA, but there were no other pests or diseases on his radar at all (in spite of the fact that there are another 10,000 pathogenic fungi and tens of thousands of insects that would make a killing if they could become established in the Pacific Islands). Noah was not oblivious to these other pests but said that unless there were erumpent fruiting structures they had no techniques for even noticing any kind of fungi in the airports. I told him that this might have been true 10 years ago but now there are some techniques that can be used to make the detection for some of the wort of the pathogenic fungi. The technics are called LAMP Assay (Loop Mediated Isothermal Amplification) or lab in a suitcase. I have since sent Noah information about how these techniques work and who he might contact if he is interested in following through. Very fortunately for Noah and the US military, there is a unique contract that states that Colorado State University will help run the risk analysis for pests and pathogens that could arrive in any country around the world as a result of military shipments. This is fortunate from a forest pathogen point of view because for the past 8 years Colorado State University has been very active in helping to monitor two of the most important pathogens in the Pacific region, *Phellinus noxius* and *Austropuccinia psidii***.** It is doubly significant because graduate students in the Jane Stewart Forest Pathology Lab at CSU have been very actively involved in developing LAMP procedures which can efficiently detect *A. psidii* and even identify the different races of these fungi. A connection in being set up between Noah and CSU and the possibility that the DOD might want to support the development of this LAMP technology is also beginning to be explored.
4) The author met with Troy Brown who heads up PPQ on Guam. Troy was particularly interested in a disease that is affecting citrus on Guam. This disease looks very similar to a disease that is affecting citrus on Rota (on the Jaimes Manglona farmstead). The author is forwarding photos of this disease onto the citrus disease laboratories at the University of Florida and asking Jason Smith, forest pathologist at that university, to provide some follow-up on identifying the cause of this disease.
5) The author had lunch with John Wichup and Poasa Nauluvula of Pohnpei. John, in particular, has been very supportive of all forest pathology work being done in FSM and had a great deal of news to share about our *Phellinus noxius* collaborators on Pohnpei. Very sadly Gibson Santos, the top scientist for NRCS, is in tough shape heath-wise.
6) The author had lunch with Tamdad Sulog and ran through a list of forest pathology activities taking place now in Yap. Probably the most exciting recent development is the strong response that Acacia are showing to fertilization in a trial that the author set up with Francis Liyeg two years ago. JB Friday has since visited these plots twice and helped manage their measurement on both occasions. These trials show that a lot of additional growth can be anticipated from trees planted on some soils (acid, aluminum toxic, low pH) of these Pacific Islands when a dose of the correct fertilizers is added. Tamdad is enthusiastic about hosting several more fertilizer trials on his island.

7) The author also talked briefly with Loyola Darius about the possibilities of doing some fertilizer trials on the Island of Babeldaob in Palau. She seemed quite interested. If these experiments are to get set up some pre-work will be necessary to set up relations with the forestry unit on Palau. This could be one of the side activities of the author if he were to participate in the PIC this coming spring.
   The other side activity of course would be to do some additional work on butt rot diseases. Many butt rot diseases were found during the author's only previous visit to Palau, but *Phellinus noxius* was only found once (in the arboretum of the Belau Natural History Museum). It is presumed this is because the author was fairly fixated on diseases that were affecting the mangroves on that particular trip.

Other Activities Undertaken by the Author While in Guam.

1) A return to the Windward Hills Golf Club was made to check on the fate of about 200 large (2 foot diameter) Casuarina trees that had been affected by a Ganoderma butt rot. At the time of this visit all but two of these trees had been blown over in typhoons. Of the two that were still standing one was dead and they both had butt rot. It was also noticed that there were about 40 more young (8 inch diameter) Casuarina trees lining the entrance to this golf course. Every one of these had Ganodema root rot. In most cases it was obvious that the main court of infection had been exposed lateral roots that had been cut by the nylon line used by grass trimmers. A couple of these younger trees had also just blown over during the recent Mangkhut typhoon. Ganoderma conks were observed on about 30% of the boles of these Casuarinas.
2) The trees of the University of Guam Campus were observed. Most of these trees were large Casuarina, but most of these have also been killed by Ganoderma. Again the fungus was able to get into the root systems of these trees because the lawn care people had dinged the root systems with the nylon cords when trimming the grass.
3) A quick trip was made with Roger Brown to visit the Casuarina Provenance test at Bernard Watson's farm (near Dededo). This test had grown phenomenally well initially (individual trees had grown up to 17 feet the first year) but subsequently this test has been pounded by two typhoons and a lot of trees were uprooted. At this point this test is mainly just serving arboretum and seed provision purposes.
4) A swim in the ocean was made one evening. The water inside and outside of the reef was clear and delightful. However, the next day another typhoon formed and there were several inches of rain. Within a day all coastal ocean water was extremely muddy within a half a mile of any river mouth.
5) A meeting was held with Dr. Andrea Blas (plant pathologist) at the University of Guam. Andrea is currently teaching 3 plant pathology courses at the University and was super busy. She indicated that she is looking to bolster her information on mychorrhizae. The author can help her with that and he also provided her with some Frankia nodules (these are formed when this Actinomycete forms a symbiotic relationship with the fibrous roots of Casuarina trees).

6) A meeting was also held with the ever-affable Dr. Jim McConnell, Ecology Professor at U. of G. He challenged the author to come up with a number of examples of tree problems that are commonly affecting trees on the Pacific Islands and also provide the prescriptions for dealing with these problems. This information would be used to make courses taught by the International Society of Arborists more relevant for tropical foresters. The author suggested this would take about 200 hours of work. However, and in the meantime, the examples of the wounded roots on the Casuarina trees is one very good example of a practice that has led to the downfall of hundreds of thousands of premier park trees Guam and other islands and is something that could simply be avoided by prohibiting the use of nylon string to prune grass around trees. Jim also showed the author an 18 inch diameter Calophyllum tree that had broken off during Mangklut. At the point in the bole where the tree had broken, the wood was completely rotten and had a specific gravity of about 0.15 (whereas the specific gravity of healthy wood should be about 0.64). The root system of this tree was exposed above the soil line by about 8 inches, and all of the bark had been scraped away by one of these aforementioned string grass pruners. When the author stood on this root it was spongy and sunk in about 2 inches. It was entirely rotten. The rot had spread from there up into the bole of the tree.
7) Wood samples from the rotten bole of the Calophyllum tree were collected and then, in the Bob Schlub Plant Pathology Lab at the U. of Guam, isolates of this fungus were made by placing chips of its mycelial wefts on PDA plates. These plates were then sent in to the Ned Klopfenstein Rocky Mountain Forest Service Lab in Idaho for identification using molecular genetic techniques. Sporocarps from the outside of one of the fallen Calophyllum trees were also collected and isolates from these sporocarps were also made and sent to the Klopfenstein Lab. These sporocarps may be related to the fungus causing the majority of the decay in these Calophyllum but they might also be saprophytic.
8) A brief conversation was also held with Lee Yudin, Dean of the School of Agriculture at the U. of Guam. He has had a very exciting year and was generally quite enthusiastic about his department's future.
9) In the company of Joe Afaisen and Meghan Borja, the author went to the Anao, near Anderson Air Force Base. Here there are hundreds of small *Phellinus noxius* infection foci and during this visit a few dozen additional trees additional trees that had just been killed were seen (these all had had the fabled "black sock" growing on their boles). Soil samples were collected from beneath infected and uninfected trees for the megagenomics exercise that is being conducted with the Ned Klopfenstein lab. The idea behind this particular megagenomics project will be to see if there is a difference between all of the DNA (of all organisms) found in soil in an active *P. noxius* infection foci and a forest soil where the same tree species are growing but which is not carrying active *P. noxius* inoculum. The reason this study is necessary is that a method is needed to determine when soils, that once had *P. noxius,* but were treated, are again safe to plant with *P. noxius*-susceptible species.
10) The author learned a great deal about CRB from Aubrey Moore's presentations and from observing hundreds of palm trees on Guam that had either been affected by CRB or were in the process of being protected from this beetle using the Frank Cushing gill net

approach. It could be noted that several thousand palm trees had lost their entire crowns as a result of burrowing CRB making the connective tissue at the base of the crown too weak to resist the force of the typhoon. Indeed, this may have been the most dramatic and longer-lasting effect of Mangkhut.

11) The author went to a meeting at the USDA Wildlife. He arrived early and so was given the Cook's tour of the brown tree snake problem and learned first-hand about all of the traps and techniques that are being used to control the spread of this snake to other islands. It is a very comprehensive, expensive and effective program.
12) The author also stopped by Guam Forestry briefly. An exciting development has been that Christina's "Don't Burn Guam" campaign has been really well received. This is extremely important. Ruddy Estoy and Justin Santos were also there. I had been hoping that I could go with Ruddy to see the new fertilizer trials that had just been set out during JB Friday's last visit, but this was not possible.
13) At USDA Wildlife the author also participated in the "One USDA" meeting that had been organized by Phil Andreozzi. During this meeting each of the entities that was participating in the effort to limit the distribution of one or more invasive species had a chance to briefly explain what they were doing. It was a good meeting and will help facilitate some future alliances.

Figure 2. *Some of the participants in the Regional Invasive Species Committee, from left to right: Unknown, Ray Roberto, Tamdad Sulog, Glenn Dulla, David Moverli, Phil Cannon, Bejay Obisbo, Roseo Marquez, Fred Sengebau, Loyola Darius, Phil Andreozzi, Diane Vice, James Stanford, Matt Kedziora, Unknown, Henry Capelle, Russell Campbell, Adelino Lorens, Derek Guerrero, Poasa Nauluvula and Jessica Gross. Photo taken by John Wichep.*

The "*Association des Forestiers Tropicaux et d'Afrique du Nord*" (AFT) Tropical forestry … in French

by
Jean-Paul Lanly, President
Former Director, FAO Forest Resources Division (1984-1996)

From the 16th century onwards, several European nations, including France, started colonizing tropical territories at different pace and times, while carrying out geographic and other scientific studies in the Tropics, and continuing importing tropical wood and non wood forest products. It is only in the 19th century, that colonial powers started organizing forestry in their tropical colonies on an institutional basis. France initiated that phase at the very end of the century in Indochina (Cambodia, Laos and Viet Nam) and in Madagascar, as well as in Guiana and in her insular territories of the Caribbean and of the Indian and Pacific Oceans, creating forest services, forestry schools and a few small forest research units. She continued in the course of the first part of the 20th century in all her African territories south of the Sahara.

After a regular forest education in France (at Nancy and in other forest and wood schools), most French public officers and technicians who were to serve in the colonial forest administrations received a specialization in tropical forestry, delivered mostly by the *Centre Technique Forestier Tropical* (based in Nogent-sur-Marne in the outskirts of Paris), a public forest research and development institution. Whereas in the private sector (logging, wood industries), most French managers were trained on-the-spot.

Around 1960, when hitherto colonial territories of tropical Africa became independent nations, many experienced French foresters continued serving them, mostly within the framework of bilateral ODA, with many young foresters joining their ranks.

Almost sixty years afterwards, the overall ODA context has changed significantly in many ways:

- tropical countries have got trained foresters in sufficient numbers, and North-South and multilateral technical assistance programs are on the decline,
- European experts are replaced by short-term consultants recruited by donors from all over the world,
- South-South and regional cooperative schemes are on the increase.

In the private sector, European companies operating in tropical Africa are being supplanted by national and Asian enterprises (mostly Chinese).

However, France (like a few other European countries) has been able to maintain her tropical forestry know-how and experience:

- she manages the forests of her own tropical territories (Guiana, with its 8 million ha of forests, Antilles, Reunion, New Caledonia, Polynesia);
- she maintains a solid tropical R&D basis in some of her important scientific institutions, such as the Agricultural Research and International Cooperation Organization (CIRAD, which publishes the quarterly forestry review "Bois et Forêts des Tropiques"with articles in French, English and Spanish), and the National Natural History Museum (Muséum National d'Histoire Naturelle), as well as in many other

research organizations and Universities which have programs related to the ecological, social and economic aspects of forest management;
- she keeps at a good level her investment programs related to forest development and conservation in tropical countries (mostly African), funded by the French Development Bank (AFD, Agence Française de Développement) and the French Facility for Global Environment (FFEM, Fonds Français pour l'Environnement Mondial);
- large consulting firms based in France have tropical agriculture, forestry and rural development competence, and a few ones have forest development and conservation in the South as their main activity;
- last but not least, many development and conservation NGOs of French status have projects related to forestry and agro-forestry in the Tropics, mostly, but not only, in African countries south of the Sahara, funded by French institutions and communities, be they at local, sub-national and national levels. These organizations benefit inter alia from the long relationship between France and its former African territories, and from the large number of French citizens of African origin.

Outside France, francophone countries of tropical Africa have not only public institutions (including schools and small research outfits), but also NGOs and private companies working in forestry and other related sectors (including the most important wood energy one). And there are in Europe (Belgium, Switzerland), in North America (Quebec) and in North Africa and Middle East, entire organizations or, at least, foresters working on tropical (or sub-tropical/sub-temperate) forestry matters with French as their main language.

As a rule of thumb, in France only, there may be between five hundred and one thousand graduate persons conversant and experienced in tropical forestry and agro-forestry. This number, to which must be added that of the other French-speaking graduates working in tropical/sub-tropical forestry all over the world is sufficient to justify the existence of a professional society whose main aims are, in an advocacy role:

- to have its members exchanging their past and/or present working experiences, and disseminate these;
- to promote the benefits of sustainable forestry for socio-economic development and environmental conservation in the tropical and sub-tropical/sub-temperate countries;
- to develop training materials in tropical forestry.

Created in 2000 as "Amicale des Forestiers Tropicaux", and reactivated in 2015 as a more embracing "Association des Forestiers Tropicaux et d'Afrique du Nord", the Society:

- produces an annual "Bulletin";
- issues every fourth month a Newsletter ("Les Feuilles du Flamboyant" – The Flamboyant leaves) with one theme as a main issue (last themes: forest certification; wood energy in Sahelian countries);
- publishes books reporting forestry experiences of its members: (i) "Vivre et travailler en forêt tropicale" (Living and working in tropical forests) by J.-C. Bergonzini and J.-P. Lanly, L'Harmattan, Paris, 2016, 291 p.; (ii) "Vivre et travailler dans les forêts du

Maghreb – Regards croisés" (Living and working in North Africa forests – Crossed glances), by J.-P. Lanly and A. Khaldi, spring 2019; (iii) a second "tropical" one in preparation;
- organizes technical meetings, the most recent one being a meeting of European stakeholders in June this year in Paris on the subject of forest certification in the Congo Basin.

One of its founding fathers, Joanny Guillard, who died recently, has published over the last years his formidable historical review of forestry in French tropical colonies and territories from1896 to 1960. He had started its professional career in Cameroon in 1948, served with French ODA in the 60's, before directing the Nancy forestry school for fifteen years, till 1983 when he devoted himself most entirely to his historical studies. Two volumes have already been published:

- "Au service des forêts tropicales – Histoire des services forestiers français d'outre-mer 1896-1960 – Tome I" (Les objectifs, les politiques) (Stewards of Tropical Forests – History of French Overseas Forestry Services 1896-1960 – Volume I (Objectives and policies)), AgroParisTech Nancy, 2014, 641 p.
- "Au service des forêts tropicales – Histoire des services forestiers français d'outre-mer 1896-1960 – Tome II (Les services forestiers coloniaux français: organization, agents, moyens)(Stewards of Tropical Forests – History of French Overseas Forestry Services 1896-1960 – Volume II (French colonial forestry services : organization, personnel, means)), AgroParisTech Nancy, 2016, 964 p.

One additional volume has been issued most recently (as Volume IV) but has yet to be referenced, dealing with activities not directly related to production forestry, i.e. nature conservation, wildlife and hunting, fisheries and aquaculture, soil conservation and watershed management, and grazing. A fourth one – in fact Volume III - , almost completed by J. Guillard before he died, is likely to be published in a not too distant future, dealing with the main forestry programs during colonial times, i.e. forest surveys, forest rules and procedures, vegetative cover protection, forest ownership and tenure, forest reserves, silviculture in tropical high forests, silviculture and plantations in dry zone areas, working plans, forest research, urban and road trees, and public education.

To conclude, I cannot but encourage those interested in tropical and subtropical forestry in French to join forces with the "*Association des Forestiers Tropicaux et d'Afrique du Nord*" *(AFT)*, as some foresters outside France have done already. A registration form is found on the following page.

AFT and I thank ISTF, and particularly Sheila Ward and Blair Orr for including this information in the Newsletter.

Association des Forestiers Tropicaux et d'Afrique du Nord

(association de droit français, loi de 1901)

****

Bulletin d'adhésion

La cotisation de base est fixée à 30 € pour l'année 2018 (10 € pour les étudiants)

Nom	
Prénom	
Adresse	
Code Postal	
Ville	
Téléphone	
Pays	
Email	
Statut professionnel actuel	
Pays de séjour ou de missions tropicales	

reconnaît avoir pris connaissance des statuts de l'association de l'Amicale des Forestiers Tropicaux et soumet son adhésion au Bureau de l'association.
Autorise la diffusion de son mail aux autres adhérents de l'association

Fait à

Signature :

Merci d'adresser ce formulaire accompagné d'un chèque de 30 € (10 € pour les étudiants) au nom de l'association de l'Amicale des Forestiers Tropicaux à l'adresse suivante :

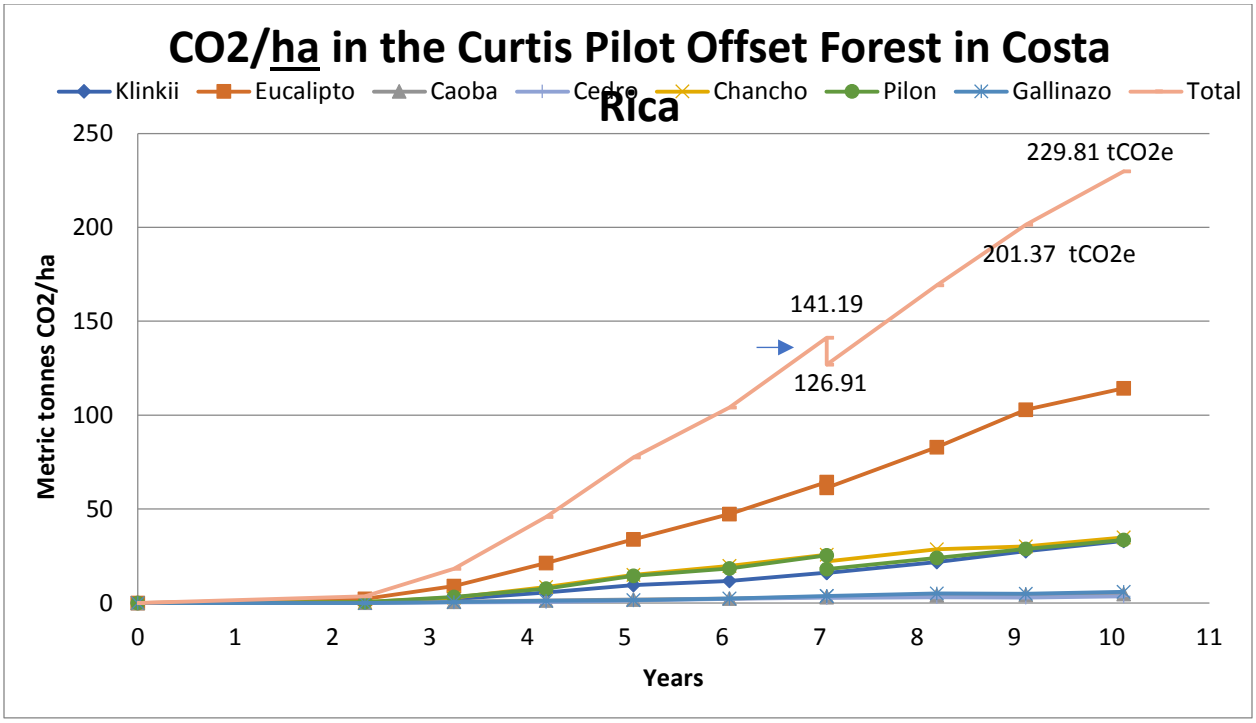
Amicale des Forestiers Tropicaux
s/c M. Jean-Paul LANLY
42 rue Albert Thomas, 75010 – Paris
Mél : jean-paul.lanly@orange.fr

REPORT ON THE
CURTIS PACKAGING CO.
10-YR OLD CARBON-OFFSET FOREST
IN
COSTA RICA

Herster Barres, Research Director & Founder
hbarres@aol.com
Rolando Camacho, Forester in Costa Rica
Greg Powell, Executive Director

Summary
In 2007 Curtis Packaging Co. sponsored a forest in the UNFCCC-AIJ applied research program of Reforest The Tropics in Costa Rica to sequester some of its U. S. CO2 emissions. As of 10.12 years of age, the 5.4-acre Curtis forest has sequestered 501t CO2e, balancing an equal amount of CO2 emissions in Connecticut.

The beginning: the Curtis forest was planted on this farm pasture in Dec. 2007. It was to be 2 hectares (5 acres) of forest.



Definitions
1 ha = 1 hectare = 2.471 acres. Your forest is 2.18 hectares or 5.4 acres in size.
tCO2e = metric tonnes of CO2equivalent stored in the form of wood in growing trees in your forest.
Carbon (C) content of forest = green stem volume * 1.5 for roots and branches * species basic density * 0.5 carbon content of wood. CO2 content = C in forest / 0.273.
Location: 10 degrees, 08 minutes, 45 seconds N; 83 degrees, 39 minutes, and 40 seconds E.

Funding
Curtis donated $14,000 in 2007 to establish a 2-ha (5-acre) pilot carbon-offset forest, for a wildlife enhancement area and to pay for a soil carbon content study. Curtis donated an additional $5,000 in 2012 for general support for our program. From these donations, the farmer received $3,500/ha or $7,000 to establish the 2-ha forest and the wildlife enhancement area.

RTT Goals for Curtis
RTT has established 73 forests, 500 acres (200 ha) on 13 farms in Costa Rica to develop, improve and demonstrate the RTT model. One of these 73 forests is the Curtis Forest.

Reforest the Tropics manages a UNFCCC-AIJ program of applied research to develop more efficient models of permanent farm forests in the tropics. Our goals are: a) Efficient long-term (100+ yr) CO2 sequestration, b) Developing a model that is attractive to farmers on whose pastures we plant RTT forests by combining farmer income from thinnings with sequestration for emitters, c) The RTT forests should be ecologically and economically sustainable, d) They should be wildlife friendly, and e) The model should be applicable to farmers in many countries and to their sponsors, including Curtis Packaging.

The Mixture of Species and Sustainability of the Curtis Forest

RTT uses mixed-species models of forests for reasons of sustainability. Significant mitigation of climate change using farm forests will require hundreds of thousands of acres of plantings. If we planted the traditional monocultures of a single species, they would possibly eventually be susceptible to insects and diseases. If we use a mixture of species, mimicking the mixtures of natural forests, we might lose one species, but the stand would regenerate maintaining its role of long-term CO2e sequestration. There are 7 species of trees in your forest. The percentages are 41% Klinkii, 18% gallinazo, 10.1% pilon, 10% deglupta hybrid, 9.8% chancho, 5.6% mahogany, and 4.8% cedar.

The Klinkii is for long-term CO2 storage. The gallinazo, deglupta and chancho are for early thinnings for farmer income because they grow much faster. The mahogany and cedar produce high value wood for future farmer income as we strive towards a 100+ year model. *Replanting shade-tolerant species under the original forest will be necessary to maintain stand density, generate farmer income, and reach our goal of 2,000 tCO2/ha by 50 years and 100+ years of storage.*

Results from the Curtis Forest

Your forest was planted in Dec. 2007. Our last annual measurement, with the data reported here, was on January 24, 2018 when your forest was 10.12 years of age. The graph above shows these measurements at 10.12 years of age for the Curtis forest.

At 10.12 years, your 2.18-ha forest has captured 501 tCO2 in the form of wood in the trees. At 10.12 years the current capture rate is a very respectable 28.44 tCO2e/ha/yr or 56.88 tCO2e in the 2.18 hectares.

The 25-yr Contract

We signed a 25-yr contract on the 10th of October 2007 with the farmer for your forest. In other words, your 10-yr old forest will continue capturing atmospheric CO2 to balance your U.S. emissions for 15 more years. The forest will be periodically thinned for the benefit of the farmer. Our goal for your 2.18-ha forest is to capture 1,000 tCO2e by the end of the first contract or 40 tCO2e/yr average. A second, third and fourth contract will follow with offsets/credits being offered and sold for farmer income.

Thinnings

Frequent thinnings (partial harvests) of the RTT model forests are essential for farmer income and to stimulate its growth /sequestration. Our goal is to begin thinning at the 7th year and to thin lightly, 15-18%, every 5 years thereafter or, if earlier, when the current annual growth rate drops. Traditional thinnings of 30% are not recommended since they will not allow the forest to accumulate CO2e while producing farmer income.

The original forest was planted with 2,200 seedlings. A 10% thinning was done at 7.07 years of age to open the canopy to stimulate the growth/sequestration and to produce the first logs for roadside sale for farmer income. Frequent thinnings about every 5 years should eventually generate a cash flow for the farmer to replace income from the cattle previously on the site.

CO2 Emissions Balanced So Far and Current growth/yr

On Sept. 14, 2007, RTT prepared a preliminary analysis of the Curtis' CO2 emissions of its U.S. operations that, deducting the green electricity, showed that an additional 827 tCO2 were needed to be balanced for Curtis to become totally "green".

Your forest is currently sequestering 57 tCO2/ha/yr, or 6% of those 827 tCO2 of annual emissions. The estimated cost of sequestration in this first 25-year contract of the RTT model forest is estimated at $15 /tCO2e.

Farmer participation

The farm whose pastures we planted for the Curtis project is named Las Delicias. The farm is owned by the farmer, Carlos Rojas and his family. It is located in the Atlantic zone of Costa Rica near the town of Pocora.

The basic goals of RTT are to create a *permanent* farm forest capable of sequestering CO2 emissions for 100+ years for Curtis and for generating income capable of competing with income from cattle on the same site for the farm.

Results of the soil carbon study

The soil carbon study was done by Prof. William Fonseca of the National University who delivered his report in February of 2008. The purpose was to set baselines of existing CO2 in the soil so that any carbon increase in the future could be attributed to the existence of your new forest. If we could prove the existence of such an increase, Curtis could claim the increase as an offset for its carbon emission accounts. We have not yet re-analyzed the soil to make such a claim. The baseline of this pasture soil, the carbon content down to 60 cm depth, was 175.9 tC/ha. This is the equivalent of 644 tCO2e/ha.

Conclusions

The Curtis Forest is doing well and is likely to reach its goal of sequestering 1,000 tCO2 in the first contract of 25 years. In the following contracts, the offset credits will be sold for farmer income to emitters at a market price.

Meetings with both Curtis Packaging and the sponsoring farmer.

FEB. 27, 2018, THE CURTIS PACKAGING CO. RTT 5.4-ACRE CARBON-OFFSET FOREST IN COSTA RICA. By 10 years of age, it had captured 501 tCO2e so far towards a goal of 2,000 tCO2e in the first 25-year contract. It is shown here at 11 years old.

WILDLIFE IN RTT & CURTIS WILDIFE ENHANCEMENT FORESTS. Captured in this night photo, these are pisotes or tropical raccoons in this RTT forest. Our forests contain tapirs, ant eaters, deer, "chickens of the forest", possums, endangered parrots, dozens of other species of birds, and possibly mountain lions, far more wildlife than there were in the pasture we planted.

REFOREST THE TROPICS
PO Box 601, 28G Cottrell St. Mystic, CT 06355 - (860) 572-8199 -
info@reforestthetropics.org - www.reforestthetropics.org

A United Nations sanctioned carbon dioxide sequestration program
RTT is a 501(c)(3) non-profit organization

Accepted by UNFCCC-AIJ in 1995 to demonstrate the effectiveness of tropical forests to fix and store carbon emissions

A Possible Reforestation Project for the Amazon Region of Peru

Prepared by: Phil Cannon
Regional Forest Pathologist, USDA Forest Service, Vallejo CA, pcannon@fs.fed.us

Executive Summary

From May 12 through May 20, 2018 the author worked in Peru. The main objective was to look into possible industrial reforestation projects that USAID might want to support in the Department of Ucayali which is on the Amazon side of the Andes. Some project ideas with good potential were identified and discussed with many parties and a four-hour lecture was given at SERFOR on Tropical Forest Plantations.

Also, as the author is a forest pathologist, it was decided that he should look into some potential Peruvian tree health situations. For this reason, an interview was held with Peru's leading forest pathologist, a separate three-hour lecture was given at SERFOR on forest pathology issues that could appear in tropical forest plantations and the health of most trees in the US Embassy Compound and all trees at the US Ambassador's residence were evaluated.

Figure 1. *Juan Cordova, Jorge Chavez and Walter Nalvarte accompanied the author to see forest plantations in the Department of Ucayali, Peru.*

Resumen Ejecutivo

Entre el 12 y el 20 de Mayo, 2018, el autor estaba en el Peru con el proposito de revisar las posibilidades para USAID de apoyar un proyecto de plantaciones forestales para fines industriales en el Departamento de Ucayali. Algunos proyectos fueron identificados y explorados entre varios grupos que podrian participar en dicho proyecto y el autor dicto una presentacion sobre plantaciones forestales tropicales en el SERFOR.

Ademas, por las experiencias del autor en el campo de patologia forestal, los anfitriones decidieron que de el autor tambien deberia dictar una presentacion sobre patologia forestal en los tropicos y tambien que el deberia revisar la salud de la mayoria de los arboles en los terrenos de la Embajada de los EEUU y de todos los arboles en la residencia del Ambajador de los EEUU.

Table of Contents

Topic

Introduction-

The Department of Ucayali, located on the Amazon side of the Peruvian Andes, is considering becoming much more active in the plantation forestry arena. This, in part, is due to a significant inducement that Peru is now offering for plantation entrepreneurs, both for individual landholders and for forest industries. At present, USAID is considering how it might be able to assist in the development of some of these plantations.

The best way to proceed, however, was not obvious from any of the scant literature that is available and there seemed to be some very complicating circumstances. For instance, the literature indicated that there are a few tree species known to grow well on some soil types found in the Amazon, but not on all; there are many land tenure issues that do not yet have clear solutions; and, there could be cost-prohibitive problems getting wood products to the best markets either in Lima or abroad.

Towards making this visit as productive as possible, Victor Mayacama had sent the author a few articles which he had access to in Peru. He set up a conversation with USAID Personnel and he also arranged for a visit to some forest plantations in the Department of Ucayali. In addition the author intensely scouted the internet.

The conversation with Victor Merina and Merisel Allende of USAID

After some introductions from Andrea von der Ohe, Victor Merina and Merisel Allende, the two USAID officers in charge of developing a reforestation assistance program for the Peruvian Amazon, explained their thoughts on industrial forest plantation possibilities in the Amazon region. At least two models had been considered. By the time of our conversation both Victor and Merisel indicated that they would favor a project that could involve a good number of the small producers. The rational was that trying to separate these producers from the land would not be viable or desirable. They also indicated that capturing carbon would also be another desirable outcome of this project since one of the objectives of USAID-Peru is to alleviate climate change.

This first conversation was fairly brief. No documents were exchanged, but it was generally agreed that following this visit the author would provide feedback directly to Andrea, Victor and Marisel on what kinds of industrial forest plantations might be the most appropriate for USAID to support financially and the kinds of USAID and International Programs technical support that might be most appropriate. And indeed, much of the information gathered during the remainder of this visit to Peru, and summarized in this report, is focused on figuring out what USAID support would be most appropriate.

Our Trip to See Forest Plantations in Ucayali

In the evening of May 13th a small band of USAID- IP engaged foresters flew to Pucallpa. The next day the author went to the field with Walter Nalvarte, the Director General of the Competitive Forestry branch of the Peruvian Forest Service, Jorge Chavez, the lead forester

for Bosques Amazonicas, and Juan Martin Cordova, Director of Forestry for the Department of Ucayali. This proved to be an exceptional combination of companions. Walter had written the record on the performance of essentially all forest plantation efforts that had taken place in any part of Peru, including all plantings in the Amazon (Nalvarte, 2015). Jorge knew the exact history of every stand that we visited on the Bosques Amazonicas property and Juan Martin was in charge of all timber stumpage being produced in the department.

As we were leaving Pucallpa on the main road, the number of large sawmills was quite impressive. There are actually 104 sawmills according to Juan, but today more than 50% of these have closed down entirely because they can no longer get logs from the native forest. And, of the mills that are still operating, most of these do not have many logs in their wood yards either.

Once we got out of town there was another shock, there were still no trees. Indeed for the entire day we would mainly be in gently rolling hills where 95% to 100% of the native forest had been removed. Logs from the bigger and higher-value species had been sent to Pucallpa's sawmills, but a lot of trees had just been cut down and burned in preparation for agriculture. After this land clearing there may have been a few years where the small producers that swarmed onto this land may have produced a few crops, but within a few years the productivity of these lands dropped quickly and the crops were abandoned. Then, exotic grasses like yaragua (*Melinus minuliflora*), Andropogon, Brachiaria and *Panicum clandestrinum* (and the non-grass kudzu (*Pueraria spp.*) were either sown and/or came in on their own. Some developers have seen the introduction of these grasses as a positive because it allows the small producers that have colonized these lands to raise beef and have some income. There has even been a first-class pasture improvement program sponsored by CIAT. However, as Jorge Chavez pointed out, once these grasses get established they are, in fact, the "most difficult thing to overcome" when establishing a forest plantation.

Bosques Amazonicas

We traveled on the main road in a southwesterly direction for 27 km and this road was quite good (it would be a Level 4 road in the National Forest system). Had we stayed on this road it would even end up in Lima within about two days of driving (and after negotiating a 15,000 ft. high pass), but then, at Campoverde, we turned and headed due south on the road towards Tournavista. After about 7 km, we stopped again, turned left, and entered into the grounds being managed by Jorge Chavez and Bosques Amazonicas. When purchased, much of this land was in grasses already, so, of course, there were more lectures from Jorge about how difficult the grass was to deal with. Don Jorge even extracted a few clumps of these grasses, knocked the soil off, and directed our attention to the spikey rhizomes to show us what a pain this grass is to get rid of.

Figure 2. *The current condition of much of the ground in the Pucallpa area where industrial forest plantation could be established. All the cattle we would see appeared quite healthy, but if some if this land is to be converted to forest plantations, the grass needs to be dealt with before the trees are planted and for several years afterwards. Note the red soil. At this location the soil was pH 4.2 (extremely acid) the aluminum saturation is over 70% and the inherent phosphorus availability is close to nil.*

A tremendous amount of work went on to get these plantations going. First, Jorge and his crew planted *Inga edulis* at a 3 x 3 meter spacing. That a leguminous tree was selected was most surprising. The soils on this farm were very acidic pH 4.1-4.3 and the rhizobium of most legumes cannot tolerate these conditions, but somehow these Ingas did pretty well and even managed to lay down a bit of an organic layer to provide some available nitrogen and improve the moisture retention and release properties of the soil. After about four years, the next plantation was established right over the top of the Inga plantation. This time with *Simarouba amara* (affectionately called Marouba). This tree species has also grown pretty well, but its wood cannot command a high price, so it, too, is only there as a nurse crop. The last tree species to be planted in this sequence is *Dipteryx oderata* and this tree does have an incredibly valuable wood. All of the Inga trees were removed at the time the Dipterex was planted, and once the Dipteryx get a bit more girth on them (approximately 12 cm dbh) the Maroubas will also be removed.

Figure 3*. Walter Nalvarte stands beside one of the stumps of one of the Inga trees that were used as a nurse tree for this site but which has since been removed to allow the Marouba trees (the trees in a row to the left of Jorge Chavez) to flourish. These Marouba trees will also be removed when the Dipteryx trees (not yet planted in this stand) reach about 4 cm. in diameter. So far, this fairly prolonged sequence of nurse trees appears to be the only way to ensure good establishment of the Dipteryx.*

Thus, the first ten years of bringing this land back into a condition where it can serve for the planting with a valuable tree species were just spent growing two nurse crops. Of course there are some other transformations that have also occurred during this period. As the crowns of the Maroubas were closing overhead another legume showed up and/or was deliberately introduced into the understory. This is Desmodium spp. The Desmodium has actually developed very prolifically (with tendrils reaching up to one meter in height) and has built in a lot of organic matter and is providing an environment where native species are now beginning to come back on their own. Thus Jorge's system is actually very effective at getting the Amazon back almost to the original Amazon condition, a feat which many people would have considered impossible. However, it is not a fast process nor cheap. Because this reconversion was taking place so slowly some economic questions came up.

Figure 4. *Jorge Chavez shows the numbered tag on one tree in one of the 75 permanent sample plots in the plantation area of Bosques Amazonicas. By measuring all trees in these plots at five year intervals it is possible to calculate the amount of carbon that these plantations are capturing and get paid for the amount captured.*

To partially answer this question, Jorge took us to see some of the seventy-five 35m x 35m permanent sample plots that have been set up on the Bosque Amazonica property. In order to set a baseline, all trees (over 5 cm diameter) are measured at the time the plots are set up, and then, at five-year intervals thereafter, all trees are measured again. So far, Bosques Amazonicas has had two additional measurements of all trees in these plots and this has enabled them to accurately calculate the amount of carbon being fixed and to collect some money for this fixed carbon. No doubt this provides some incentive for establishing these plantations, but almost certainly these payments do not come close to covering the full costs of establishing the plantations.

Figure 5. *Jorge stands waist deep in Desmodium, a ground cover legume that is planted (and/or comes in as a volunteer) and quickly colonizes the understory. Native tree species can seed in easily and naturally in this protected and enhanced environment.*

One other thing that Jorge showed us was a few individual Caoba *(Sweitenia macrophylla)* trees. This species is capable of extremely fast growth, and it's wood is of extraordinarily high value, but it's terminal leader and other shoot tips are very vulnerable to the larvae of the *Hypsipyla grandella* moth and the tree's form and value are ruined whenever this moth attacks. Jorge indicated that Caoba can be grown as individual stems in the understory, but that the overstory, at least in this part of the Amazon, can never be removed because this would then enable Hypsispyla to find and ruin the leader.

Bolaina Plantations and Natural Regeneration of Bolaina

Another forest area that we visited was another "27 km" down the road to Tournavista. It was an area where a Korean investment company had established a plantation of bolaina (*Guazuma crinita*). I had wanted to see this tree growing naturally and in plantations because of a considerable amount of hype that I had received about this species prior to making the trip.

Figure 6. *This picture of the Korean bolaina plantation demonstrates the potential of this tree for rapid growth and outstanding form. Note that some of the thinned out bolaina trees are being used as corduroy in a low muddy section of the path. Thinned bolaina are also frequently used as fence posts.*

Figure 7. *The importance of thinning of bolaina stands is well demonstrated in this pair of pictures. These bolaina stands were planted at the same time, but the stand on the left was thinned about two years earlier and the remaining trees, free of competition, were able to grow quickly in girth. The bolaina on the right, by contrast, were never thinned and have only developed at a fraction of their potential.*

It is important to note that making this trip to see bolaina made our field trip much longer, but until we made this trip we had seen almost no bolaina at all. This is because prior to this we had been mainly on the super acid laterites (pH 4.1-4.3) and the bolaina apparently cannot perform well in such acid soils. As we started getting closer to the bolaina plantation area we also started seeing naturally regenerated bolaina in lots of places. I was told that the pH of the soils that we had come on to was now 5.3-5.4 which many rhizobium can tolerate.

The bolaina were very easy to spot because all of these trees were flowering profusely at the time of our visit and the whole tops of their crown were bright pink. These naturally regenerated bolaina also had an exceptionally straight bowl with very little taper and a clean, greatly recessed crown due to exceptional self-pruning.

Finally we came to the Korean plantations. The owners were not present at the time of this visit but a couple of neighbors were and they were happy enough to have us go into the stand and have a look.

It appeared that about 200 ha of bolaina had been planted about 5 years earlier. The spacing was probably 3 x 2 meters initially, but there had been some thinning (as evidenced by stumps) in most of the plantation and the residual spacing was now about 6m x 8m and all of these residual trees had a large girth (20 to 25 cm dbh). There were two exceptions to this general observation. In a one ½ ha section of the plantation no thinning had taken place and the bolaina trees had remained very skinny (5-15 cm in diameter). Also, in another 50 ha section of the plantation there had been a fire and very close to 100% of tree in that fire had died. In addition, lots of grasses (apparently Andropogon and Yaragua (*Melinus*)) had seeded in on the burned area following the fire.

Teak and Eucalypt Plantations

There were two other plantations that we looked at this day, and these were back in the outskirts of Pucallpa. One was a teak plantation and one was a eucalypt hybrid plantation. Both looked exceptionally good and were being managed extremely well. I would later find out much more about these plantations from Enrique Trujillo (see ahead).

Figure 8. *Teak (on the left) and eucalypt plantations on the outskirts of Pucallpa. Both species are showing some promising early growth in plantations established by Reforesta Peru.*

After our tour to the forest plantations in the Ucayali Department, Victor Miyakama and I had to sprint to the Pucallpa airport because our 9:00 PM flight had been moved up a couple of hours. We made the flight and got back to Lima no problem, but then, all night long the author's head was wrestling with several thoughts: what kinds of industrial forest plantations might make sense for the Ucayali area? What kinds of projects might be reasonable for USAID to help out in? and, What kind of support and help could USAID offer that would be both successful and appropriate.

By morning, I thought I had it figured some of this out. At least sort of, and, later, when I would give my lecture on Tropical Forest Plantations for Industrial Purposes at SERFOR, I would be able to test out a few of these concepts with many of Peru's most knowledgeable foresters.

Lecture and Dialogue at SERFOR on Industrial Forest Plantation Options

The offer to go to Peru and check on plantation options came about because it was known that the author had spent about 25 years of his life tightly engaged in developing industrial plantations in the tropics. (This included long stints of a few months to five years in Colombia, Ecuador, Peru, Brazil, Costa Rica, New Zealand, the Philippines, Burma, Ghana and Tanzania and shorter, consultancy-length, stints in another half-dozen countries).

The author put together a 50 minute, 55-slide, powerpoint presentation on things he thought should receive attention before embarking on industrial forestry plantations in the Amazon region, however, during the presentation, there were a lot of good questions and comments, so this presentation took about 100 minutes.

Then the author had also compiled a 12 slide power- point presentation on the main features that had been discussed in the field during the review of forest plantations in Ucayali earlier in the week and had Jorge Chavez give the bulk of this presentation. This presentation took another 20 minutes.

Finally we had a round table discussion, for another two hours, about the way forward for forest industries in the Amazon Area. Everybody that stayed actively participated in this dialogue, with an exceptionally active participation by Enrique Toledo who had spent most of his professional life preparing for and directing the development of the company Reforesta Peru.

Not too surprisingly Enrique Toledo, who has skills and experience in both manufacture of forest products and the economics of forest industries, had also clearly come to the conclusion (but years earlier) that only high- end forest products should be attempted in the Amazon region. But the special strength of Enrique is that not only was Jorge he able to identify which forest products had the greatest chance of being successful, he also knows the most economic ways of manufacturing these products using the tree species that were currently available in the Pucallpa area. This capacity was developed because he had spent 10 years working abroad in commercial woodshops in Germany and Japan. Another of Enrique's strengths is that he is an excellent

speaker and has been able to convincingly share his plantation and manufacturing dreams with several investors.

Of all possible products that can be made from wood (and there are hundreds) Enrique also hit on the idea of producing high-value doors as the most promising. He has also found that bolaina, which is easy to produce either through natural regeneration or through plantations can provide the ideal low- cost wood that he needs to produce the block board that will go into the core of the door. To date Enrique has been using sliced caoba produced from the natural forest for the veneer sheets that will cover this core and give the door its gorgeous appearance. But caoba is getting very scarce and it is very tricky to grow because of the aforementioned Hypsipyla. Because of the increasing scarcity of caoba, Enrique is moving to plantation-grown teak for this veneer. This species also has a very hard and charismatic heartwood. And there is already a great market for teak internationally and especially in many of the Asian markets. It should be noted that Enrique's plan will work well only on the better soils (well drained and higher pH) because, as mentioned above, this is probably the only place that teak is capable of having rapid growth and good form. Unfortunately for Enrique, it may be very difficult to get large extensions of land with these "better soils" as these have also been the soils that were preferentially colonized by the small producers that have been moving into the Pucallpa area over the past 40 years.

Un Almuerzo de Amistad y Trabajo

As a result of the foregoing series of events, ideas on what forest industries might make sense in Ucayali gelled even further. And, there would be one more excellent occasion to discuss these industrial forest plantation options and that would be during a 4 hour lunch on Saturday with Prospero Yance and Alberto Yataco.

A Summary of Industrial Forest Plantation Options that USAID Might Support

Finally, we arrive at the point in this report where the author is willing to make his first suggestions about what industrial forest plantation projects might make sense for the Pucallpa area. Although a dozen industrial forest options were considered, only a few stood out as especially positive. We will start with the very simplest of these projects and progress to some that get a little more involved.

A Bolaina Tree Improvement Program

There are several tree improvement activities for bolaina that could be easily be supported by USAID. Again, we will start with the very simplest of the bolaina improvement projects and then progress to some that are a little more involved.

Density Management in Bolainales

At the very least it would seem reasonable that in areas where there is a market for lots of bolaina wood it would be a good idea to develop a simple extension system to promote optimal density management in natural stands of bolaina.

Shortly, an experiment to determine optimal spacing of bolaina will be described. However, while that experiment is being run, there still needs to be a lot thinning in existing bolainales so perhaps an estimated thinning regime would be helpful. If there was just to be one thinning operation, I would guess that it should be when the bolaina are about 18 months old (or when the bolaina are about 5 meters tall) and that at that time the numbers of stems should be taken down to 800 evenly spaced stems per hectare (sph).

But maybe there could also be two thinnings. If that is possible I would do the first thinning to waste (where the cut trees are discarded) at about 1 year and reduce the density to 1000 sph at that time. Then, the second and final thin could take place at about age 2.5 years with a reduction to about 500 sph. At the time of this second thinning an intermediate product might be possible; for instance trees removed during this second thin might be cut into 2 meter lengths and used as fenceposts. (Note if this fencepost option were to be pursued an obvious first step would be to determine if these young bolaina poles were recalcitrant to treatment with a range of different preservatives).

Teaching thinning is not hard (it can be done in an hour in a plantation that is ripe for thinning) and the benefits of thinning are too enormous to ignore.

At this point it would be wise to remember that although thinning along the lines described above will certainly provide a significant boost to the growth of bolaina, these recommendations probably are not the absolute optimal. Other foresters operating in the Amazon region may be able to modify these instructions somewhat, immediately. In the longer run however, the results of a formal spacing experiment should provide the absolutely best spacing recommendations.

One possible experimental design to determine optimal density in bolainales could include planting bolaina on tenth hectare plots at 4,000, 2000, 1000 and 500 stems per hectare (sph) (in a four block randomized block experiment) and comparing the development of trees on the interior 20m x 20m meters of these plots up through age 10. This experiment could be begun immediately and would require about 2 ha of homogeneous bolaina-conducive ground.

It would also be important to determine the best age to thin, whether multiple thinnings were necessary, and how intense the thin should be at each intervention. This would be a split-split plot experimental design and would require about 5 ha of fairly homogeneous ground. A graphic display of what these experiment would look like is available on request. Of course, it will take nearly a decade to get the results of these trials.

Once these tests are run and analyzed, sharing of the “best spacings” could be promoted via a simple publication and a simple extension program.

One thing that could seriously complicate thinning operations, however, is that in the Amazon it is not always clear who owns the land (and therefore the trees). Therefore, it might be difficult to promote thinning in all bolaina stands. A lot of additional considerations about how to cope with land-tenure issues are considered in Sears et al. (2018).

Natural Propagation and Establishment of Bolaina

It was observed that bolaina does propagate itself quite well through natural regeneration, but there might also be some easy tips, like deliberate scarification of the soil shortly before bolaina seed set, that might also promote good initial and more evenly distributed natural establishment of bolaina.

Redistribution of naturally regenerated bolaina would also be worth looking into and promoting if it works. Done well this would mean lifting some recently generated bolaina seedlings from where they had germinated en masse and moving them to a local that had less than full stocking. What constitutes full stocking, of course, will also be easier to scope in on following the spacing experiment. In the meantime getting the numbers of bolaina trees to 500 sph would seem to be a worthwhile objective of any young bolaina redistribution program. There is also the possibility of establishing bolaina in plantations and my understanding (from the internet) is that there is already one community/company that is successfully doing this.

Harvesting and Marketing of Bolaina

There has got to be a better way of deciding when to harvest naturally produced bolaina and also of marketing that wood so the small farmers can get somewhat greater profits.

One of the ways of increasing the value of bolaina will be through combining (gluing and pressing) some bolaina blocks with other bolaina blocks in the making of engineered wood products like block board and finger jointing. Another will be to cover these engineered bolaina panels with a veneer of a high-value hardwoods. There are many different engineered wood products that could greatly help bolaina have a much more successful role in the markets.

Block board, of course, can be made from many different clear relatively light weight woods (eg poplar pine) and so, by itself, block board from bolaina would not be especially worth producing. However, if this amazon-produced hardwoods could be combined with a higher value hardwood also produced in the Amazon, then, potentially, one could make a lot of profit.

Further, if USAID-Peru was open to the idea of sending some Peruvian "students" to the US to get a little experience with understanding the properties of bolaina (and other woods) then they could equip Peru with some huge potential. While in the states, these students should also learn manufacturing possibilities that would be advisable for a wood with bolaina characteristics and the potential for marketing products manufactured with this wood. The USDA Forest Products lab in Madison Wisconsin and the wood labs at several state-side Universities (eg N.C. State and Oregon State) are in an excellent position to provide this guidance. Also, Rich Vlosky at the Louisiana Forest Products Development Center is extremely well-placed to help show how these bolaina products could be optimally marketed.

Production of High Value Hardwoods

Forest Plantations in the Ucayali region need to be very well thought out in order to be successful, but there may be some forest ventures that could be highly successful. The greatest

drawback of producing timber products in the Amazon area of Peru is the tremendous cost of getting a product to the market. Therefore only forest products with a very high value are going to be worth producing in plantations in the Amazon. Bolaina might be a part of that forest product, but it will almost certainly need to be enveloped as block board or serve flooring base and then covered with a wood of a species with a much higher value before its production will be economical.

Two "high-value" species that grow reasonably well in the Pucallpa area that should therefore be of great interest in this regard are Dipteryx and Teak. Of course Dipteryx is a native species and its wood is extremely hard and gorgeous. It could be used for very high-class flooring. The big drawback for Dipteryx, so far, is that it appears to need a long nursing period and then even after the nursing period is complete, it continues to grow quite slowly. In sum, an extremely long rotation appears to be needed to get the tree to a utilizable size. A challenge that could be well worth undertaking by a USAID-supported project could be to find ways to get the Dipteryx establish more quickly and then grown faster through to the end of the rotation. There are several silvicultural techniques that could be tried to help make this happen. Very succinctly, they include: site selection, genotype selection, site preparation, fertilizer optimization, density control, pest control and weed control. (Note: the author would be glad to design research experiments to explore all of these approaches. The challenge of finding an optimal fertilization regime is especially intriguing; 93% of the Amazon is deficient in Phosphorus and 74% has aluminum toxicity problems (Cochrane and Sanchez, 1981). The author spent a good amount of his career unlocking these problems for trees in other parts of the tropics and would enjoy working with others to find some economical solutions to these problems for Peru. This might not be especially difficult. At the Yurimaguas Station, a few hundred kilometers north of Pucallpa, Peru already has a 40 year history of trying to cope with these problems on similar soils but different crops.

There may also be several ways of defraying the costs of a long Dipteyx rotation. For instance it should be possible to grow Dipteryx trees in certain Agroforestry configurations (with corn, plantain, coffee, cacao, yucca citrus or other) and it is even possible that the collection of the Dipteryx seed (commercially referred to as Tonka) might help pay for some plantation management costs until the trees can be harvested.

A lot of these trials, I am guessing, could be done on Reforestacion Amazonica Land. Jorge Chavez is a most innovative forester himself and has already made dozens of discoveries on how to get Dipteryx established. It might also be a wise idea to bring in ICRAF professionals, such as Jonathan Cornelius, to help work out some of the best agroforestry combinations to try, best experimental designs to use when trying to determine which are the best combinations of plantations trees and agricultural crops, and also for analyzing the copious amounts of data that are inevitably going to be generated in such agroforestry experiments.

It is a little bit shocking that no other high-value native hardwood species appeared to have been tried in the Pucallpa area. However, in a species trial in the Amazon of Brazil, where there are very similar soil and climatic conditions to those of Pucallpa, Machado et al (1918) compared the growth and health of 4 native tree species and one exotic species for five years and concluded that Dipteryx was the best option (the other native species were *Swietenia macrocarpa*, *Parkia*

decussata and *Jacaranda copaia*; the exotic species was *Acacia mangium*). (Note: the criteria for ranking these species was based on tree health, survival rates and wood value and only partially on growth rate; Dipteryx was actually the slowest growing of all species in this trial.)

There are probably some much more economical ways of using the wood of Dipteryx when it is produced. Especially the use of thin sliced veneer of Dipteryx heartwood to cover bolaina blockboard could be an excellent way of making this very valuable wood go a lot further. When sliced, it should also be possible to use Dipteryx wood in flooring systems such as with the Pergo systems which are sold very successfully at major wood yards like Lowe's and Home Depot in the US. Again, wood research units such as the US Forest Service Lab at Madison or the wood labs at NC state or Oregon State could probably help with these studies on wood property studies and also on the best ways to manufacture the gamut of most promising products.. There are also specialists in the US that could help bring these products into the market. Besides the US, there are also many other national markets that would be interested in this kind of flooring product (eg Italy, Japan, Germany, Scandinavia)

Teak, is not a native species to the Amazon Basin, but it has shown that it can grow very fast and with good form on at least some of the more extensive soil types found in the Peruvian Amazon. This is actually a little surprising, I had thought that this area might be too continually rainy to get good teak form (normally teak needs a definite dry season so it can set its terminal bud and let some side shoots develop) but the picture in Figure 8 clearly shows that good lateral buds are also being formed. It still might be worth doing a little provenance progeny testing to ensure that the germplasm that get planted in the Pucallpa area has a high enough propensity to form lateral shoots under these climatic conditions.

One thing teak has going for it is that there is an abundance of information on silvicultural practices to optimize its growth in the field and also of optimizing the use of the wood produced from this species both from mature stands as well as when the thinnings are being pulled out. There is also a great amount of information available on how communities can organize to produce teak on their own land. Furthermore all of the extension materials needed to do all of these things have already been produced as well. Of course some modifications would probably be needed to fit these lessons to the realities of Ucayali. Places worth modeling would include the Guanacaste Teak cooperatives in Costa Rica. Also, somewhat more locally, RAMSA (according to the literature) seems to be doing a nice job of working with local farmers in the relatively nearby department of San Martin.

Very locally Reforesta Peru might be able offer an especially attractive partnership. According to Enrique Toledo they would like to produce about 70% of the timber that they will need for their mills on their own lands but they are also counting on getting the remaining 30% of the wood that they need from cooperative arrangements with small producers living within the Pucallpa Wood Basket. It seems very probable that Reforesta Peru will be producing hundreds of thousands of high quality teak seedlings in their nursery and that they will be hiring a few extension foresters that could help small producers get teak seedlings properly planted and maintained on the land of these producers. Reforesta Peru might even be able to help procure funding for the reforestation costs.

A challenge, of course, in this kind of arrangement will be to figure out the fair share that Reforesta Peru should pay for teak timber stumpage produced by the small producers with help from Reforesta professionals. I am not good at settling this kind of situation, but I know that there are several entities in Peru that could probably help come up with a fair arrangement. This list would include SERFOR and CIFOR.

There is one other important consideration with teak. A rust disease (*Olivea spp*) has shown up in Vicosa, Brazil. It is likely that this rust will find its way to Peru and when it does, the climate of the Amazon will favor its rapid spread. When this rust colonizes more than 50% of a teak leaf, the leaf drops regardless of the season. Fortunately, there is a large degree of genetic variation in susceptibility to this rust. It is strongly recommended that all teak growers in Peru obtain rust-resistant germplasm and which is also adapted to growing well in the Amazon environment. Some genetic testing with this species should be anticipated in upcoming years.

Additional Possibilities

The trip to the Amazon was a most excellent trip, however, we were just there for one day and were not able to see one of the most abundant soil types in the Pucallpa area. These were the Hapludults that abound especially on the eastern side of the Ucayali River. These soils, are poorly drained and are often under water during the monsoon season. In general only a few palm trees are known that can thrive on these soils. Never-the-less, these lands are not nearly as heavily populated as the more upland soils and so there could be big blocks of land available for purchase. Some conversation was made about the possibility of buying some big spreads of this land and then installing a system of drainages. In some situations similar to this, for instance in the land-locked bottom lands of Paraguay, it has been possible to drain lands like these and make them productive for agricultural crops. It might be very risky but then again, if the proper measures were taken it might be possible to plant a tree like *Calyophyllum spruceanum* and take it through to a full rotation. *C. spruceanum* produces a fine wood and is also among the most tolerant of the native hardwoods to poor drainage.

It must be remembered however, that when these lands are used for agricultural crops, the soil section only needs to be reasonably dry for 100 to 150 days which should be possible as the flooding usually occurs only during the two monsoon seasons. By contrast, with a tree crop one needs to keep the soil section sufficiently dry for maybe 5,000 days (15 years) straight.

Tree Health Issues examined during this visit.

Meeting with Carlos Torres, Peru's only tree pathologist

Carlos Torres is one of about six agricultural pathologists that works at SENASA but he has also taken a keen interest in looking into diseases that affect trees. He has some experience with trees in plantations in the Amazon, but most of his experiences are with tree diseases in urban Lima. Carlos already had commitments for most of the week that the author was in Peru, but he was available on Monday morning (May 13th) so we made the most of it. Carlos gave me a 42 page book that he edited on Disease and Insect Problems of Trees in Peru (SENASA, 2008) . It was written in collaboration with 11 international authorities on these disease and insect problems

and is loaded with good information and great pictures. However, Carlos is well aware that this book is just the tip of the iceberg of what Peru would need to know about tree diseases if it were to get fully engaged in industrial forest plantations and was extremely enthused about setting up a collaborative forest pathology arrangement. We talked for about 90 minutes and he showed me the place where he works at SINASA. It is right next door to the International Potato Research Center (CIP). While there, I also gave him a dry run of the power point that I had prepared for this consultancy titled "Patologia Forestal en plantaciones forestales en los tropicos". Later on, I also left a copy of the book I had written years earlier titled, "Patologia Forestal en El Ecuador (260 pp)". I also left him with a DNA kit so he can collect samples of fungi that appear to be causing problems in trees growing in Peru, make isolations of these fungi onto petri plates, and then send these petri plates to the Ned Klopfenstein Forest Pathology Lab in Moscow, Idaho where the fungi can be identified to an exceptionally accurate level using DNA analyses.

Lecture and Dialogue at SERFOR on Diseases that can Adversely Affect Tropical Forest Plantations

Many things have to go right in order to have successful industrial plantations in the tropics and this includes, legal, financial, social, environmental, and silvicultural aspects of plantation forestry. It also implies that the forest plantations must be healthy and free from serious insect and disease problems. The author presented a 55 slide power point on the diseases that he thought could become problems on forest plantations growing in the Amazon Region of Peru and also discussed the best ways of eschewing or dealing with these diseases. A total of about 8 abiotic diseases and 20 biotic diseases were covered and plenty of time was taken for discussion. This session was attended by 30 persons and lasted for 3 hours.

Tree Pathology problems at the US Embassy and the Ambassador's residence.

On Thursday and Friday mornings the author spent time in the company of Jonathan Kodadek and Russell Duncan reviewing the health and condition of trees at the US Embassy in Lima and of the trees growing on the grounds of the US Ambassador's residence. These visits were prompted by the fact that a large chinaberry tree had fallen over at the Embassy and almost caused damage to some personnel. The grounds at both of these locations are spectacular, never-the-less, we found several tree-health situations that could be improved on. Most of these are listed below.

At the Embassy-

- The troublesome chinaberry tree (*Melia azaderach*) was the first tree looked at. It had been killed by a root and butt rotting basidiomycete. The stump that was left measured 40 cm in diameter and the interior 18 cm of the heartwood of this stump was totally rotten (see Figure 9). Several Ganoderma-like sporocarps (fruiting bodies) were collected from the base of the stump and isolations were made from one of these in an *ad hoc* transfer-hood set up in the author's hotel room. The petri plates resulting from these isolations were then sent to the Ned Klopfenstein laboratory for Forest Pathology at the USDA Forest Service Rocky Mountain Research Station in Moscow, Idaho (including, of course, all the needed permit papers).

- The next set of trees we looked at included a row of about 20 flame trees (*Delonix regia*) which are referred to as Poinsiana trees. It appeared that about 4 flame trees had already been removed and that for each of these a young flame tree had been planted in its place.

  About six mature flame trees were highly chlorotic (yellow foliage) and of these chlorotic trees 4 had very substantial dieback.

  During this visit it was noticed that much of the grassy areas at the Embassy had at least a thin film of water at the surface; the problem with the chlorosis of these flame trees at the embassy may well be due to a conflict between the needs to keep the grassy areas on the grounds a nice emerald green, by watering every day, and the fact that by doing this the roots of the flame trees were suffocating from too much water. A general rule of thumb is that you do not want roots of most tree species to be under anaerobic conditions for more than 4 consecutive days.

  Another thing we checked on was the possibility that the nylon string grass pruners may have caused damage at the base of the affected trees. There was some evidence that there was a little grass-pruner damage, but there were not enough of these problems to explain all of the woes that these flame trees were experiencing.

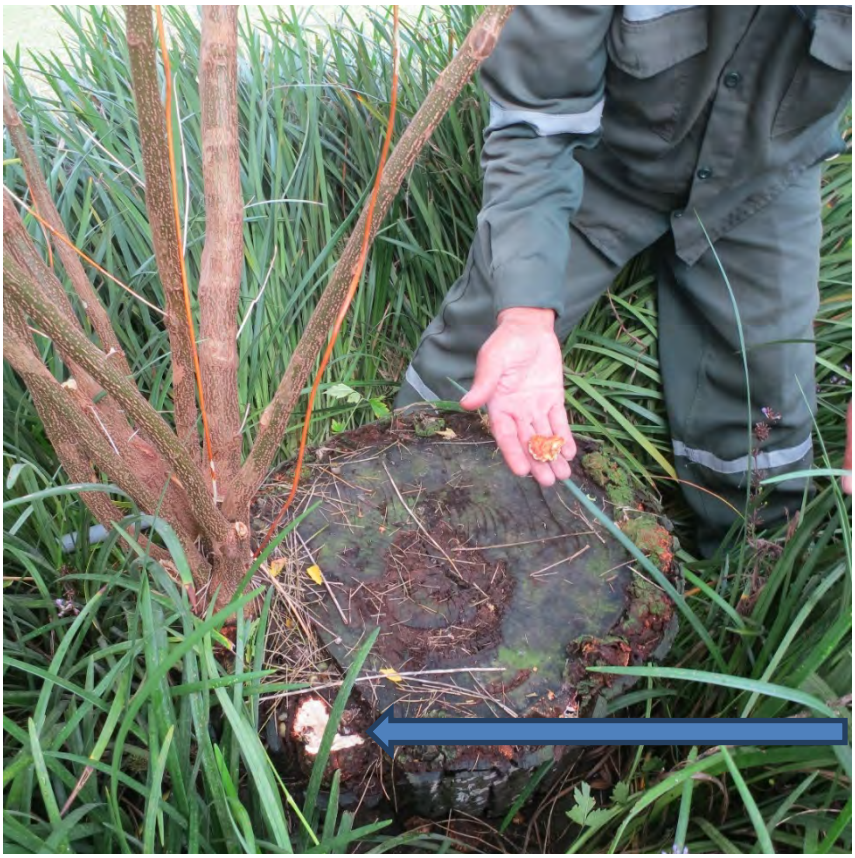


Figure9. *The stump of the troublesome chinaberry tree at the US Embassy. One of these trees had fallen over and nearly hit someone. This picture shows that the heartwood of this tree is completely rotten (bottom arrow). There were about one dozen fructifications from this fungus around the base of the stump. The groundskeeper holds one of these in his hand; it could be a Ganoderma. An isolation was made from this fungus onto agar in a petri plate and the resultant*

culture was sent to the Dr. Ned Klopfenstein, RMRS Forest Pathology Lab in Idaho where molecular genetics will determine the exact identification of this fungus.

The author recommends that about three of the most chlorotic Flame trees be removed now and that the three next most chlorotic flame trees be followed for the next six months. It was obvious that the Embassy wants to have flame trees in this row because there have been another 6 younger trees already planted in this area. If the Embassy has to have flame trees here, consider modifying the watering regime of these trees.

- Of course, one of the things that you look for when one species of tree is suffering a lot is an alternative tree species that could take its' place. Looking nearby, we saw that there was a young row of Molle trees (*Schinus molle*) that looked very healthy. These seemed to be growing very well so far, however, in the authors experience this tree can also become susceptible to butt rotting fungi at later ages (greater than 30 years). This is especially the case when molle is grown where there is an overabundance of water because the extractives in its heartwood will become leached out and this heartwood will then become very vulnerable.
- The next set of trees that were examined were the 11 large but ragged looking row of *Grevillea robusta* that had been planted along the wall near the large apartment complex. These trees had obviously grown well for several years but then, for some reason, their water supply had been cut off. Indeed, the irrigations ditch that ran along their base was bone dry. Most of these trees are now in a very scraggly condition. I would recommend going in with a cherry picker and dropping all of these trees in sections. (Note: the reason a cherry picker will be necessary is because there are two walls and an apartment complex nearby and the crowns of the Grevillea trees are highly irregular which would likely preclude an accurate directional felling of these trees from their bases).
- The next set of trees examined was a row of about 30 *Grevillea robusta* trees that ran along another wall (just on the far side of the tennis courts). These trees were probably planted at the same time as the 11 Grevilleas mentioned in the previous paragraph, but unlike those Grevilleas, these Grevilleas had received ample water throughout the time they have been growing there. Indeed, as we were examining these trees there was a gush of water coming into a ditch that would supply all of these trees with water. (This water was coming from the water treatment plant right there on the compound). It was insightful to note that these trees had approximately double the diameters of the 11 grevilleas in the previously described row. This would mean, very crudely, that these Grevillea in the healthy row had received about 5 times as much water over their lifetimes as their counterparts in the dying row (based on the knowledge that it takes about 400 liters of water to produce one kilo of wood). In spite of the generally healthy nature of these 30 Grevillea we did notice that a few of these trees had received some damage from the grass pruners.
- Jonathan asked about the condition of three palm trees, one of which was leaning over the walkway into the back entrance of the Embassy. The leaning of this one tree has taken

place because the palms are struggling to get into a position to receive more light, but all of these trees are in a very healthy condition and it should not be necessary to remove any of them in the near future.

- We also looked at a very handsome Norfolk Island Pine (*Araucaria heterophylla*) on the main gate-side of the Embassy Compound. This tree was in a very healthy condition and might present a good option for planting if it is ever decided to replace the row of flame trees on the back side of the Embassy.
- All of the remaining trees in the Embassy compound near the main gate also appeared to be in great health.

At the Ambassador's Residence

There are about 10 very prominent 30 to 40 cm diameter (30m tall) Norfolk Island Pines (*Araucaria heterophylla*) at the US Ambassador's Residence. Generally these are very stately and give the grass lawn area a magnificent setting for holding outdoor activities such as the Annual Fourth of July Picnic. There is, however, a problem with gummosis on about five of these trees and also some of the trees have lost a high proportion of their needles on some of their branches. Also, three or four of these trees were showing a fair amount of "needle" casting. On many of these trees there has also been a high degree of pruning in the base of these trees. Presumably this was done because the limbs that were pruned had lost most or all of their needles.

With respect to the gummosis, this has been observed on Norfolk Island pine in other locations as well. Gummosis can occur as a result of some physical damage but it can also occur when there are canker causing organisms trying to get into the tree like Botryosphaeria (Slippers et al 2006) or Dothiorella or Botryodiploidia (Kliejunus, 1976). The needle casting can occur when there is either too much or too little water.

Ironically all of these symptoms may be related. If the trees were not watered enough they could drop their needles. The fact that they did not get enough water could also make them substantially more vulnerable to canker-causing organisms such as Botryosphaeria (Slippers et al, 2005). Under conditions like the Ambassador's residence there would be the temptation to want to prune off any limbs that might have dropped all their needles but this could also be risky as the saw used to prune the dead limbs off of one tree could also be carrying spores of this fungus with it when used to prune limbs off the next tree.

It was also seen that two Norfolk Island Pine trees had been removed entirely, presumably because their condition had deteriorated even further (these trees were both loaded with bluestain, a fungus that commonly comes in after a tree has died).

It was also noticed that a few Norfolk Island pine had been planted in the past few years and that there were a couple dozen more of the NIP in the nursery area. It should not be a problem to raise healthy Norfolk Island Pine at this location, however, a few tips are offered in continuation just to increase the odds of success.

Plant all future Norfolk Island Pine at least two meters away from the existing stumps of trees that have been removed.

Keep the soil of the Norfolk Island Pine moist (but not saturated) down to a depth of at least 20 cm. This will be a little tricky because the gardeners will also be trying to maintain the grass green all of the time as well; grass and trees have different optimal watering regimes!

If branches must be pruned off, prune the right way (actually this appeared to be happening both at the Embassy and at the Ambassador's Residence) but also sterilize the sawblade when switching from one tree to the next. (The fast way of doing this is to spray alcohol on the blade and then light it on fire). This will prevent the saw from carrying the Botryosphaeria spores from one tree to the next.

Big CedroTrees-

There are also six quite large Cedro trees (Cedrella oderata) trees (30-40 cm in diameter) that need to be removed from the compound. One of these is hanging over the diagonal wall that is all the way across the lawn from the main entryway into the compound. The other five can be found by turning left after entering the compound and continuing to go along that wall until reaching a corner. There apparently, five cedros were weakened and started to die back when a living hedge was set up to protect the view of a utility house from the main house.

In all six of these cases the cedros are not currently in good shape and should be removed using a cherry picker so they can be dropped in sections and not smash up infrastructure below them.

References

Anon. Map of Peruvian Soils.
http://4.bp.blogspot.com/-FkE2mOpp68/TaoCpzmCqkI/AAAAAAAACyk/ogGNBLvGvQE/s1600/mapa-de-suelos-de-peru.jpg

Camino R. and J.P. Morales. 2013. Las plantaciones de teca en America Latina: mitos y realidades.

Cannon, P. Patologia Forestal en El Ecuador USAID 260 pp.

Corchrane T. and P. Sanchez. 1981. Soil properties and their management in the Amazon Region: A state of knowledge report. In: Amazon Land Use Research. CIAT Cali, Colombia.

Kliejunas, J. 1975. Bleeding canker of Norfolk Island Pine (*Araucaria heterophylla*) in Hawaii. 1976. Food and Agricultural Organization of the United Nations.

Krishnapillay, B. (no date). Silviculture and management of teak plantations. http://www.fao.org/docrep/x4565e/x4565e04.htm

Nalvarte, W. 2015. Situación y perspectivas del sector plantaciones comerciales para madera en Perú (sierra y selva). Una consultoria por CIFOR (112 p).

Machado, M., R. Camara, P. Sampaio, J. Ferraz and M. Pereira. 2018. Silvicultural performance of five forest species in the central Brazilian Amazon. Acta. Amaz. Vol 48 no 1. DOI: 10.1590/1809-4392201700602.

Mendiola, A., C. Aguirre, J. Davila, M. Fernandez y P. Vittor. 2016. Estructura economico y financier de un instrumento de participacion en negocios forestales: el caso de la teca en la region San Martin. Universidade ESAN, Esan Ediciones. 192 pp.

Sears, R. P. Cronkleton, F. Vilanueva, M. Ruiz, M. Perez Ojeda del Arco. 2018. Farm-forestry in the Peruvian Amazon and feasibility of its regulation through forest policy reform.

SENASA, 2008. Hongos y Insectos Forestales en el Peru. Subproyecto: Identificacion e inventario de insectos, hongos y cromistas de improtancia forestall en las regions de Haunuco, Junin, Lima, Loreto, Madre de Dios, San Martin y Ucayali. Ministerio de Agricultura SENASA, Peru. 42 pp.

Slippers, B. B. Summerell, P. Crous, T. Coutinho, B. Wingfield and M. Wingfield. 2005. Preliminary studies on Botryosphearia species from Southern Hemisphere conifers in Australia and South Africa. Australasian Plant Pathology. 34: 213-220.

Toledo, E. 2018. Ayuda Memoria: Presentacion Empresarial. Reforesta Peru. 9 pp.

IUFRO e-lists promote communication

Sheila Ward tropicalforesters@gmail.com

The International Union of Research Organizations (IUFRO) is the major global network for forest scientists. It includes about 15,000 scientists in 700 Member Organizations in more than 110 countries. Scientists participate in IUFRO on a voluntary basis. IUFRO is divided into Divisions as large topical areas, which are subdivided in to Research Groups and further into Working Parties. IUFRO has various elists to promote communication among those interested in various topics in forestry. This table gives the active lists for the Divisions, Research Groups (RG), and Working Parties (WP). The link in the first column gives access to the page where you can sign up for a given e-list. The last column gives archives to past messages for that e-list.

List Name	Mailing List for:	Archive
Divisional Lists		
Division 1	Discussion within Div. 1 - Silviculture	Visit Archive
Division 2	Discussion within Div. 2 - Physiology and Genetics	Visit Archive
Division 3	Discussion within Div. 3 - Forest Operations Engineering and Management	Visit Archive
Division 4	Communication within Div. 4 - Forest Assessment, Modelling and Management	Visit Archive
Division 5	Discussion within Div. 5 - Forest Products	Visit Archive
Division 6	Discussion within Div. 6 - Social, Economic, Information, and Policy Sciences	Visit Archive
Division 7	Discussion within Div. 7 - Forest Health	Visit Archive
Division 8	Communication within Div. 8 - Forest Environment	Visit Archive
Division 9	Communication within Div. 9 - Forest Policy and Economics	Visit Archive
RG Lists		
RG 1.01.00	Discussion within RG 1.01.00 - Temperate and boreal silviculture	Visit Archive
RG 1.02.00	Discussion within RG 1.02.00 – Tropical and subtropical silviculture	Visit Archive
RG 1.05.00	Discussion within RG 1.05.00 - Unevenaged silviculture	Visit Archive
RG 2.04.00	Discussion within RG 2.04.00 - Genetics	Visit Archive
RG 4.02.00	Discussion within RG 4.02.00 - Forest resources inventory and monitoring	Visit Archive
RG 4.03.00	Discussion within RG 4.03.00 - Informatics, modelling and statistics	Visit Archive
RG 5.01.00	Discussion within RG 5.01.00 - Wood quality	Visit Archive
RG 7.01 Forclimair	Discussion within RG 7.01 Forclimair - Impacts of air pollution and climate change on forest ecosystems	Visit Archive

RG 7.02 Forpath	Discussion among scientists working in the field of RG 7.02.00 - Forest Pathology	Visit Archive
RG 7.03 Forent	Discussion among scientists working in the field of RG 7.03.00 - Forest Entomology	Visit Archive
RG 8.02.00	Discussion within RG 8.02.00 - Forest biodiversity	Visit Archive
RG 9.01.00	Discussion within RG 9.01.00 - Information services and knowledge organization	Visit Archive
WP Lists		
WP 1.01.07	Discussion within WP 1.01.07 - Ecology and Silviculture of Beech	Visit Archive
WP 1.02.04	Discussion within WP 1.02.04 – Sustainable management and genetic resources in Meliaceae	Visit Archive
WP 2.04.01	Discussion within WP 2.04.01 – Population, ecological and conservation genetics	Visit Archive
WP 2.08.07 Acacia	Discussion within WP 2.08.07 – Genetics and sSilviculture of acacias	Visit Archive
WP 2.09.02	Discussion within WP 2.09.02 – Somatic embryogenesis and other vegetative propagation technologies	Visit Archive
WP 4.04.03	Discussion within WP 4.04.03 – SilvaPlan: Forest management planning terminology	Visit Archive
WP 7.01.08	Discussion within WP 7.01.08 – Impacts of air pollution and climate change on forest ecosystems – Hydroecology	Visit Archive
WP 8.01.02	Discussion within WP 8.01.02 – Landscape ecology	Visit Archive
WP 8.02.02 Deadwood	Discussion within WP 8.02.02 – Forest biodiversity and resilience	Visit Archive
WP 9.05.07	Discussion within WP 9.05.07 – Science policy interactions	Visit Archive

Global Competition on Best Practices in Forest Education

Deadline for submission: 18 January 2019

On the 21st March of each year the forest community at large comes together to celebrate the International Day of Forests (IDF). In 2019 the day will address the theme 'Forests and Education'.
More often than not, great educators do not receive the recognition they deserve and their powerful teaching methods have a limited sphere of influence. To raise awareness of forest education and its impact on sustainable forest management, IUFRO, IFSA, HY+ and the University of Helsinki have launched a Global Competition to find the Best Practices in Forest Education. Winning methods will be shared to a worldwide audience, and winners will of course receive prizes!
The Best Practices competition will award 2 main prizes, one IUFRO 2019 World Congress Prize Package sponsored by the International Union of Forest Research Organizations (IUFRO), and one Forest Visit to Finland, sponsored by the University of Helsinki and University of Helsinki Centre for Continuing Education HY+.
Find detailed information here: https://www.iufro.org/science/task-forces/forest-education/competition-best-practices-in-forest-education/

Dragon trees – tertiary relicts in current reality, 1st World Conference on Dragon Trees,

Mendel University in Brno, Czech Republic September 5 – 8, 2019.

Only a few species among more than 60–100 species of *Dracaena* genus reach arborescent form. Arborescent dracaenas were classified into dragon tree group comprising following species: *Dracaena cinnabari*, *D. tamaranae*, *D. draco* s.l., *D. ombet* s.l., and *D. serrulata* s.l. spread in South Arabia, Macaronesia and North Africa.

The significance of these group of species is given by many reasons, most important are:

1. Dragon trees are tertiary relict species, the ecosystems (woodlands and very rare forests) with these species belong to one of the oldest ecosystems around the world

2. Most species are endemic with limited (often island) distribution

3. The distribution of most species is scattered to the small population with unbalanced age structure, where often young trees are missing

4. Most species are endangered and listed in IUCN Red List

5. Natural regeneration of most species is endangered by overgrazing

6. Most species are important source of non-timber products since ancient times (resin, fodder for cattle or beekeeping) thus belong to culture heritage

7. Most species are spread in developing countries with unstable political situation, the populations are under pressure of local inhabitants and weak governments do not have sufficient resources and possibilities to protect these species

The main objective of the conference is to present latest results of research focused on species of dragon tree group and to determine main gaps for future investigation as the bases for conservation management. For this reason, the informal Dragon Trees Consortium will be established within conference.

More information can be given by prof. Petr Madera, petrmad@mendelu.cz

African Forests Tropical Ecology

Tropical Forest in Gabon. Photo credit: mongabay.com. Used with permission under GNU Free Documentation license.

SAVE THE DATE. Watch for the coming meeting on African Forests Tropical Ecology (AFTE): AFTE2019: International Forum on the Ecology, Uses and Conservation of African Tropical Forests, scheduled for 3-6 December 2019 at Libreville, Gabon *(AFTE2019: Forum international sur l'écologie, les usages et la conservation des forêts tropicales africaines, 3-6 déc. 2019 Libreville, Gabon*). From Pierre-Michel Forget pierre-michel.forget@mnhn.fr

Tropical Biology and Conservation Meeting - Madagascar

The Association for Tropical Biology and Conservation will hold their 56th annual meeting in Antananarivo, Madagascar (https://atbc2019.org/) from 30 July to 3 August 2019. The theme of this meeting is "Tropical biology and sustainable development". MADAGASCAR ATBC 2019 aims to gather researchers, students, and professionals in a range of scientific disciplines from around the world in order to provide an effective tool towards this common effort to harmonize biodiversity conservation and human well-being. The meeting will provide an important and effective learning platform by addressing a wide range of topics and methods applied in the

fields of tropical biodiversity, conservation, and environmental and social safeguarding. It will also be an opportunity for Malagasy researchers to disseminate their research findings and to highlight Madagascar's uniqueness biodiversity. It will also be an occasion to raise awareness and draw the attention of Malagasy political leaders, civil society, private sectors, and the public about the need to preserve Madagascar's unique biodiversity, especially given that biodiversity is an important economic source that can increase the country's revenues in a sustainable development perspective. This annual meeting of ATBC is hosted by the Faculty of Sciences of the University of Antananarivo under the authority of the Ministry of Higher Education and Scientific Research and the patronage of the Ministry of the Environment, Ecology, and Forestry. Information on key dates and submission for symposia and workshops can be found at https://atbc2019.org/dates.html.

Joint BES/gtö Symposium – Unifying Tropical Ecology: Strengthening collaborative science

Pierre-Michel Forget pierre-michel.forget@mnhn.fr

Join us for this Joint Meeting of the Society for Tropical Ecology (gtö) and the British Ecological Society Tropical Ecology Group (BESTEG). #UTE2019 at the Appleton Tower, Edinburgh, UK 8 – 12 April 2019. The event celebrates the fourth European Conference of Tropical Ecology, the annual meeting of the Society for Tropical Ecology and the Annual Meeting of the BES Tropical Ecology Special Interest Group (BES-TEG). The event is additionally supported by the Association for Tropical Biology and Conservation, in particular promoting participation from its new Africa Chapter. This collaborative venture will bring together ecologists from the UK and Europe, together with their research partners from across the entire tropics. The meeting will promote the work of diverse research groups, foster innovation in linking people, research topics, countries and continents and inspire participants to collaborate in work that will strengthen the field. For more information, see https://www.britishecologicalsociety.org/events/ute2019/

Earlybird registration is open until **17:00 (GMT), Friday 22 February.** Abstracts are due between now and 1 February 2019. See https://www.britishecologicalsociety.org/events/ute2019/abstract-submission/ for details.

U.S. FOREST SERVICE
INTERNATIONAL PROGRAMS

CENTER FOR PROTECTED
AREA MANAGEMENT
COLORADO STATE UNIVERSITY

INTERNATIONAL SEMINAR ON PLANNING & MANAGING TOURISM IN PROTECTED AREAS

2019

September 5th - 21st, 2019
Northern Rocky Mountains, United States

U.S. FOREST SERVICE
INTERNATIONAL PROGRAMS

COLORADO STATE
UNIVERSITY

SEMINAR THEMES

1) **Planning and Management for Tourism and Public Use in Protected Areas:**
Topics will include zoning, management plans, carrying capacity, over-tourism, marketing and promotion, stakeholder involvement, and destination planning, as well as the implications of climate change for tourism in protected areas.

2) **Governance, Policy, Law, and Finance:**
Participants will observe and discuss the role of different government actors and levels of government, local communities, landowners, academia, businesses, NGOs, indigenous people, universities, industry associations, user groups, volunteers, and concessionaires and other public-private partnerships. Legal and policy frameworks and funding mechanisms will also be examined.

3) **Infrastructure and Public Services:**
Transportation networks, trails, hotels, campsites, souvenir shops, restrooms, parking, food and fuel, emergency services, signage, staff housing and facilities, and public services (water, sewerage, electricity, trash disposal, communications, etc.) will be analyzed.

4) **Interpretation and Environmental Education:**
The seminar will focus on guided and self-guided interpretation, visitor centers, night programs, wayside exhibits, publications, the role of guides and outfitters, online information, and the importance of using visitation to build public support for conservation.

Ideal participants will be mid-level professional and technical personnel who work for governmental or nongovernmental conservation and tourism organizations, in academia, in the private sector, and in community-based and indigenous tourism and conservation initiatives in or near protected areas.

HOW TO APPLY

For questions or more information, please email: protectedareas@colosate.edu

To complete the application, visit: https://conservation.warnercnr.colostate.edu
The deadline for submission is **May 10, 2019.**

For information regarding other USFS IP seminars, please visit: https://sites.google.com/fs-ip.us/seminars/home

SEMINAR EXPENSES

The fee for the seminar is $5,495 US. This includes: registration, course materials, seminar-associated travel, food, lodging and US health insurance. The fee does not include: visa and passport fees, travel insurance, or food/lodging before or after the Seminar. It is recommended that participants bring an additional $300 US to purchase appropriate personal equipment for field trips. Travel to the United States and back home is the responsibility of the participant or sponsors.

SERVICIO FORESTAL DE LOS EE.UU. PROGRAMAS INTERNACIONALES

CENTER FOR PROTECTED AREA MANAGEMENT
COLORADO STATE UNIVERSITY

SEMINARIO INTERNACIONAL SOBRE MANEJO DE ÁREAS PROTEGIDAS

2019

CURSO EN ESPAÑOL

Del 2 de julio al 3 de agosto del 2019

Montañas Rocallosas, Estados Unidos

SERVICIO FORESTAL DE LOS EE.UU.
PROGRAMAS INTERNACIONALES

UNIVERSIDAD ESTATAL
DE COLORADO

TEMAS DEL SEMINARIO

1) **Manejo y planificación de áreas protegidas:**
Los participantes estudiarán las fortalezas y debilidades de varios tipos de modelos de planificación para áreas protegidas terrestres, de agua dulce y marinas, con el fin de reconocer su potencial en la protección de los recursos, así como una distribución equitativa y sustentable de los beneficios. Los temas adicionales incluyen: ordenamiento; planes de manejo; el manejo de usos de extracción; la integración de la protección de áreas silvestres con el desarrollo sostenible y la planificación del uso del suelo; y el manejo de pesquerías, vida silvestre, pastizales y recursos forestales.

2) **Gobernanza y financiamiento de áreas protegidas:**
Se observarán cómo funcionan diversas tipos de gobernanza en áreas protegidas a nivel federal, estatal y local. Investigaremos los métodos de colaboración entre diferentes actores e instituciones clave en el manejo de áreas protegidas. Se estudiarán mecanismos de financiamiento de áreas protegidas incluyendo pago por servicios ecosistémicos.

3) **Turismo, concesiones y manejo de visitantes:**
Durante el curso, los participantes debatirán temas relacionados con el turismo basado en la naturaleza y el uso público de las áreas naturales incluyendo ordenamiento, interpretación, educación ambiental, infraestructura, senderos, reducción del impacto de los visitantes y cómo trabajar con socios como los concesionarios y guías. Discutiremos estrategias de turismo y las consecuencias del aumento de visitantes tanto en el medio ambiente como en la experiencia de los visitantes, y analizaremos los beneficios de las alianzas públicas/privadas en el manejo de áreas protegidas.

4) **Liderazgo y retos emergentes en áreas protegidas:**
Los participantes investigarán y ampliarán sus capacidades de liderazgo personales, comunitarias y profesionales para abordar de mejor manera los retos actuales en la conservación. Los temas adicionales incluyen manejo de conflictos, colaboración y como lograr consenso entre actores. También se discutirán retos y temas emergentes en áreas protegidas, como el desarrollo de la resiliencia al cambio climático mediante la mitigación, adaptación y educación; la protección del cielo nocturno y sonidos de la naturaleza; así como le inclusividad y equidad de género.

Los participantes idóneos son personal profesional y técnico de nivel medio que trabajen para organizaciones de conservación y de turismo, ya sea gubernamentales u ONG, instituciones académicas, en el sector privado y en iniciativas de conservación indígenas y comunitarias en áreas protegidas.

CÓMO POSTULARSE

Para postularse, favor de visitar:
https://conservation.warnercnr.colostate.edu/

Para más información y preguntas, favor de enviar un correo a: areasprotegidas@colostate.edu
La fecha límite para enviar su solicitud en línea es el **1 de febrero, 2019.**

Para mas información sobre otros seminarios ofrecidos por la Oficina de Programas Internacionales del Servicio Forestal de los EE.UU., favor de visitar:
https://sites.google.com/fs-ip.us/seminars/home

COSTO DEL SEMINARIO

El costo del seminario es USD 6.595. Este monto incluye la matricula, los materiales, traslados terrestres que forman parte del curso, alimentos, alojamiento y seguro médico en EE.UU. La cuota no incluye el costo del trámite de la visa, seguro de viajes ni alimentos u hospedaje antes o después de las fechas del seminario. Se recomienda que los participantes lleven consigo USD 300 para comprar equipo personal para visitas de campo. El traslado de su país de origen a Denver, Colorado y de regreso es la responsabilidad de los donantes, la organización del participante, o el participante.

U.S. FOREST SERVICE
INTERNATIONAL PROGRAMS

CENTER FOR PROTECTED
AREA MANAGEMENT
COLORADO STATE UNIVERSITY

INTERNATIONAL SEMINAR ON PLANNING & MANAGING TOURISM IN PROTECTED AREAS

2019

September 5th - 21st, 2019
Northern Rocky Mountains, United States

Help Wanted:

The Society of American Foresters International Forestry Working Group's focus for this year is to help their members become involved in overseas programs, projects and experiences. We have heard from members ranging from students to retirees that they want to get involved internationally, but are finding it difficult to find available opportunities.

If you know of any international programs that would be open to forestry and natural resource students or professionals please send the information to Bob Sturtevant, Chair-International Forestry Working Group (robert.sturtevant@colostate.edu). These can include programs that are only offered through your university or agency. They can also include non-profit and religious oriented programs. We are aware of some of the well-known opportunities: Peace Corps, Study Abroad and Semester at Sea; but there must be many more out there. Please share what you know!

If you are involved in a unique or successful international project that you would like to showcase to your fellow SAF members, we are looking for some presentations at the Louisville SAF Convention next October 30th - November 3rd. The call for abstracts will come out soon.

Join an SAF Working Group

This newsletter goes out to people beyond SAF members, but if you are on the working group list you receive this newsletter.

As a member of the Society of American Foresters you can join SAF working groups by going to the website:

Join a working group here:

If you want to join, or rejoin, this working group, we are B3, the International Forestry Working Group. Please pass this information along to SAF members who might be interested in joining a working group – especially B3, the International Forestry Working Group.

ISTF Update 10 December 2018

Dear ISTF members:

See below for the latest ISTF news. Please scroll down for news on a carbon course at the University of Freiburg, ISTF-linked sessions at IUFRO2019, and the ISTF-Yale 25th Annual Conference, and other news. Please contact tropicalforesters@gmail.com with any questions or comments.

Sheila Ward

1. Member vote on ISTF Organizing Documents. A total of 69 members voted on the Bylaws, Chapter Guidelines, and Communication Strategy. The vote was: 68 in favor, 1 opposed, for the bylaws; 66 in favor, 2 opposed, for the chapter guidelines; and 69 in favor, 0 opposed, for the communications strategy. We appreciate your further suggestions for improving these documents.

2. Carbon Forestry Course at University of Freiburg in Feb./Mar. 2019 – Scholarships available. The Chair of Silviculture of Freiburg University accepts now applications for a 3-week Carbon Forestry Course, which takes place between 18.02 and 08.03.2019. As in past years, the course will be conducted in close cooperation with renowned partner organisations and land-use experts. It is designed for participants that want to increase their competencies in the field of land use-based climate change mitigation activities and to gain expert knowledge about climate policy instruments at national and international levels. Due to its interdisciplinary perspective on practical aspects of project implementation, participants considered the course to be highly useful for their further careers. With the support of the German Federal Ministry of Food and Agriculture, a limited number of scholarships are available for selected participants that cover parts of the course fees, accommodation costs and living expenses. More information and application forms for the course/scholarships are available at https://www.waldbau.uni-freiburg.de/news_events/carb_forestry

3. ISTF-Yale 25th Annual Conference. Examining Tropical Changes: Resilience in the Context of Disturbance and Transgression. 31 Jan – 2 Feb 2 2019, Yale School of Forestry and Environmental Studies New Haven, Connecticut, USA. The Conference will delve into the conditions surrounding global challenges to tropical systems and highlight the perseverance of forests and their people. This conference will demand reflection on past lessons learned as well as focus on urgent present actions and problem-solving for the future. Understanding where we have failed, where we have succeeded, and how we should move forward is essential. For the 2019 ISTF Conference, ISTF-Yale invites academics, practitioners, policy-makers, activists and forest-dwelling peoples to share the challenges and opportunities in tropical forest landscapes and the survival of these complex networks in the face of global disturbances and transgressions.

See Concept Note here To register for the conference, go here. Apply to present in a flashtalk, breakout sessions, Tools and Skills Expo, or Poster, or for the ISTF Leadership award here. All presenters will need to register for the Conference.

4. The International Society of Tropical Foresters is organizing or co-organizing seven sessions for the **XXV World Congress of the International Union of Forest Research Organizations (IUFRO2019) to be held 29 Sept – 5 Oct 2019 at Curitiba, Brazil.** Please consider submitting an oral or poster presentation for one of these sessions or another IUFRO2019 session (see below). **Abstracts for presentations can be submitted until 31 Dec 2018 at** http://iufro2019.com/

You will need to be registered for IUFRO2019 to submit an abstract, but you do not need to pay until later. You will also need to indicate the session of preference. See https://iufro2019.com/abstracts-submission/ for details on abstract submission. Information on all IUFRO 2019 sessions can be found at http://iufro2019.com/wp-content/uploads/2018/10/sessions-english-portuguese.pdf . IUFRO will have financial assistance available for certain participants (see https://iufro2019.com/scientist-assistance-program-sap/).

SESSION A2a: Sustaining iconic and high-value species in natural forests and plantations

ISTF CONTACT: Erich Schaitza, EMBRAPA, Brazil (erich.schaitza@embrapa.br)

SESSION SUMMARY: Maintaining healthy populations of heavily used species like *Araucaria* and *Swietenia* is a challenge. Problems include habitat loss; overharvest (past or present); insufficient regeneration and genetic variation, failings in forest policy, governance, or regulations; and devaluation of products because of species removal from the market. The session will cover possible solutions, including, among other topics: corrections to harvest policies, regulations, and planning; sustaining regeneration and genetic variation of target species; corrective regeneration and silvicultural practices; modelling to balance extraction, regeneration, and genetic diversity; use of market demand to create value and interest in these species.

SESSION A4c: Monitoring and Assessing Urban Forest Services and Values at the National to Local Scale

ISTF CONTACT: Vindhya P. Tewari, Himalayan Forest Research Institute, India (vptewari@yahoo.com)

SESSION SUMMARY: Trees and forests within urban areas provide numerous benefits to city residents, but relatively little is known about their structure, the services provided by these forests and how these forests are changing. While many countries inventory and monitor rural forests, only recently have forest inventory and monitoring efforts been established within urban areas. The purpose of this session is to discuss the various approaches that countries across the world are taking to develop national inventories of urban forests. This session will not only address the approaches to inventorying and monitoring, but also mean to assess the services and

values derived from the urban forests. By discussing current means to inventory and monitor urban forests, many nations can learn how to monitor and assess these important forests that directly affect the health and well-being of over half of the world's population.

SESSION B5b: Small-scale sustainable energy alternatives for developing countries

ISTF CONTACT: Lamfu Fabrice Yengong, University of Buea, Cameroon, (lamfu2035yengong@gmail.com)

SESSION SUMMARY: In developing countries, wood accounts for 50-90% of the fuel used, and increased efficiency or replacements for wood are needed. This session explores sustainable energy alternatives. Presentations might include: utilizing waste through "3R" (reduce, reuse, and recycle); more efficient technologies for cooking with wood fuel; social costs of increasing scarcity of fuel wood; characteristics related to fuel wood energy content; solar cooking as an alternative; potential for material and energy recovery from waste; appropriate technologies for developing countries; integrated renewable energy production and utilization from biomass combustion and waste gasification, among other topics.

SESSION C1b: Advances in management and science for the high-value Meliaceae

ISTF CONTACT: Liu Jun, Research Institute of subtropical forest, Chinese Academy of forestry, China, (ywliu2005@163.com)

SESSION SUMMARY: Tropical timber species of the Meliaceae (including *Cedrela*, *Entandrophragma*, *Khaya*, *Swietenia*, and *Toona*) are among the world's finest woods, and many species have other uses. Their sustainable management faces similar issues around the world. This session will share the latest in research and applications for a global perspective on these species. Topics could cover conservation of genetic resources, genetic improvement, advances in shootborer control, natural forest management, and development and products useful for human health, among others.

SESSION C1c: Improving high-value Meliaceae yields in plantations

ISTF CONTACT: Antonio Ferraz, Universidade Federal do Piauí, Brazil (acferrazfilho@gmail.com)

SESSION SUMMARY: This session will focus on better production of Meliaceae species grown in plantations. Many species (e.g. mahogany, African mahogany, Australian red cedar, *Melia*) have recently been grown as plantations around the world and research is needed over a wide range of topics. The main objectives are to share experiences and to find common research themes to build possible collaborations among researchers working with Meliaceae species in plantations around the world.

SESSION C9a: Discovery, curation, and uses of legacy tropical forest data sets

ISTF CONTACT: Sheila Ward, Mahogany for the Future, Inc., Puerto Rico (tropfordata@gmail.com)

SESSION SUMMARY: Legacy tropical forest datasets have been generated by various projects over time, and many are in danger of being lost. These datasets are valuable for understanding how tropical forests change through time, and many of the forests they characterize no longer exist. To safeguard these data, standardized metadata and electronic archiving schemes need to be developed. The purpose of the session is to share information on the potential uses of such datasets, their current status, and appropriate curation and metadata strategies.

SESSION F6b: Effective educational strategies for the next generation of forest professionals

ISTF CONTACT: Ruth Metzel, Azuero Earth Project, Panama, (ruth@proecoazuero.org)

SESSION SUMMARY: University-based programs on forest related fields are evolving and inherently need to change towards multidisciplinary programs. Some major drivers of these changes are globalization of the economy, climate change, and new technologies and informatics, in a similar vein solution for real life resource management problems around forest key issues like health, bioenergy, climate change are consistently calling for more holistic and cross-sectoral approaches. Universities curricula need to meet diverse higher demands, and new ways to approach these challenges involving various disciplines in a multicultural environment. This session will highlight finding on research aiming to understand those challenges and also research that addresses innovative strategies that allow forestry students and professor and providers of non-formal education to keep abreast with the time, such online classes, field practices, case studies among others.

5. ISTF online resources. A new ISTF website is under development, thanks to the team of Paul Dargusch at the University of Queensland. Ciro Moura and Adriane Tobias will help. The current online resources for ISTF include:
1) Blair Orr's continuation of the former ISTF newsletter as a newsletter for the Society of American Foresters International Forestry Working Group. (Available at: http://www.orrforest.net/saf/). If you fill out the table, we will add you to the list for receiving this newsletter
2) The old ISTF web page, still at http://www.istf-bethesda.org/
3) The ISTF Facebook group page at: https://www.facebook.com/groups/2262122534/
4) The ISTF Linked-In page at: https://www.linkedin.com/groups/12150640/
5) The ISTF twitter handle is @tropforester
6) Student chapter at Yale University, which sponsors the annual Yale ISTF conference: http://istf.yale.edu/ , https://www.facebook.com/yalefesistf/
7) Student Chapter at North Carolina State University: https://research.cnr.ncsu.edu/sites/istf/ , https://www.facebook.com/NCSUISTF/

6. ISTF Chapters. If you are interested in starting an ISTF chapter, please fill out this survey https://docs.google.com/forms/d/e/1FAIpQLSehc5LDeycz-91TY6SLZKFaAVs3lePFTSKjmtW_gmArgJIQwg/viewform (if you have not already done so). We will be working with organizing chapters in 2019.

7. ISTF membership. ISTF now stands at 917 members. Help us keep growing! If you have any contacts that you would like to invite to join ISTF, you can use the following message:

Dear friends:

We hope you will be interested in joining the International Society of Tropical Foresters. With its focus on being a communication network, ISTF can help you connect with others interested in tropical forests and forestry. ISTF was founded in the 1950s and "in response to a worldwide concern for the fate of tropical and subtropical forests, ISTF is committed to the protection, wise management and rational use of the world's tropical forests". So far, over 700 people from around the world have joined. For now, the organization will be dues-free (although this is under discussion). If you would like to join, please fill out the membership for at GoogleForms (https://docs.google.com/forms/d/e/1FAIpQLSdy9FqCZ5Yj3TTA-mDJkgwm8n1jbCkEGlFrXMBRK2wNbLP6FA/viewform?c=0&w=1&fbclid=IwAR1A5Ze_kl9PpuSzZRTBZaNyTLLOTHam2fiiAlsU9q7mwdXefWWerHu1ogM)

Questions? Email tropicalforesters@gmail.com

ISTF Transition Team

From the archives:

The National School of Forest Sciences, Honduras on a 100 Lempira note.
https://www.banknotes.com/hn.htm

Primary Forests, Biodiversity and Haiti

by Joel Timyan (jctimyan@gmai.com)

In the September 2015 edition of the IFWG Newsletter, I wrote about the state of natural forest cover in Haiti. At that time, my colleagues and I were developing a geospatial methodology to detect the change in primary forest cover using a time series of Landsat imagery dating back to the 1980s. We also were focused on distinguishing primary forests from secondary or re-growth forests, plantations and agroforests. Biodiversity is inextricably linked to primary forests which occur in only the most isolated regions of the country. As primary forests disappear, so does the flora and fauna.

Being able to distinguish species-rich natural forests by remote sensing allows government and non-profit conservation groups to target their limited funds and design better strategies to halt the continuing loss of biodiversity. The results of this study were published by the Proceedings of the National Academy of Sciences (USA) in October, 2018. Below is the citation, abstract and link to the article.

Citation. Hedges, S. B., W. B. Cohen, J. Timyan & Z. Yang. 2018. Haiti's biodiversity threatened by nearly complete loss of primary forest. *Proc. Natl. Acad. Sci. USA* 115 (46): 000-000. doi: 10.1073/pnas.1809753115. **URL.** http://www.pnas.org/content/early/2018/10/23/1809753115.

Abstract. Tropical forests hold most of Earth's biodiversity. Their continued loss through deforestation and agriculture is the main threat to species globally, more than disease, invasive species, and climate change. However, not all tropical forests have the same ability to sustain biodiversity. Those that have been disturbed by humans, including forests previously cleared and regrown (secondary growth), have lower levels of species richness compared with undisturbed (primary) forests. The difference is even greater considering extinctions that will later emanate from the disturbance (extinction debt). Here, we find that Haiti has less than 1% of its original primary forest and is therefore among the most deforested countries. Primary forest has declined over three decades inside national parks, and 42 of the 50 highest and largest mountains have lost all primary forest. Our surveys of vertebrate diversity (especially amphibians and reptiles) on mountain tops indicate that endemic species have been lost along with the loss of forest. At the current rate, Haiti will lose essentially all of its primary forest during the next two decades and is already undergoing a mass extinction of its biodiversity because of deforestation. These findings point to the need, in general, for better reporting of forest cover data of relevance to biodiversity, instead of "total forest" as defined by the United Nation's Food and Agricultural Organization. Expanded detection and monitoring of primary forest globally will improve the efficiency of conservation measures, inside and outside of protected areas.

A copy of the article can also be requested by sending an email to jctimyan@gmail.com.

Remote Sensing Accuracy – A Case Study in India

Kwame T. Awuaha, Nils Nölke, Maximilian Freudenberg, B.N. Diwakara, V.P. Tewari and Christoph Kleinn (2018). Spatial resolution and landscape structure along an urban-rural gradient: Do they relate to remote sensing classification accuracy? – A case study in the megacity of Bengaluru, India. n, *Remote Sensing Applications: Society and Environment* 12: 89–98.

Abstract: Along the urban-rural gradient in megacities, the extent and material composition of impervious surfaces are different. This leads to variations in the frequently mentioned heat-island property, but possibly also to different spectral signatures and, consequently, different accuracies in remote sensing image classification. This, in turn, creates a challenge when it comes to selecting suitable image processing techniques. In this study, we examine how the accuracy of land-cover classification changes along an urban-rural gradient as a function of spatial resolution and the gradient in landscape structure. RapidEye, Sentinel-2A and Landsat 8 images were used. Land-cover classification was performed using a deep learning model and landscape metrics were used to assess landscape structure. A high degree of landscape heterogeneity and lowest classification accuracy was observed in the transition zone between urban and rural domains, within a stretch of 15–20 km from the urban center. As expected, spatial resolution was found to be influential in classification accuracy. A comparison of classifications indicates that within rural landscapes finer resolution images retain more spatial and thematic details in land-cover, e.g., RapidEye and Sentinel-2A imagery better distinguish built-up areas within the agricultural landscape and discriminate more of the mapped land-cover/use classes than Landsat 8. Overall accuracy increased with increasing spatial resolution (30 m, 10 m, 5 m) within the urban and rural areas, however, the 10m resolution image (Sentinel-2A) produced better results in the transition zone. The findings from this study provide a basis for more focused, consistent and possibly more accurate time-series analyses of land-use dynamics at the urban-rural interface.

The paper is available at https://doi.org/10.1016/j.rsase.2018.10.003 otherwise author may be contacted at vptewari@yahoo.com for details.

The impact of protected area governance and management capacity on ecosystem function in Central America

Authors: Carlos L. Muñoz Brenes , Kelly W. Jones, Peter Schlesinger, Juan Robalino, Lee Vierling

Published: October 18, 2018https://doi.org/10.1371/journal.pone.0205964

email: carlosglobal@gmail.com

"The impact of protected area governance and management capacity on ecosystem function in Central America"
OPEN ACCESS: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0205964

Abstract
Protected areas (PAs) are a prominent approach to maintaining and enhancing biodiversity and ecosystem services. A critical question for safeguarding these resources is how PA governance processes and management structures influence their effectiveness. We conduct an impact evaluation of 12 PAs in three Central American countries to assess how processes in management restrictions, management capacity, and decentralization affect the annual change in the satellite-derived Normalized Difference Vegetation Index (NDVI). NDVI varies with greenness that relates to plant production, biomass, and important ecosystem functions related to biodiversity and ecosystem services such as water quality and carbon storage. Any loss of vegetation cover in the form of deforestation or degradation would show up as a decrease in NDVI values over time and gains in vegetation cover and regeneration as an increase in NDVI values. Management restriction categories are based on international classifications of strict versus multiple-use PAs, and capacity and decentralization categories are based on key informant interviews of PA managers. We use matching to create a counterfactual of non-protected observations and a matching estimator and regression to estimate treatment effects of each sub-sample. On average, strict and multiple-use PAs have a significant and positive effect on NDVI compared to non-protected land uses. Both high and low decentralized PAs also positively affect NDVI. High capacity PAs have a positive and significant effect on NDVI, while low capacity PAs have a negative effect on NDVI. Our findings advance knowledge on how governance and management influence PA effectiveness and suggest that capacity may be more important than governance type or management restrictions in maintaining and enhancing NDVI. This paper also provides a guide for future studies to incorporate measures of PA governance and management into impact evaluations.

Citation: Muñoz Brenes CL, Jones KW, Schlesinger P, Robalino J, Vierling L (2018) The impact of protected area governance and management capacity on ecosystem function in Central America. PLoS ONE 13(10): e0205964. https://doi.org/10.1371/journal.pone.0205964

Characterization of teak wood planted in different ages and regions for floor production
(Dissertation in Portuguese.)

Vanderlei Benedetti
vabenedetti@gmail.com

Abstract: The purpose of this work was to evaluate the anatomical and chemical characteristics, physical and mechanical properties, obtain the yield of the flooring production process and its quality and to elaborate programs of simplified drying of the wood of teak trees (*Tectona grandis* L. f.) of plantations forest at different ages, approximately 9.5; 14.4 and 18.7 years, from the municipalities of Glória D'Oeste, Porto Esperidião and Rosário D'Oeste in Mato Grosso, and from Angatuba in São Paulo state, aged 9.4 years. The logs obtained from these stands were processed to obtain samples for the said evaluations, as well as for the production of lots of solid wood floors, which were also analyzed through specific quality tests. The drying programs of the wood were determined for each of the treatments, using the simplified drastic drying method. Through these evaluations and analyzes it was sought to verify if the properties of the teak wood, regardless of age, region and management, present similar results, as well as if the floors produced with the use of thinning woods and younger age show similar quality to the products generated with the wood coming from forests with defined age for intermediate and final cuts. The same evaluation was carried out comparing the wood produced in the states of Mato Grosso and São Paulo at the age of 9.5 years to verify possible differences in wood quality due to climatic, soil and management variations. The results show that the forest management, mainly in relation to the initial population density, influenced the growth of the trees. Age influenced the largest diameter and individual volume of trees. The volume and percentage of heartwood presented the same tendency, increasing with the age, but the eccentricity of the marrow reduced with the age. The dimensional stability was lower in SP planting, due to the more pronounced climatic differences and the greater initial settlement population. There is a positive correlation between the basic density and all the mechanical properties studied, as well as some anatomical dimensions such as fiber length and wall thickness. There was no correlation between planting age and physical, mechanical or anatomical properties. The higher the forest age, the higher the conversion rate in the flooring production process. However, the flooring volume generated by area was higher in the forest with better management adopted, that is, lower initial population density. Among the evaluated treatments, the 9.5-year old plantation in MT presented better flooring productivity per area, which shows that this treatment, associated with this purpose, is more economically advantageous than the others, but an evaluation of the flooring production cost is need. This indicates that the management applied in this area, mainly as the lower population density in theforest implantation, presented better results of log total production and conversion to flooring and good quality of the final product.

Benedetti, Vanderlei
Caraterização da madeira de teca plantada em diferentes idades e regiões para produção de piso / Vanderlei Benedetti. - - versão revisada de acordo com a resolução CoPGr 6018 de 2011. - - Piracicaba, 2018.107 p.
Dissertação (Mestrado) - USP / Escola Superior de Agricultura “Luiz de Queiroz”.
A copy may be obtained from Blair Orr at blairorr@ymail.com.

Health Status of Mangroves in the Pacific Coast of Columbia with Particular Emphasis in the San Pedro Natural Reserve

J. Alexander Osorio[1]
[1]Facultad de Ciencias Básicas y Tecnologías, Programa de Biología, University of Quindío, Armenia, Quindío, Colombia. (osorio.romero17@gmail.com)

Abstract: Mangrove forests are important habitats for rich species diversity, and provide many ecosystem services including coastal protection. Despite this importance, they are increasingly threatened by anthropogenic disturbances such as clearings, pollution and climate change. These contemporary issues also increase pest and pathogen pressure on mangroves. However, although pests and pathogens are recognized as increasing threats to forest health worldwide, measures of mangrove health that consider biotic factors such as insects and fungi have been conducted in South East Asia and United States of America. Colombia is considered as one of the richest countries in biological diversity, including mangroves which constitute vast areas along the Atlantic and Pacific littorals. However, information regarding biotic factors associated with the health of mangroves in Colombia remains poorly investigated. With the objective to elucidate the possible mangrove health status in San Pedro Natural Reserve, Buenaventura, Colombia, quantitative and qualitative data from pneumatophores condition, diameter at breast height, presence of wood-boring beetles and disease incidence and severity were measured. Insect identification to genera was performed to determine its taxonomic placement. Of four mangrove species inhabiting this area, none showed signs or symptoms representing levels of deterioration. In general, the results suggest that, even though, natural and anthropogenic stressors are common factors that induce mangroves decline, natural areas or reserves need to be included by the governments as management plans, this will mitigate ecosystems damage by an array of opportunistic pests and diseases.

Key words: *disease assessment, Laguncularia racemosa*, *Mora oleífera, Pelliciera rhizophorae, Rhizophora mangle.*

Practical aspects of planting mahogany by seed

Patricia Negreros Castillo patri_nc@yahoo.com

Carl Mize carlmize@gmail.com

We have found that mahogany (*Swietenia macrophylla*), one of the most valuable timber trees in the world, seed germinate and the resulting seedlings do well when sown in a slash and burn field during the last cropping year before abandonment (fallowing) of the field (1). As mahogany seed require about 30 days to emerge, a high percentage of seed would be predated between the sowing date and the time of emergence (2) As a result, many seed would need to be sown to get a reasonable number of established seedlings, and their distribution would likely be very irregular.

A solution would be to reduce the number of days between sowing and emergence. Planting seedlings would be a solution, but the fields are often a considerable distance from any road, and 2 bagged seedlings weigh about 1 kg which is the weight of about 2000 mahogany seed. We think that by dampening the seed for some days before sowing, the days to emergence after sowing would be reduced and predation reduced.

We would like to communicate with individuals who know about planting seed that have been treated for extended periods of time before seeding and individuals with suggestions about what we might do. We know that shading and moisture improve emergence. (3)

1 – Negreros-Castillo, P., I. Martinez-Salazar, C. Alvarez Aquino, A. Navarro Martinez, C.W. Mize. 2018. Survival and growth of *Swietenia macrophylla* seedlings from seeds sown into slash and burn fields in Quintana Roo, Mexico. Bois Et Forets Des Tropiques 336. 10 p.

2 – Negreros-Castillo, P., I. Martinez-Salazar, K.F. Kellner, C.W. Mize, R.K. Swihart, M.A. Navarro-Martinez. 2016. Bois et Forets des Tropiques 329. 10 p.

3 – Morris, M., P. Negreros-Castillo, and C. Mize. 2000. Sowing date, shade, and irrigation affect big-leaf mahogany (*Swietenia macrophylla* King). Forest Ecology and Management 132:173-181.

TROPICAL NOTES:
Recent findings of ecology or management of forest and fauna that tropical foresters should understand

Isabel Mariana Fernandez, Frank H. Wadsworth and Library Staff
International Institute of Tropical Forestry
USDA Forest Service
San Juan, Puerto Rico

Herbivores transfer nutrients to the sea

In Australia two mammals, bats and kangaroos, release nutrients in a mangrove forest draining to the sea. The transfer from terrestrial to marine ecosystem is thought driven by hydrological connectivity. On Lizard Island in Western Australia kangaroos that feed in grasslands and shelter in the mangrove. At Lizard Island two mangrove forests (marine ecosystems) received nutrients from kangaroos and a bat roost. Other mangroves lacked the nutrients up to 150% of the foliar N

R. Reef and others. Mammalian herbivores in Australia transport nutrients from terrestrial to marine ecosystem via mangroves. [Journal of Tropical Ecology 30 (3) 179-188 2014].

Afforesting the grasslands

Early efforts in India were to convert grasslands into more productive timber forests. Colonial foresters thought that tall land ended in forests. Grasslands were thought to be the results of tree felling, fire, and grazing. This led to large-scale efforts to plant exotic trees in grasslands. These efforts persisted despite repeated failures and ecological evidence that even native tree seedlings started in the grassland failed to establish. In spite of this, today the grasslands bear large-scale commercial plantations. True grasslands are being used by invasive species. Joshi and others. Foresting the grasslands: historical management legacies in forest-grassland mosaics in Southern India and lessons for the management of tropical grasslands.

[Biological Conservation 224 144-152 2018].

Tree fruit set near forests and orchards

Pollinators are sensitive to their proximity to orchards and forests. Different pollinator groups respond differently to distance from sources. Rambutan fruit set is significantly influenced by distance to forest.. The main visitors to rambutan flowers are bees. To durian and mango they are nectarivorous bats and flies. And fruit set is not influenced by distance from forest. Maintaining forest patches may provide stepping stones across fragmented landscapes.

T. Sritongchuay and others. Effects of forest and cave proximity on frit set of tree crops in tropical orchards in southern Thailand.[Journal of Tropical Ecology 32 (4) 269 -279 2016].

Activity of Kenya leapords

The activities of seven leopards (*Panthera pardus*) outside a preserve were tracked in rural Kenya. Activities during the days avoided prospective encounters with people. These same locations were used at night. Human habitats were also visited during far-ranging activities. There is a need tom balance leopard and livestock ranching.

K. van Cleave and others. Patterns of movement activity and habitat use by leopards (*Panthera pardus*) living in a human dominated landscape in central Kenya. [Biological Conservation 226 224 – 237 2018].

Thinning for regrowth

In New South Wales thinning of *Callitris glaucophytia* was done 16 -22% experimentally to determine the short-term and long-term effects on bats, birds, invertebrates, reptiles, non-violent mammals and plants. Bat activity was mostly positive. Reptile diversity and abundance were positively associated at an immediate time since thinning.(8-20 years) Bird diversity was greater in recent and older thinning treatments, although species composition was not affected. Thinning did not affect invertebrate biomass it was associated with more even distribution among size classes after 8 years and a greater representation of beetles. The activity, diversity, and composition of non-violent mammals did not differ, nor did understory diversity or composition. Overall, thinning has neutral to positive effects on biodiversity.

L. G. Bradley and others. Biological outcomes for multiple taxa from silvicultural thinning of regrowth forest; [Forest Ecology and Management 425 177- 188 2018].

Taeda growth, native or exotic?,

Evidence exists that *Pinus taeda* grows faster outside its native range. Hypotheses that the cause is either differences in light use efficiency or volume growth per unit heat sum. To expose the cause, *Pinus taeda* seedlings of common genetic composition were planted on 3 or 4 replications in adjacent native and exotic sites in North Carolina and Virginia, USA and on a exotic site in Parana, Brazil. Densities were 618, 1,235, and 1,853 per hectare. After 5 years the Trees in the Brazil site were taller, and their stand basal area and volume were greater than on the other sites. , There was no evidence of Light use efficiency differences or heat sum differences. Other factors of respiration and climatic conditions may contribute to growth differences but their assessment would call for more intensive research. The sites used in this study for further research are ideal because they have the same genotypes.

J. Albaugh and others. A common garden experiment examining light use efficiency and heat sum to explain growth differences in native and exotic *Pinus taeda*. [Forest Ecology and Management 425 35 -44 2018].

Litterfall role in regeneration

Litterfall is recognized as active in nutrient cycling and maintenance of soil fertility. It is subject to seasonal and human activity impacts. Litterfall quantity and quality relate to the status of forest habitats. Litterfall is less in disturbed

habitats. The dynamics of litterfall and its decomposition reflect the progress of forest recovery.

Silva and others. Are litterfall and litter decomposition. Processes indicators of forest regeneration in the Neotropics? Insights from a case study in the Brazilian Amazon. [Forest Ecology and Management 429 189 – 197 2018].

Fodder trees

Included are trees suited for silvopastoral systems available for cows around pastures. Critical is the nutritional potential of leaves. Tree leaves were collected during the summer months and analysed. Much depends on the species selected. Levels were found of digestability, crude protein, and major and minor elements. Calcium, and phosphorus. No effect of soil type was found on leaves. Species and sampling period are key to potentials. Depending on the species, trees can provide useful nutrients to the diet of livestock.

Luske and others Nutritional potential of fodder trees on clay and sandy soils. [Agroforestry Systems 92 (4) 975 – 986 2018].

Plantation practice for rosewood oil

Rosewood essential oil is an Amazonian crop required by fragrance and cosmetic industries worldwide. It is obtained from the tree *Aniba roseanodora*. Management of the trees influences the quality and international price. A study was performed in the plantations of two producers. It showed a difference between different tree parts and harvest seasons. First harvest is from branches and leaves. The use of different plant parts is a major management selection. Despite higher yield from the stem, sustainability is assured from crown pruning. Greater understanding of these differences may permit higher yields.

M. Kramovic and others. Changes in rosewood (*Aniba roaeodoea* Ducke) essential oil in response to management [Forest Ecology and Management 429 143-157 2018].

Threat of oil palm expansion

It is a major conservation priority to ensure that projected expansion of oil palm in Africa and Latin America does not lead to analogous environmental devastation in these places. Highlights of threats to birds, mammals, and amphibians are listed for Colombia.it can be shown that oil palm expansion in Colombia can be done without severe conservation risks.

N. Ocampo-Penuela and others. Quantifying impacts of oil palm expansion in Colombia's threatened biodiversity [Biological Conservation 224 117-123 2018].

.

Bats in Brazil's Atlantic Forest

Foraging and roosting were studied for two fruit bats in a five-year-old forest. *Carollia perspicillata* (C) and *Artibeus lituratus* (A) Both species strictly used forests (restored or not) for day roosting and their main feeding habitat. Newly restored forests can be readily incorporated as foraging and roosting habitats. The average range and commuting distance for (A) was 124 ha and 1,159 m, for (C) they were 32ha and 489m. C alters its behavior relative to preferred food availability (*Piper* spp.). Bats also have a potential for natural seed dispersal.

L. C. Trevein and others. Use of space by frugivorous bats (*Chiroptera Phyllostomidae*) in a restored Atlantic Forest fragment in Brazil. [Forest Ecology and Management 291:138-143 2013].

Abiomass in secondary forest vs. monocultures

Secondary forests and monocultures are the most common forms of reforestation. There exists a general tendency for above grand biomass accumulation to be marginally higher in plantations. Plantation growth rates were negatively correlated with seasonably prior rainfall. Secondary forest growth is positively correlated with surrounding tree cover. The difference in above-ground biomass between the two is small. Secondary forests appear superior near existing tree cover and where there is highly seasonal rainfall.

M. T. L. Bonner and others. A meta-analytical global comparison of aboveground biomass accumulation between tropical secondary forests and monoculture plantations. [Forest Ecology and Management 291:73-86 2013].

Pinus strobiformis

Pinus strobiformis is a five-needle pine found in Sonora, Chihuahua, Durango, Zacatecas, Coahuila, and Nuevo Leon. Also in southern Arizona, New Mexico and western Texas. In Mexico in mixed upland forest subject to frequent surface fires. Seriously afflicted by *Cronartium ribicola*, the white pine blister rust. Regeneration augmented by bird and rodent seed dispersal in part of its range.

C.E.Looney and others. *Pinus strobiformis*, stand dynamics, regeneration, and disturbance ecology. [Forest Ecology and Management 287:90-102 2013].

Forest regrowth following subsequent moisture

A study in dry forest in eastern Amazonia exposed primary forest productivity increases due to prior aboveground biomass moisture increase, a suggested lag product of rainfall. Growth was most strongly correlated with previous year annual and dry season precipitation. The experimental treatment was significant following strong previous dry years but not a weak dry year. Productivity increased with moisture in an earlier entire biomass moisture, rather than just forest litter.

S. S. Vasconcelos and others. Aboveground net primary productivity in tropical forest growth increases following wetter dry-seasons. [Forest Ecology and Management 278:82-87 2012].

Selective logging impacts in hill dipterocarps.

A study was made of conventional selective logging impacts in Peninsular Malaysia. The extraction of 27 trees per hectare affected all diameter classes. Forty percent of the prior stems were dead. In a count of only the rare and commercially important species 24% were lost. About 50% of the residual species were very rare and with but single stems. Logging also altered the curve of all tree size classes. To reduce this loss of diversity the study suggests integration of diversity with management and improved logging practices.

Saiful and others. Effects of selective logging on tree species composition, richness, and diversity in a hill dipterocarp forest in Malaysia. [Journal of Tropical Forest Science 26(2):188-202 2014].

Dry forest tree seed collection

A common problem is the lack of good seed. A five-year study of 14 species of western Mexico identified three flowing and fruiting periods: (1) flowering and fruiting exclusively in the rainy season, (2) flowering in the rainy season and fruiting in the dry season, (3) flowering and fruiting exclusively in the dry season. Specific collection schedules were made for each strategy and recognize variability by years and species. Descriptions of seed population levels are essential for management programs.

A. L. Luna-Nieves and others. Reproductive phenology of useful seasonally dry tropical forest trees: Guiding patterns for seed collection and plant propagation in nurseries. [Forest Ecology and Management 393:52-62 2017]

Notes from the editor

The ever-expanding subscription list.

This newsletter will be sent to approximately 1,900 subscribers, a big leap forward from our initial list of about 50 people many years ago. Special thanks to Ken McNabb, our first editor, for getting us started.

Feel free to send this newsletter on to others.

Many thanks to the many contributors to this issue, our largest ever with contributions from around the world. The next issue is scheduled for March 2019.

If you would like to be added to the distribution list for the newsletter, send an email to Blair Orr (blairorr@ymail.com).

- Blair Orr, IFWG Newsletter Editor
(blairorr@ymail.com)

Sign up for the ITTO Tropical Timber Market Report

The International Tropical Timber Organization (ITTO) releases the Tropical Timber Market Report two times per month. You can receive a free email subscription by signing up at their website:

http://www.itto.int/market_information_service/

IUFRO Electronic News

The newsletter is also available for download as a PDF or Word file at:
http://www.iufro.org/publications/news/electronic-news/.

FAO InFO News
A newsletter from FAO Forestry

The Food and Agriculture Organization's Forestry newsletter is available at this link:

http://www.fao.org/forestry/infonews/en/

Unasylva

http://www.fao.org/forestry/unasylva/en/ - An FAO forestry publication going back to 1947.

Global Forest Information Service (GFIS)

https://www.gfis.net/gfis/en/en/ (also available in Spanish and French) Global Forest Information Service contains up-to-date information on news, events, publications and job vacancies (on the homepage) and lists other info resources such as databases, as part of the GFIS system.

Cámara Forestal DE BOLIVIA

http://www.cfb.org.bo/noticias
