International Forestry Working Group Newsletter
Working Group B3

September – 2019

Volume: 7 Issue: 3

Society of American Foresters

International Society of Tropical Foresters

SAF International Forestry Working Group (IFWG) members and ISTF members,

This Newsletter is looking for general articles, announcements, field practices, and research abstracts.

GENERAL ARTICLES: If you have a story about an international activity or project for the newsletter please send it along. I am usually looking for a one or two page article, but longer articles will be considered. Color pictures are welcomed and encouraged.

ANNOUNCEMENTS AND OPPORTUNITIES: If you have announcements of trainings or educational opportunities, forthcoming meetings, or other international events I will put them in the newsletter.

RESEARCH ABSTRACTS: If you have a recently published article you think may be of interest to other IFWG members send the citation, abstract and information on how to obtain the full article if that is available, either online or author contact information.

FIELD PRACTICES: Short articles on methods that are useful for foresters working in the field, probably something an academic journal would not publish.

SUBMISSION INFORMATION:

- The text should be in a word document.
- We have no required format but beginning with the December 2019 issue we will provide templates with a format for those who wish to use them.
- For figures and photos .jpg is preferred but other formats can probably be converted.
- The manuscripts are sent to blairorr@ymail.com only.

Editor	Co-Editor
Mr. Blair Orr Professor of Forestry Michigan Technological University Houghton, MI 49931 USA Email: blairorr@ymail.com; bdorr@mtu.edu (906) 487-2291	Dr. N. Krishnakumar Research Fellow Forest College and Research Institute Tamil Nadu Agricultural University Mettupalayam – 641301, Tamil Nadu, India Email: krishna.forest@gmail.com +91 9443796166

Content

****

NOTES FROM THE EDITORS & CO-EDITORS

Welcome to Dr. N. Krishnakumar as the new co-editor

With this issue Dr. N. Krishnakumar is joining the IFWG – ISTF newsletter as co-editor.

Dr. N.Krishnakumar is borne at the faculty of Forestry and is currently working as a Research Scholar at Forest College and Research Institute, TNAU, Mettupalayam. He is a tree breeder involved in varietal development programme of Thornless bamboos and Sandalwood. Currently he is involved in developing new species and clones amenable for Composite Wood Product Development. He is a recipient of Rajiv Gandhi National Fellowship and has published 5 books and several research papers in the journal of national and international repute.

Feel free to send this newsletter on to others.

Many thanks to all the contributors to this issue. The next issue is scheduled for December 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

CONTRIBUTED ARTICLE

Secret Life and Heartbreak of our Forest

Vedaste Dushimirimana

Student in University of Rwanda, Option of Agroforestry

Email: fistonvedaste@gmail.com

Here is our secret: our reasons to frequent forest wild life is because we have found a friend there. See, every time we enter into the forest, trees are glad to receive us, with a heartfelt greetings of flesh air they blow upon us, accompanied with beautiful melodies of symphony improvised by their casual guests (birds) and trees join in a gentle dance of their blanches. It is really amazing when you are keen to life full of natural joy.

In middle of the forest, life is party, I can't tell you how it looks like coz everyone have his/her own touch in enjoying it, some feel sick to go back in chaos cities, choose to stay to camp and enjoy the talk around camp fire the rest of night. In forest Some do this and that, but the result is the same; they end up happy. True friend will never hurt his/her best friend intentionally, the same for you whatever you intend to do never hurt the forest in any way at expense of your joy, it feel sad too, it cry but we are too blind to see its tears, they suffer death as we do. They have families don't make their seedlings orphans they need love of their mother tree and neighbors through the shade and protection they provide. Don't make them suffer loss of their beloved, since you know how it feels then Conserve them, protect it biodiversity.

Life in forest is real and friendship so strong, when you touch a tree it touches you back, when you are tired it provide you with something to lean on like a stick to support you in your journey, when you are exhausted it doesn't let you down it gives you a strong tree which you can lean on and regain your strength, when you are hungry it shows you a way to its kitchen through a strong smell of fruits and honey it produces. When you want to refresh your mind after a long day, it opens up a door for you to its untouched garden with flowers of different kinds. When it rains, trees become your umbrella. Trees are working tireless every day to clean up the mess you are causing to the world by polluting the air, it is willing to take in carbon dioxide you produce so that you can get oxygen in return, consider this as a favor. But note this, who receives eat well but who gives sleep well, don’t be eager in receiving only. True friendship is built on reciprocity, do something in return for your friend to motivate him. Conserve them, conserve it biodiversity.

When you have visited a forest and time to go home comes it doesn't bother and doesn't feel sad or mad at you. The same way it has received, it treats you alike. But it doesn't forget the most important thing, farewell culture. When you depart, it provides you with something to accompany you to your doorstep and some souvenirs like; mud on your shoe and fruits of Spanish -needle (ibishokoro) on your clothes. So, the next time you come to visit your friend (Forest) make sure you will behave like a true friend, you know now day it is sick, threatened and endangered, your fellow brothers and sister are cutting down some of his family member every day. Please help it by doing something, show it that you are thankful for its deeds and show it that you care about it struggle and suffering. Amazon is crying asking for help, what is your plan for it, what it is your plan for the forest and woodlot in your village?

If you don't want to lose your friend (forest) forever do something for him, conserve, conserve, and protect it biodiversity, know that it has suffered and endured enough.

Tree plantations in the Caribbean lowlands of Costa Rica: The beginnings and EARTH University

Ricardo O. Russo[1] and Carlos L. Sandí[2]

[1] Professor of Tropical Silviculture, EARTH University, Guácimo, Limón, Costa Rica.

[2] Academic Forestry Farm Coordinator, EARTH University, Guácimo, Limón, Costa Rica.

The role of tree plantations:

The establishment of native tree plantations in the Caribbean lowlands of Costa Rica started in the early 90s after previous experimental plots was undertaken at Diamantes Experiment Station in Guápiles in the 70s and the Organization of Tropical Studies (OTS) in La Selva Biological Station in Sarapiquí. Originally they were proposed as a strategy to recover abandoned and degraded pasture and agricultural lands. The usefulness of establishing native tree plantations for restoration of degraded pastures is widely recognized. Other beneficial effects of native tree plantations include the recovery of biodiversity within agricultural landscapes. Trees remove carbon dioxide (CO2) from the atmosphere and store (sequester) it as carbon in the plant material and in the surrounding soil. So, tree plantations are seen as carbon sinks due to their potential to sequester large amounts of carbon dioxide from the atmosphere in tree biomass, and also as suppliers of other environmental services including restoration of soil fertility. Such native tree plantations have also economic returns when they are properly managed.

The role of EARTH University in Environmental Issues:

Since the beginning, EARTH University was concerned with environmental issues. One year after inauguration, in 1991, a collaborative effort between EARTH and the (OTS) was carried out. As an immediate action of this agreement, Carlos Sandi was trained in nursery techniques and the Forestry Nursery was established. This nursery currently produces more than 500,000 seedlings annually. Then, a trial was established on EARTH campus with the general objective to evaluate the performance of eight native tree species that had been successful in a trial in La Selva. This trial, known as “Nativas 91”, was planted on a 2.6 ha degraded pasture that had been grazed for many years. The trial was established according to a completely randomized block design (4 blocks with 8 species each one), where seedlings were planted in a 3x3 m pattern in monoculture within each block, at a density of 1,111trees/ha, The species selected for this study were: *Calophyllum brasiliense* (“cedro maría”), *Dipteryx panamensis* (“almendro”), *Hieronyma alchorneoides* (“pilón”), *Jacaranda*

copaia (“gallinazo”), *Stryphnodendron excelsum* (“vainillo”), *Virola koschnyi* (”fruta dorada”), *Vochysia guatemalensis* (“chancho”), and *Zanthoxylum mayanum* (“lagarto”). The first thinning took place in 1994 in Vochysia, and subsequent thinnings were performed in the other species, except for Stryphnodendron, in 1996, 1999, and 2001 to reduce tree stocking. Actual stocking closeness at the time of biomass and soil sampling in July 2005 ranged between 190 and 491 trees ha-1 . Diameter at breast height (DBH) and total height of the trees were taken for each tree species to determine timber volume and mean annual increments (MAI). The best performance in growth was observed in *Vochysia guatemalensis* in which values of MAI duplicates those of the rest of the species. Statistical differences were also observed in diameter, height and volume, all in favor of *Vochysia*. *Hyeronima alchorneoides* and *Calophyllum brasiliense* showed a good performance considering the species characteristics, slower growth and higher timber quality.

Table 1. Growth of three native tree species at fourteen years at EARTH campus.

Species	**Current Stock trees ha^{-1}**	**Diameter (cm)**	**Height (m)**	**Volume (m^3 ha^{-1})**	**M.A.I. (m^3 ha^{-1} yr^{-1})**
Vochysia guatemalensis	413 b	34.6 a	30.1 a	584.4 a	41.7 a
Hyeronima alchorneoides	481 a	23.5 b	26.9 ab	280.6 b	20.0 b
Calophyllum brasiliense	491 a	21.6 b	22.7 b	204.2 c	14.6 c

Means with the same letters in a column are not statistically different (P<0.05) according to Duncan test.

Later, between 1994 and 1997, the European Community Forestry Project (PROFORCE), established on campus more than 60 ha of Demonstration and Training plots with 17 native timber species for reforestation of abandoned pasture lands, including natural regeneration management, and small plots on farms in the surrounding communities. Additionally, the Project organized 24 workshops for small farmers on nursery and reforestation techniques.

Following that line, in 1997 an Institutional reforestation effort started to be carried out with support from the Board of Directors including six native species: *Calophyllum brasiliense* (“cedro maría”), *Dipteryx panamensis* (“almendro”), *Hieronyma alchorneoides* (“pilón”), *Terminalia amazonia* (“roble coral”), *Vochysia ferruginea* (“botarrama”), *Vochysia guatemalensis* (“chancho”), and two exotic species, *Gmelina arborea* (“melina”), and *Tectona grandis* (“teak”). A total of 140 ha were planted until 2000.

Since the year 2000, the Municipality of Rotterdam has funded two reforestation projects, a first phase of abandoned banana areas and a second phase including abandoned pasture lands, totaling the effort around 300 ha up to date. Furthermore, once a year in June, on Arbor Day, a journey is dedicated entitled "Siembra Institucional" when all personnel and students go out to the field and plant tree seedlings, covering around 2 ha each year. This practice has been extended to the surrounding communities in the last years. Also, the University sponsors the governmental "Blue Flag Program" in the communities and schools, whose objective is watershed protection through reforestation and waste management practices.

Finally, it can be said that between 1991 and 2005, but primarily in the last five years, EARTH University has implemented about 500 ha reforestation projects. Each reforested hectare, can fix annually around 4 tons of carbon in the biomass. This is equivalent to the sequestration of 14.6 tons of CO2 from the atmosphere, to compensate part of the carbon dioxide emitted by the institutional car pool that produces CO2 emissions equivalent to 180 tons per year (sequestered by just 12.3 ha of reforestation).

Note: Based on calculations of fuel consumption of 36 vehicles, consuming 200 l/day.
Each gram of fuel (C8O18) produces 3.52 gram of CO2 after complete combustion.

Reference

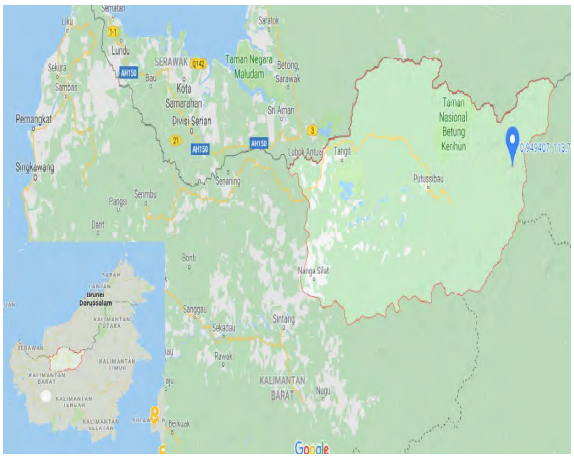
- Arce,H.,Barrantes,A. (2006) La madera en Costa Rica, situación actual y prespectivas. San José,C.R.
- Barrantes,A.,Salazar,G. (2005) Usos y aportes de la madera en Costa Rica. Oficina Nacional Forestal y FONAFIFO. San José, C.R.
- Budowski G., (2000) Explotar en forma sostenible los bosques naturales primarios, secundarios ylas plantaciones. Posibilidades y Limitaciones. UPAZ-INBio. Heredia, C. R.
- Figuerola J. (1999) Fondo Nacional Financia Deforestacion. Boletín FECON. San José, C.R.
- Fonafifo, (2006) Estadísticas de PSA y Reforestación. www.fonafifo.com
- Jimenez M.,Quirico (2008) Empresa de Servicios Públicos de Heredia. Comunicación Personal.
- Leandro U.,Rodolfo. (2000) El consumo de madera en el Valle Central, Costa Rica. UNA-ONF-CCF-FONAFIFO. Heredia. C.R.
- Programa Estado De La Nacion. (2006) Informe # 13. www.estadonacion.or.cr

Electricity from the Forest for a Rural Community in West Kalimantan

WahyudiIsnan
Environment and Forestry Research and Development Institute of Makassar
Jl. Perintis Kemerdekaan Km.16 Makassar, Sulawesi Selatan, Kode pos 90243
Telp. +62411554049, Fax +62411554058

E-mail : yudix19@gmail.com

Forest areas that are generally located in the upper watersheds function as regulators of water systems. Water from forests is very potential to be used as a source of micro hydropower plants. Electricity is now a basic need of the community to support all aspects of life. The importance of water from forests for micro-hydro power plants encourages the Indonesian government to concentrate on reforestation and land rehabilitation, especially in the upper watersheds by encouraging community participation. Community participation in maintaining good forests can be done by incentivizing electric power from micro-hydropower plants.



Micro-hydro power plants systems are generally used in developing countries such as Indonesia. Electricity from micro-hydropower plants systems is used to meet the electricity needs of the community that is not affordable by the State Electricity Company. Due to the country's limited electricity coverage and remote areas, micro-hydropower plants have become an alternative choice that can meet the people's needs for electricity. With electricity generated from forest water, it can strengthen the relationship between the community and the forest. Micro-hydro is classified as a power plant with a power of 5 - 100 kW which is sufficient to meet the needs of one village. The selection of micro-hydropower plants as an energy source is in line with the Indonesian Government's national development efforts that prioritize environmentally friendly development. The Ministry of National Development

Planning (BAPPENAS) states that the National Medium-Term Development Plan for 2020-2024 will be the first low-carbon national development plan. Low Carbon Development is a new development platform that aims to maintain economic and social growth through development activities with low GHG emissions and minimize the exploitation of natural resources.

To realize the effective, efficient and accountable development of micro hydropower plants, before the construction phase is carried out, a feasibility study, detailed engineering design, and a budget design are carried out. The focus of the feasibility study covers technical studies including aspects of hydrology, soil and geology, civil engineering, and mechanical electrical. While the socio-economic aspects include aspects of investment feasibility, environmental impact, and socio-economic culture of the community and institutions

This feasibility study, detail engineering design, and budget design project is funded by the Asian Development Bank through the Forest Investment Project (FIP-1) program in partnership with the Ministry of Environment and Forestry which is carried out by the Balai Perhutanan Sosial dan Kemitraan Lingkungan Wilayah Kalimantan. The location of the study was conducted in Tanjung Lokang Village, Putussibau Selatan District, Kapuas Hulu Regency, West Kalimantan, which is included in the Betung Kerihun and Danau Sentarum National Park. The output of this activity is a feasibility study document, detail engineering design, and a draft budget.

Helping Dominicans Cope with a Pine Bark Beetle Outbreak

Dr. Ronald F. Billings

Texas A&M Forest Service (retired), College Station, TX 77845

Since the late 1960s, when I was a Peace Corps Volunteer in the small towns of Constanza and Jarabacoa, the Dominican Republic has made major advances in forestry. Many threatened watersheds and steep hillside agricultural plots (*conucos* in Spanish) have been reforested with plantations of native and exotic pines (*Pinus occidentalis* and *P. caribaea*, respectively). Although Dominican law protects them from harvesting, pine forests of all ages are routinely damaged by natural forces. Among these are hurricanes, droughts and competition among densely-planted trees (i.e., lack of forest management). These factors predispose Dominican pine forests to destructive insects and diseases. In recent decades, outbreaks of the pine bark beetle *Ipscalligraphus* have killed thousands of pines of all ages, particularly around the town of San José de las Matas.

This bark beetle is considered a secondary pest of pine forests within its native range in the southern United States and Central America, being overshadowed by the more aggressive southern pine beetle (*Dendroctonus frontalis*). But in the Dominican Republic, where the southern pine beetle does not occur, it is a different story. I was the first to collect *Ipscalligraphus*on Hispaniola in 1966 near Jarabacoa. Presumably, this pest was imported unintentionally from the southern United States on imported logs or lumber with bark. It now is abundant throughout pine forests of Hispaniola. Being a recent invader, this bark beetle has few natural enemies or competition from the southern pine beetle or other bark beetle species which help to control it within its natural range.

Earlier this year, I was contacted by the U. S. Forest Service/International Programs, U. S. Agency for International Development, and the Dominican non-governmental organization Plan Sierra to provide assistance with a major outbreak of *Ips calligraphus* centered near San José de las Matas (Fig. 1). I had visited the D. R. several times in previous years (1988, 1990, 1997, 2000 and 2016) as a bark beetle specialist to address previous outbreaks, but this one had developed into the worst one on record in the D. R.

Figure 1: Large infestation of *Ips calligraphus* in native stands of *Pinus occidentalis* and control operations near San José de las Matas, D. R.

Most of the outbreak was centered around Monción and San José de las Matas on private forest lands administered by Plan Sierra. Initiated in 1979, Plan Sierra is a successful public-private partnership devoted to protecting valuable watersheds in the region while providing job opportunities and improving the standard of living of the indigenous populations that call the mountainous region home. Forestry personnel with Plan Sierra were addressing the bark beetle outbreak as best they could using temporary suppression crews to reduce the exploding beetle populations. As with most previous bark beetle outbreaks in the Dominican Republic, this one had been incited by drought - the worst one in the country since official records have been kept. Little rain had fallen since May, 2018, and residential trees, plantations and native forests of all ages were under severe stress. Such conditions allow *Ips* populations to expand rapidly, switching their behavior from attacking downed logs to killing standing trees. With 10 to 12 generations per year, *Ips* populations can be explosive. Attacks often are initiated in the upper crowns of standing pine trees and eventually may extend throughout the entire tree bole, killing the tree in the process.

I spent three weeks in the Dominican Republic in April 2019 evaluating the outbreak and Plan Sierra's efforts to control it. Plan Sierra had hired and trained some 50 suppression crews, each consisting of a supervisor, chainsaw operator, an insecticide applicator and 8 or 10 workers. The control effort, based on my earlier recommendations and Spanish-language field guide (Billings and Espino 2018), consisted of identifying and falling freshly attacked trees, delimbing the trees, and removing the bark with short-handled shovels (Fig. 2). Simply

removing the bark is sufficient to kill developing bark beetle eggs, larvae and pupae, as well as most adults present beneath the bark. But the Dominicans wanted to be sure, so were applying insecticides (cypermethrin) to the exposed wood and peeled bark to kill any beetles that may have survived bark removal.

Figure 2: Suppression crew debarking infested trees with short-handled shovels. San José de las Matas.

Plan Sierra personnel also had installed more than 150 pheromone traps to monitor *Ips* populations in flight (Fig. 3). During the peak of the outbreak, some of these traps were collecting over 25,000 *Ips* adults per week. A crew of women had been hired to count trap catches one beetle at a time (Fig. 4). After I assessed the situation, my recommendations were to discontinue use of insecticide and rely solely on mechanical controls to reduce pest populations until seasonal rains ended the drought. Many trees were being felled and laboriously debarked and sprayed with insecticide when only the top portion of the tree was infested (Fig. 5). I suggested that suppression crews delay debarking uninfested portions of the felled trees and use them as trap logs. Once the flying beetles in the area had colonized the tree completely, then the logs in the lower bole should be debarked before the immature beetles complete their development and emerge.

Figure 3. The author inspects one of the pheromone traps used to monitor *Ips calligraphus* populations in the outbreak area.

Figure 4: One of the Plan Sierra workers counting *Ips* beetles from pheromone trap catches. The small white cup was calibrated to measure out an estimated 900 *Ips* at a time.

Figure 5: Many logs were being debarked before they had become infested (lower). *Ips* galleries are evident on the surface of the upper log.

I also recommended that the infested area be divided into zones and to establish control priorities and focus on the advancing infestation front to slow spread of the outbreak. With regard to pheromone traps, I suggested reducing the monitoring traps to no more than 50and locate most of the traps in areas yet to be infested as a tool for early detection. Also, trap catches exceeding ca. 500 beetles should be estimated volumetrically, using a graduated cylinder or other calibrated implement. This and other recommendations I made were effectively put in place before I left the country.

By the middle of May, the rainy season had returned and the number of new infestations began to rapidly decline. As of mid-June, according to the Plan Sierra staff members in charge of the suppression project (Fig. 6), some 2,700 infestations had been detected and suppression crews had treated 98% of them by felling and debarking some 280,000 infested trees comprising 93,800 cubic meters of logs. Where accessible, downed

logs were harvested by oxen or tractors and loaded by hand onto log trucks to be processed at local sawmills (Fig. 7).

Figure 6: Plan Sierra staff in charge of the suppression project: Director of Research Alfredo Jiménez, forest technician Juán Gilberto and forester William Guzmán.

Figure 7: Loading logs by hand following debarking for control of *Ips*.

Figure 8: Participants in a short course on management of *Ips calligraphus* presented by the author at the Plan Sierra training center in San José de las Matas.

Hopefully, Dominican foresters will take advantage of the on-site training I provided (Fig. 8) to better prepare for and more rapidly respond to the next bark beetle outbreak. It was a pleasure to once again return to the D. R. and be able to help ensure forestry and forest health programs are being successfully implemented.

Reference

Billings, R. F., y J. V. Espino M. 2018. El escarabajo descortezador del pino (*Ips calligraphus*): Cómo reconocer, controlar y prevenir plagas. Publicación # 1, Agencia Internacional de Desarrollo de los Estados Unidos, Servicio Forestal de los Estados Unidos/Programas Internacionales, Instituto de Conservación Forestal (Honduras), y Servicio Forestal de Texas AyM., Washington, D.C. 19 p.

Highlights of the *Phellinus noxius* trip to Taiwan, May 18-June 25, 2019

Phil Cannon, USDA Forest Service, Forest Pathologist (R5)

Because Taiwan and a large number of the US Affiliated Islands in the western Pacifichave very active *Phellinus noxius* infestations that they are trying to get rid of, it was thought that an exchange of information about this fungus and its management might be appropriate. After some early written exchanges, a very full program was set up by Dr. Chia-Lin Chung and doctoral candidate Zong-Chi Wu for a visit of the author to Taiwan.

The author flew to Taiwan on the May 18th arriving there on the evening of the 20th. He was met in the Taoyuan International Airport by Zong-Chi Wu, Yuen-Yi Pang and Ting-Zhi Liao at 6:00 PM and was quickly whisked away to Taichung on the High Speed Rail, arriving there at about 7:00 PM.

Figure1. About half of Dr. Chia-Lin Chung's Plant Pathology research team at the National Taiwan University is shown in this picture. Dr. Chia-Lin Chung is in the colorful striped shirt on the left. Zong-Chi Wu is in the Gap Sweatshirt in the center of the picture and Ting-Zhi Liao and Yuen-Yi Pang are directly in front of him. Ting-Zhi and Yuen-Yi were my guides/interpreters for the first three days of this trip and performed most admirably in this capacity.

Day 1

The morning's planned activities were cancelled out by an exceptionally heavy rain (six inches in two hours). I used this time to read technical papers written by the researchers I would be meeting on this trip and practiced the speech that I would be giving four times over the next few days. In the afternoon we met with Dr. Jhin-hen Yan, a nematologist, who took us to see the Vice President of National Chung Hsing University, Jenn-Wen Huang (a George Kuhlman grad student at Univ. of Athens, Georgia) who has developed, and commercialized Fungichromin (Figure 16), a product that causes cytoplasmic leakage and cell death of *Phellinus noxius*. We also met Ka Tung Leung,who had recently finished his MSc working on Koch's postulates for a new tree species found to be susceptible to Phellinus (Taiwan Myrtle). He had also developed some bio controls of *Phellinus noxius*. He presented apower point on these topics and I showed a short version of my well-rehearsed power point. Then we went to see three different infection sites on the University Campus. At one site soils beneath an infected banyan tree (*Ficus microcarpa*) had been drenched with the fungicide Triadimyfon and this had apparently reduced infection significantly. This tree was now healthy. At another site (near the huge Taichung sports complex) two huge banyan trees had been toppled by a combination of high winds and Phellinus- rotted roots. Sign and symptoms of this pathogen are very similar to *P. noxius* in the Pacific Region.

Day 2

This was a very big Phellinus day. We were picked up by Dr. Jyn Wenn Tsai who took us to the Dadu Great Wall Hiking trail. In the area around the parking lot of this trail there were about four dozen trees that had been infected by *Phellinus noxius*. Dr Tsai spent 90 minutes showing us how to understand what the disease was doing on many of these trees and showing us how some Ficus trees could be saved from the fungus as long as the disease had not progressed too far. Basically the steps to follow are as follows:

1) Remove all of the mycelial sheath of the *Phellinus noxius* from the surface of the infected tree using an "Open Mountain" knife. The sheath should be removed just down to where the green in the cambial tissue is beginning to show.
2) Paint the Triadimefon/Prochloroz fungicide (See Appendix I) onto the scraped area on the tree bole;
3) Treat the soil around the base of the tree with a mixture of Triadimefon/Prochloraz, lime and urea (an pressurized injection to about 50 cm depth in the soil is the

preferred application technique) (Note, the dosage mentioned was 50 to 100 liters per tree, and these trees were 50 to 100 cm in diameter).

4) Redirect aerial roots of the banyan tree so that some of these roots are going down into Phellinus-free soil.

Important note: I need top share these management techniques with James Manglona in the very near future as he is currently trying to save a very important Ficus tree on Rota. This tree (158 feet in circumference) should be easy to save according to the lessons shared by Dr. Tsai. The Hong Kong Urban Tree team would also be able to make good use of this information.

Figure2. Dr. Jyn Wenn Tsai using the "open-mountain" knife to scrape the *Phellinus noxius* mycelia sheath down to the layer of green cambial tissue.

Figure 3 *Phellinus noxius* mycelium and zone lines in a Norfolk Island pine root system that has been totally destroyed by this fungus.

We then went to the Agricultural Research Station where we saw a 300 foot-long row planting of Norfolk Island pine that was being progressively killed by *P. noxius.* Limestone had been applied to about 1 inch of depth over the remaining part of this row planting, but this, by itself, was not enough. Additional trees had died. Landscapers were in the process of removing the most recent casualty and did a very thorough job of removing the bole and entire root system.

We then moved to Dr. Tsai's office where he showed the following four power points and a movie that he had prepared on *Phellinus noxius*:

1) A comparison and ranking of the effectiveness of 60 different fungicides for retarding growth of *Phellinus noxius* (the top two are Tridimefon and Prochloroz);

2) A description of the process by which Dr. Tsai had developed the primers to isolate the ITS loci in the DNA of *P. noxius* isolates (this protocol is now used internationally);
3) Effective treatments to apply to recuperate soils that had been infested with *P. noxius*;
4) Treatments for preventing tree to tree spread of the *P. noxius* root rot (placing a vertically oriented thick plastic sheet in a trench dug between infected and uninfected trees works best).
5) The movie showed basidiospores being released from a set of *P. noxius* conks; en masse these lavender-tinted spores look and move like smoke.

Figure 4. Dr.Jyn Wenn Tsai, who has spent his life studying *Phellinus noxius* and ways to manage this fungus, shared four power points he has developed on this subject and Yuen-Yi Pang did a marvelous job of translating all of this information.

In the afternoon we went with Dr. Wen-Wei Hsiao, National Taiwan University Forest Health Extension Agent. First we went to see *Phellinus noxius* that was associated with the natural forest and a *Cunninghamii lanceolata* plantation in a wild mountainous area near Shuili. At one location about one hectare of trees had obviously been affected by Phellinus. We were able to find it in the root system of every dead or dying tree that we cut into. We also went to a second site that was near a road that went a long ways up into the watershed of the "Mother" River. We ended up walking about one mile on a path on top of a bank that had been constructed to contain that river. Along the way we saw several dozen dead trees. Every one of these that we hacked into had *P. noxius*. Dr. Wei then took us on a long car ride down to the Xitou Nature Education Center where we spent the night in one of the guest houses. This is a huge piece of forested land owned and operated by the National Taiwan University (about 1% of the total land area of Taiwan). That evening we took some

forest walks and found an interesting wilt-causing disease of the golden-haired tree ferns (see Figure14).

Figure 5. It is possible that Dr. Wen-Wei Hsiao, National Taiwan University Forest Health Extension Agent, is even more obsessed with *Phellinus noxius* than the author. On the left he held up a section of *Phellinus noxius*- infected wood that proved to be an inspiration to both of us. On the left half of this piece of wood one can see that the infected tissue is totally wet, and, in fact, free water could easily be squeezed from this wood. The right hand side of this piece of wood, however, is perfectly dry.

Day 3

In the morning we were met by Dr. Chieh-Yin Chen, one of whose responsibilities is to do Forest Extension work for visitors to Xitou. Our exchange began with a movie that the University had made of the natural phenomena of the Xitou Area and also a review of a study called "Forest Therapy". In this therapy study the authors had taken hundreds of work-stressed bankers and arranged for them to go on a series of six-hour hikes into the Xitou wilderness. At the beginning and end of about 10 of these wilderness hikes they took measurements of "happiness" enzymes in their mouths of all study participants and were able to show that their stress levels (as was inversely correlated with the amounts of enzymes collected) had been substantially reduced.

Figure 6. Over 200 large fancy tour buses showed up in the morning and almost 2,000 visitors piled out of these buses and immediately began a five hour hike up through the Xitou Forest Education Center.

Their pace was not fast, but very deliberate and many natural phenomena that they saw along the way caught their attention. The road is not steep in the section shown here, but soon the slope would get to and remain at about 15% as it wound up into the countryside for several miles (see mid-slope in Figure7). This hiking is a large part of the huge Forest Therapy program that this education center facilitates. Approximately 80 % of the folks hiking on this day were over 60; Taiwan has a very large retiree population and this nation is very deliberate in its attempts to keep this part of the population healthy, alert and engaged.

Figure7. The eastern two-thirds of Taiwan is very mountainous. Indeed the country has 200 peaks that exceed 10,000 feet in elevation. Day 1 was spent in the flat area near Taichung City. Parts of Day 2 and Day 3 were spent about one-third of the way up the slopes in the area above Changhua City.

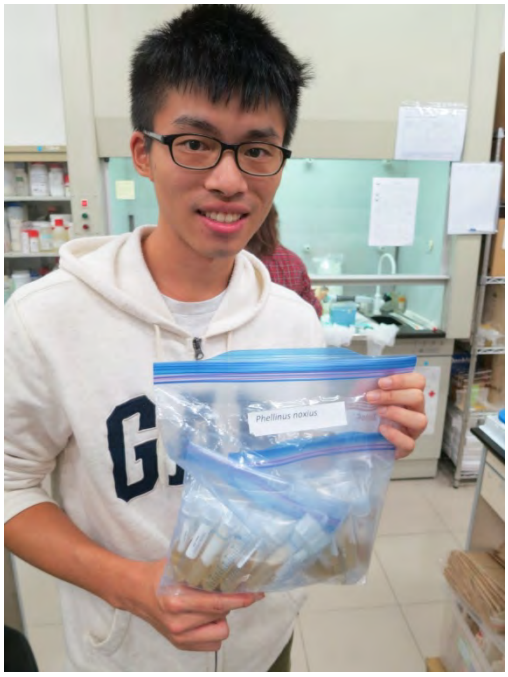


Figure8. Doctoral candidate Zong-Chi Wu (Jimmy) shows test tube copies of the 158 samples of *Phellinus noxius* that we collected from all of the US Affiliated islands in the Pacific.

Dr. Chen also took us to see a giant Taiwania tree (previously one of the biggest trees in Taiwan) that had fallen over as a result of butt rot (*Stereum salcatum* fructifications were visible). We also went on the Xitou Skywalk which permitted us to see how tightly the crowns of a *Cunninghamii laceolata*plantation had become and also to study a great deal of damage that had been caused in this plantation by an exotic black squirrel (these squirrels girdled the terminal leaders causing trees to fork multiple times). Dr. Chen then took us back to Taichung where we caught the high-speed rail to Taipei.

On arrival to Taipei we went to Dr. Chia-Lin's laboratory at the National Taiwan University where we met most of her 18 graduate students (Figure 1). Each of them introduced themselves and explained what they were doing. (All told, six were working on *Phellinus noxius*). Then we went out as a group for dinner at the traditional Maoyuan Restaurant

Day4

This day was spent entirely on the National Taiwan University campus. This is huge university and has a long and impressive history; it was begun as one of the 10 original

campuses of the University of Japan. At 11:00 I gave a major presentation to the faculty and students in the Ag Sciences Department (Figure9). This lecture had 60 slides on the way we are finding and dealing with *Phellinus noxius* on our Pacific Islands. It also had about 30 slides on the molecular genetics that have been done with isolates of this fungus (this work has largely been done in the Stewart Lab (Colorado State) the Klopfenstein Lab (Moscow, Idaho) and the Chia-Lin Chung Lab (Taiwan). And this presentation also had 10 more slides discussing future molecular genetics work that might be done in the arena of Metagenomics. There were approximately 30 minutes of questions. After that we had a formal lunch with the Professors of the Plant Pathology Department at the NTU faculty club. Then there was a tour of all of the *Phellinus noxius* work that has taken place on the NTU campus for the purpose of learning how to best deal with this pathogen.

Figure 9. Faculty and graduate students of the Plant Pathology and Agriculture departments at Taiwan National University gathered for a *Phellinus noxius* lecture from the author.

Figure 10. Locations visited on the campus tour of National Taiwan University.

Day5

The morning of this day was spent with PhD. candidate Tse-Yen Liu (aka George), who currently works for the Taiwan Forest Research Institute. First, we drove all the way across town to visit a site at a high school (near the 101 Tower) where an area where almost an entire row of eucalyptus had been killed by *P. noxius* was in the process of being rehabilitated. An interesting twist here was that after treatment, but before tarping, they buried about a dozen artificially infected *Phellinus noxius* doles. After three weeks, which is the time that they normally leave the tarp on, they pull these samples from the ground and check them in a lab to see if any *P. noxius* inoculum remains viable. If all of these sample

bolts come back negative for the fungus, they consider the treatment a success and can then replant the area with other trees.

Figure 11. One of the Phellinus clear-up sites on the NTU Campus. Standing behind the loquats, from left to right, are Zohn-Chi Wu, Ting-Ting Li and Drs. Chia-Lin Chung and Shean-Shong Tzean.

We also saw a banyan tree that had been given very special treatment. It had contracted *Phellinus noxius*, however, since it was a tree of historical value, it was given special treatment. The entire tree was extricated from the ground. Then all infected parts of the tree and of the root system were cut off with a chainsaw and then Phellinus fungicides (Triadimefon) were painted on these cut surfaces. Then this tree was transported across town and planted in a site that was infection-free but which was treated with anti-Phellinus fumigants anyway (Dazomet). The banyan tree was then planted and cabled into place and a huge net was placed over the tree to cut back on transpiration demands (See Figure24). Large amounts of watering and monitoring were going on. I quit paying attention to the economics of this transplanting operation after the costs had soared past 200,000 for this one tree. It does show, however, that extreme measures can be used to save a tree.

Figure 12. Taiwan Forest Research workers show an area that they have just finished clearing up of *Phellinus noxius*.

After this we went to the Taiwan Forest Research Institute. A quick visit was paid to the Herbarium and the Entomological Collections and then we went to the Arboretum where we saw *Phellinus noxius* growing on several tree species in one area. This was followed by lunch and then the author gave his last power point presentation to those researchers at the Taiwan Forest Research Institute that had a special interest in *Phellinus noxius*. About 25 attended including the Director of TFRI, Dr. Bin Chang. This was followed by about 20 minutes of questions and then 30 more minutes of general conversation.

Some of the important Photographs in this trip

Figure14. Tree ferns (*Cyathea lepifera*) are very common in some forests of Taiwan.

Figure15 This giant tree fell over two years ago.

Figure16. Fungichromin, developed by Dr. Jenn-Wen Huang is being modeled here by Ting-Zhi.

Figure17. These pods of *Phellinus noxius* have obviously been excavated by something that can digest the fungus very well but which cannon digest the material in the zone lines.

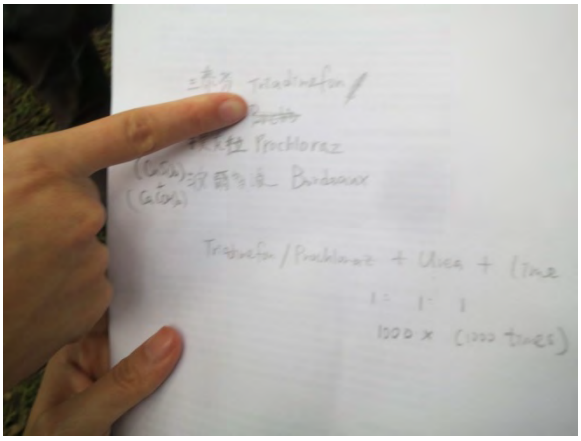


Figure18. Dr. Tsai's concoction for dealing with *Phellinus inoculum* in the soil. It is injected into the soil to a depth of about 50 cm.

Figure19. Dr. Tsai shows how aerial roots of this ficus tree can be redirected to *Phellinus* free soil.

Figure20. Yuen-Yi signals that this ceiba tree is beyond hope of being rescued from *Phellinus noxius*

Figure21. At this site ground limestone was applied to thickness of one inch. It was not effective for deterring the advancement of *Phellinus noxius*.

Figure22. Trees in this long line of Norfolk Island Pines were dying one after another.

Figure23. Dr. Tsai presents the author with an "open-mountain" knife, a tool that he has found to be perfect for the removal of the mycelial sheaths of *P. noxius*.

Conclusions and Future Activities-

Chia Lin and her students and all of the contacts that she lined up for this visit provided an exceptionally rich experience for the author. He was able to fill in many of the unknowns that he had previously had for *Phellinus noxius* and was able to co-develop several ideas about future research and management activities that will be well worth trying. Following are some of the specific lessons learned.

Figure13. Dr. Chia-Lin Chung spent 6 years at Cornell earning her PhD. She currently leads most of the molecular genetics work on *Phellinus noxius* that is taking place in Taiwan and knows about all of the other *P. noxius* work that is getting done in Taiwan.

In terms of the treatment to give to *Phellinus*-infected trees on our Pacific Islands we were close to having it right for most tree species. However, after taking some of the best ideas that I learned during this Taiwan trip the latest version of my recommendations for routinely getting rid of *Phellinus* will be as follows. Fall and dispose of *Phellinus*- infected trees. Be sure to extract all portions of the root system down to 0.7 cm in diameter (the width of the average adult pinky finger). Burn all of this biomass if possible, otherwise chip up all infected wood until there is no piece that does not have dimensions that are less than 0.7 cm in width; then mulch this waste or treat it with an appropriate fungicide. Fill in the root traces with 3 cm depth of urea and lime (this amount of lime will vary by soil pH) and add water to the point where all of the urea is well-saturated. Cover the urea and lime in the trench with loose soil and then cover the treated root area with a sheet of plastic to let the volatilizing urea go to work. The idea behind this treatment is to greatly alter the soil environment where the roots once were so that a plethora of other micro-organisms can come in and decompose the *Phellinus*. This will be the cheapest treatment that will be recommended. If an even more effective or speedier treatment is required (and can be afforded) then these same treatments mentioned above can be combined with the fungicides Triadimefon, Prochloraz, Bordeaux mixture and/or Dazomet being injected into the soil to a depth of about 50 cm. The author did not ask which environmental precautions to follow when using any of these fungicides, however, it was mentioned that Dazomet should not be used near waterways.

As a result of conversations with Dr. Chia Lin Chung and several of her grad students I got several ideas about the interests and capabilities of her research lab. A large proportion of these skills and interests reside in the area of the molecular genetics of *Phellinus noxius*. Then, on return to the US, I had conversations with Ned Klopfenstein, Jane Stewart and Mee-Sook Kim who represent the three large Molecular Genetics powerhouses in the field of Forest Pathology in the Western US.

After talking with both of these groups, I made the following draft list of potential projects that could be developed between these US institutions and the Chia-Lin Chung lab.

1) Conduct genomic sequencing for as many diverse isolates as possible from each of the three major clades of *P.noxius* (refer to Figure 4 in Stewart et al). The Chia-Lin Chung Lab is likely the best-suited to conduct these studies, but the Stewart Lab and Kim Lab are likely/possible collaborators.

2) Conduct complete genomic sequencing for at least one of the isolates from American Samoa and low-coverage sequencing for at least 5 additional isolates. The Stewart Lab and Kim Lab plan to conduct this part of the project associated with #3 below.
3) As there is evidence that the*P. noxius* on American Samoa is a completely different species (based on genetic data). There is interest in getting representative fruiting bodies (both conks and the resupinate structures) so that this likely new species can be officially described.The authorneeds to plan how these collections and associated cultures can be accomplished. Dr. Hattori (of Japan) is considered the authority that hopefully can make morphological examinations for comparisons with genetic date to determine if a separate species name is warranted. Mee-Sook/Jane will collaborate with Drs. Hattori and Yuko Ota to explore the process to describe this potential new species from American Samoa.
4) Determine the directions that genetically related isolates have been moving. Note: this may involve doing the "fast" DNA work (using just one or two locations) an even larger number of isolates. For example, we know that genotype H3 (from Stewart et al.) of *P. noxius* has been found on Japan, Saipan, Guam, and Pohnpei, but we do not know which direction this fungus has been moving. This can be partially determined by detecting where genetic bottlenecks occur; these will generally be the locations to have been "recently" colonized by the fungus. Stewart et al. indicated that they have a "gene flow" program that can determine this migration direction and they also indicated that the number of available samples (already collected) should provide sufficient material for these analyses. Jessa Ata (PhD student of Stewart at CSU) was also on the phone conference, and she has been involved in previous surveys for *P. noxius* in the Philippines, in which *P. noxius* was not found. We informed her that we are still hoping that she will find some good *P. noxius* specimens/isolates from the Philippines, where *P. noxius* is documented to occur.
5) Explore whether hybridization among distinct genetic groups has occurred, and evaluate potential threats posed by hybridization. This work will likely take place in collaboration with Japan, Taiwan, Hong Kong, and/or other regions. The RADseq data, generated by Stewart and Kim is currently being analyzed by the Stewart Lab and will give insight and preliminary results for this.
6) Do some transcriptome research to determine which genes are getting upregulated as *P.noxius* goes into and through its various pathogenic stages. A poster by Hsin-Han

Lee et al. was presented at the Tampa APS meeting in 2016. This poster documented the different transcriptomes that at the different stages of *Phellinus*-caused decomposition. It was suggested that Chia-Lin Chun and Jason Tsai are extremely well-placed to coordinate future studies in this arena; however, *invitro* transcriptomes of *P. noxius* have also been obtained and a manuscript will be submitted by August by the Stewart and Kim labs.

7) Do some research to determine which probes can be used to extract (and ultimately measure) the amount of *P .noxius* DNA in a unit of soil. Andrea Garfinkel (Post-doc of Mee-Sook and Jane) has developed and tried seven qPCR primers to do exactly this and found that five of these primers worked well in a preliminary test. So, this should be an excellent start. Soils from *P. noxius* sites are required for further testing, as well as isolates of closely related fungi, such as *P. lamaensis*, which was previously found in Hawaii by Fred Brooks.
8) Do additional work to determine if there is a critical amount of *P. noxius* DNA in the soil that might lead to an infective capacity, which likely involves the other soil microbial communities (metagenomics/metabarcoding approaches can examine the soil microbial communities).
9) Test several of the management techniques for brown root rot disease in the western Pacific. The focus will be on finding cost-effective ways of reducing *Phellinus* inoculum levels to a point where infection is unlikely. Phil will lead this piece of the initiative and will probably be consulting with Jyn Wenn Tsai and Tse-Yen Liu (George) and Bob Schlub.
10) Do some "time-in-motion" studies to determine the actual costs of treating fixed units of infested land.
11) Prepare a handbook on the recognition and management of *P. noxius* in the Pacific Islands. Phil will take the lead on this, however, he is expecting help from many co-authors and reviewers.

Several other ideas were discussed during this trip including the possibility of Taiwanese forest pathologists coming to California or Guam.

Key references

Cannon P. 2017. *Phellinus noxius* and other activities in Hong Kong, Micronesia and CNMI during March/April of 2017. US Forest Service Trip Report. 54 pp.

Fu CH, HM Hsieh, CY Chen, TT Chang, YM Huang and YM Ju. 2013. gen. et sp. nov. a diaporthalean wilt disease of *Cyathea leppifera* in Taiwan. Mycologia 105(4): 861-72

HH Lee. CY Chen RF Liou, IJ Tsai CL Chung. 2016. Genome and transcriptome analysis of a wood decay fungus *Phellinus noxius.* Annual meeting of the American Phytopathology Society Tampa, Poster number 62.

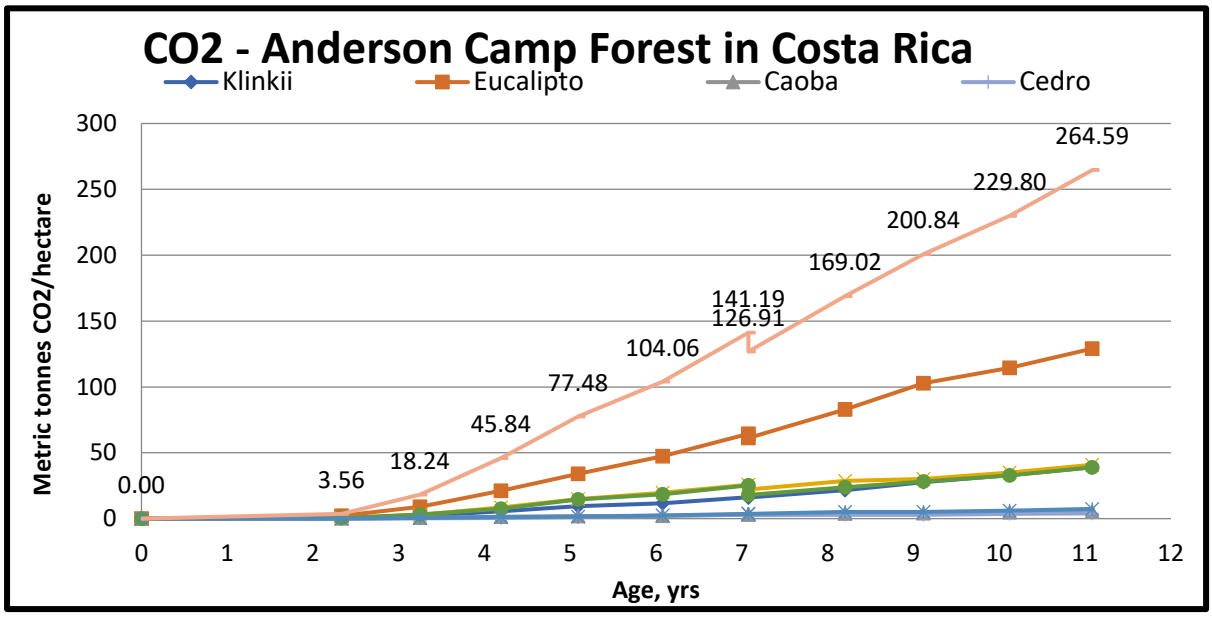
Stewart JE, MS Kim, Y Ota, JW Hanna, M Akiba, JP Ata, N Atibalentia, F. Brooks, CL Chung, EK Dann, AM Farid. T Hattori, SS Lee, K Otto, GS Pegg, RL Schlub, LS Schuey, AMC Tang; JN Tsai, PG Cannon and Klopfenstein N. In review. Phylogenetic analyses reveal three distinct lineages of the invasive brown root-rot pathogen, *Pyrrhoderma noxium*, and bioclimatic modeling predicts differences in associated climate niches. European Journal of Forest Pathology.

THE ANDERSON-CAMP FAMILY FOREST IN COSTA RICA in the Las Delicias Farm near Pocora, CR. is 11.4-years old. It has captured 265 metric tonnes of CO2 so far with a goal of 500 tonnes by 25 years of age. The purpose is to balance the CO2 emissions of this family to mitigate climate change through extraction of tonnes of CO2 from the atmosphere. All RTT forests operate with a successive series of 25-year contracts to reach our goal of permanency for at least 100 years. There are 7 commercial tree species in this forest to promote biodiversity. In addition to an initial grant to the farmer of $3,000 from the sponsor to help in planting the forest, the forest provides income to the farmer by selling logs from thinning the forest lightly every 5 years and eventually from selling verified offsets. H. Barres.

The tree species visible in this photo are the Klinkii tree (*Araucaria hunsteinii*), left, and the *E. Deglupta* 'hybrid', a cross between two provenances of this species, right. Five other native species participate in this 11-yr old biodiverse forest. (See list of tree species below the graph title)

This 1-hectare (2 ½-acre) forest is in the Rojas family farm in the Atlantic Zone of Costa Rica. It is part of a UNFCCC-AIJ sanctioned, applied research program to develop improved models of permanent tropical farm forests to offset our U.S. CO2 emissions. This program is managed by Reforest The Tropics, a U.S./C.R. non-profit organization founded by Dr. Herster Barres in 1996. Seventy-eight RTT forests, 540 acres on 13 farms, have been sponsored by U.S. emitters in this program so far.

For more information contact
Greg Powell,
Executive Director,
28G Cottrell St. in Mystic,
CT, USA,
Tel. 860-572-8199,
Email : GPowell @reforestthetropics.org.
Web site; reforestthetropics.org.
Our foresters in Costa Rica are
R. Camacho and V. Hernandez. H. B., May 31, 2019



What does this all mean?

The Anderson Family have sponsored this project to offset their U.S. CO2 emissions to mitigate climate change. RTT is managing their forest under contract and in cooperation with the farmer. Since year 3, the Anderson forest has grown and sequestered an annual average of 31 metric tonnes of CO2 for their account. The average U.S. family emits 20 tonnes of CO2 annually.

This forest was established on a pasture under a 25-year contract with Mr. Rojas. Approximately 1000 trees/ha of 7 different species were planted to begin this forest. The characteristics of each tree species vary. For instance, aside from the capacity to sequester CO2 from the atmosphere, the flowering of the trees differs, providing food for the insects over an extended period. Insects are a beginning of the food chain for some of the 300 species of birds in this region. Bananas and papayas are planted in the new forest provide a quick shot of food for animals, our hidden cameras show. The colorful poison dart frogs live in the leaves below the forest as do other insects and mammals.



- Left, planting a pasture provides work for locals.
- Centre, the native poison dart frog, part of the biome. Can you find the red frog?
- Right, papayas and bananas feed the wildlife that reoccupies the new forest.

Trees have the capacity to extract CO2 from the atmosphere in the RTT newly designed forests at a cost of $15 to $25/metric tonne, far less expensive than most other options. Moreover, the forests we can create provide the raw material for enterprises that use wood for housing, furniture and other products. Clean water is another product of the RTT forests.

In our contracts, Reforest The Tropics provides technical assistance for the management of this forest. Key to making the sequestration permanent is an emphasis on selling longs from thinnings the forests for the farmer to sell, even while we increase the

amount of sequestered CO2 in the stand. If the farmer can make a significant amount of income from the forest, he will have financial reasons to sign the second, third and fourth 25-year contracts. In addition to selling the logs from light thinnings, we expect to sell the offsets that are generated after 25 years to buyers to offset their emissions, more income to the farmer.

Our thanks to the Andersons for participating in this innovative program of permanent tropical farm forests to mitigate climate change.

Forest Pathology Workshop in Puerto Rico
Phil Cannon

Background

Five years ago, Dr. Lydia Rivera Vargas of the University of Puerto Rico Mayaguez, asked the author to design a Forest Pathology Workshop for a grant she was applying for with the USDA. The author complied. A few years later that grant was authorized under a project titled "Encouraging Careers in Food Security and Safety" (ECaFSS). Shortly afterwards, Dr. Rivera contacted the author and asked him if he would be willing to come teach the workshop. The author agreed and also suggested that Dr. Rivera invite MSc. Marcela Arguedas Gamboa to come teach some sections of this workshop as MSc. Arguedas has had a few decades of experience diagnosing disease problems in forest plantations in several Central and South American countries. Dr. Rivera agreed.

Figure 1. Participants in the first Forest Pathology Workshop at the University of Puerto Rico Mayaguez.

A chronology of the course

In preparation for the course, the author spent about 100 hours preparing thirteen power point presentations of between 15 and 45 minutes in length (320 slides in total). MSc. Arguedas also prepared 8 power points of 30 to 45 minutes in length.

The author traveled to Mayaguez beginning on Sunday afternoon, July 28, and arriving Monday evening July 29th. MSc Arguedas arrived from Costa Rica at about the same time.

On Tuesday Dr. Rivera along with other UPR faculty and technicians, MSc Arguedas and the author traveled to the Guajataca Forest Reserve for the purpose of planning the field trip for the Workshop. A two miles trek was selected for the field day because it passed through a gamut of natural forest types and a Blue Mahoe (*Taliparitielatum*) plantation and because it was also loaded with a range of different fungal pathogens. Many of these specimens were flagged so that they could easily be re-found during the field day. Mental notes were also taken on the condition of these forests after suffering from Hurricane Maria and the degree to which they had been able to recover since that time.

On returning to Mayaguez the author and MSc Arguedas sat down and went through the whole workshop one lecture at a time. The objective of this practice session was to make sure that the full range of tropical forest pathology topics would get covered and that there would be a minimum of redundancies. The program that was settled on is shown in Appendix I. It should be noted that Dr. Rivera also added one additional power point presentation on palm tree phytoplasms. This had been recommended by Jason Smith of the University of Florida.

Early Wednesday, Dr. Rivera, MSc Arguedas and the author loaded all of the presentations onto the university computer. The course was then initiated for the 30 students that were registered and proceeded at an intense pace all of that day. Throughout all of the presentations provided, emphasis was given on how to recognize the pathogens, determine the level of impact they were causing and also to show how they could be economically and effectively managed. Audience participation was excellent. A great number of questions were asked and answered.

On Thursday we made the field trip back to Guajataca Forest Reserve and revisited most of the forest pathogens that had been flagged during our previous visit. Also, it had

rained heavily since our first visit; this had greatly increased the number of fructifications found during this second visit, particularly of jelly fungi, root and butt rots, a range of stem and leaf infecting fungi and many saprophytic basidiomycetes. MSc Christian Torres (In charge of the Puerto Rico Arboretum) joined us for this portion of the field day and this greatly helped us with the identification of some of the trees species that we were looking at. Puerto Rico has a huge level of dendrological diversity.

During the last third of this field trip, we divided the class into four sub-groups and provided instructions for each group to select a separate forest tract in the Guajataca and spend about one hour looking for additional pathogens that were effecting forest health. In this short period, they were to document the impact that these pathogens were having, document the conditions under which they were occurring and collect good specimens of these diseases for subsequent laboratory analyses.

Subsequently we returned to Rivera's Plant Pathology lab at UPRM and then members of each of these groups proceeded to identify these pathogens. They were able to use the excellent microscopes and stereoscopes (which had also been purchased with the USDA Project funds), dichotomous keys and host indices, to help them with these identifications. Very fortuitously several of the microscopes were also hooked up to computer screens which facilitated the taking of excellent photos of some of the fruiting and hyphal structures that were found. Also, although time would not be nearly long enough, Dr. Rivera walked each group through the paces (and the equipment) that could be used to precisely identify a pathogen using recently developed molecular genetic techniques.

On Friday we finished all of the formal lectures scheduled for the workshop by about 2:30 PM (see Appendix I). Then we took one more short field trip right there on the UPRM campus to see about six more excellent forest pathology problems. Then we returned to the lecture hall and had a directed discussion to try and assess the damage that had been caused by Hurricane Maria and also to come up with suggestions about what Puerto Rico should doto cope with hurricanes in the future.

One of the striking conclusions was that the damage caused by the wind in Hurricane Maria had denuded millions of trees of their foliage and had caused breakage of many boles and branches. However, aside from the fact that there was a lot of cleanup required and pruning of limbs and cleaning up of trees fallen on roads etc., most of these trees had recovered from the winds of Hurricane Maria and two years later were sprouting full

canopies of green foliage. It was agreed on by all members of the workshop that if a photographs were taken from space it would be very difficult to distinguish between before and after pictures of the tree conditions in western Puerto Rico except for in one certain kind of environment.

This exception would be the flat low-lying areas that are commonly seen from the coastal highways. Many of these areas were simply inundated for too long and as a consequence, trees that had been growing well in these areas were drowned (asphyxiated from a lack of oxygen). Examples of such areas are in Vega Baja, which lies to the north of highway 2 for about 50 miles (on the north coast) and stretches of land between Aguadilla and Añasco and Mayaguez on the west coast. It is said that at one point more than 60 inches of rainfall has fallen in a five day period during Hurricane Maria, and in these low, flat locations water just could not drain-off the land fast enough.

Closing Session-

The formal part of the closing session was very brief. Basically the lecturers acknowledging the solid participation of the students in this workshop. After this there were some delicious snacks and an informal closing where most of the students just hung around and talked with the instructors. There was quite an interest in going on to grad school and in forest pathology thesis projects that might be worth undertaking.

Conclusions

The last day of the workshop MSc Arguedas and the author both had a sense of immense satisfaction. The group that we had come to work with at this workshop had turned out to be extremely interested in forest pathology, all were extremely intelligent and many of them were already quite accomplished in the ways of Plant Pathology. With a little nudge we felt that several of these people could become very productive in the field of forest pathology. Apparently the students also appreciated the workshop. Their evaluation is shown in Appendix II.

APPENDIX I
Taller de Patología Forestal en Puerto Rico

Recursos:
Phil Cannon, Ph.D. – Regional Forest Pathologist, USDA Forest ServicePacific Southwest Region
Marcela Arguedas, M.Sc. - Escuela de Ingeniería Forestal, Instituto Tecnológico de Costa Rica

Día 1 – Miercoles, 31 de julio de 2019 Introducción al Taller
9:00 Bienvenida - Dra. Lydia Rivera- Directora Proyecto ECaFSS
9:10 Auto-Introducción de todos los participantes
9:25 Objetivos del taller y diferencias de la Patología Forestal de la Patología Vegetal - Phil Cannon
10:15 Merienda
10:30 Agentes Abióticos Causantes de Estrés y Muerte - Marcela Arguedas y, al final, unas observaciones por Phil Cannon
11:30 Introducción al rango de agentes bióticos que causanenfermedades forestales - Phil Cannon
12:00 Almuerzo (por su cuenta)
13:00 Taxonomía de agentes bióticos que causan enfermedades forestales - Phil Cannon
13:30 Enfermedades del follaje - Marcela Arguedas
13:45 Enfermedades que causan cancros en los fustes – MarcelaArguedas
14:00 Hongos que causan enfermedades de raicillas – PhilCannon
14:20 Royas de árboles forestales - PhilCannon
14:40 Enfermedades de las raíces y los troncos - PhilCannon
15:00 Descanso
15:15 Marchitamientos vasculares - Marcela Arguedas y Phil Cannon
15:45 Enfermedadesco-evolucionadascon insectos - Phil Cannon
16:30 Formación de Equipos e instrucciones para el Día Del Campo
17:00 Preguntas y Cierre

Día 2 – Jueves, Primerode Agosto, 2019 Día del Campo y Laboratorio
7:30 AM Reunión frente al Edificio J.T. Piñero
8:00 Salida en buses hacia el Bosque Estatal Guajataca, Isabela PR.
*Nota cada participante debería tener botas o zapatos cerrados, mochila, una capa, agua y meriendas. También habrán lupas, machetes (hachas), bolsas de papel, picos, palas, etc.
10:00 Llegada al bosque y recorrido por veredas para observar y documentar aproximadamente 6 diferentes tipos de enfermedades forestales.Tomando muestras.
12:00 Almuerzo. –
12:45 Romper el grupo en 4 equipos donde cada equipo invertirá 75 minutos buscando muestras de más enfermedades.
14:00 Volver a los laboratorios de patología vegetal en la UPR
15:30 Instrucciones sobre cómo utilizar el equipo para identificar patógenos en el laboratorio.
16:00 Tiempo en el laboratorio, cada grupo tendrá un microscopio para examinar las muestras tomadas en el campo.
16:45 Instrucciones para la tarea dela noche por cada equipo – Phil Cannon
17:00 Cierre

Día 3 – Viernes, 2 de agosto de 2019

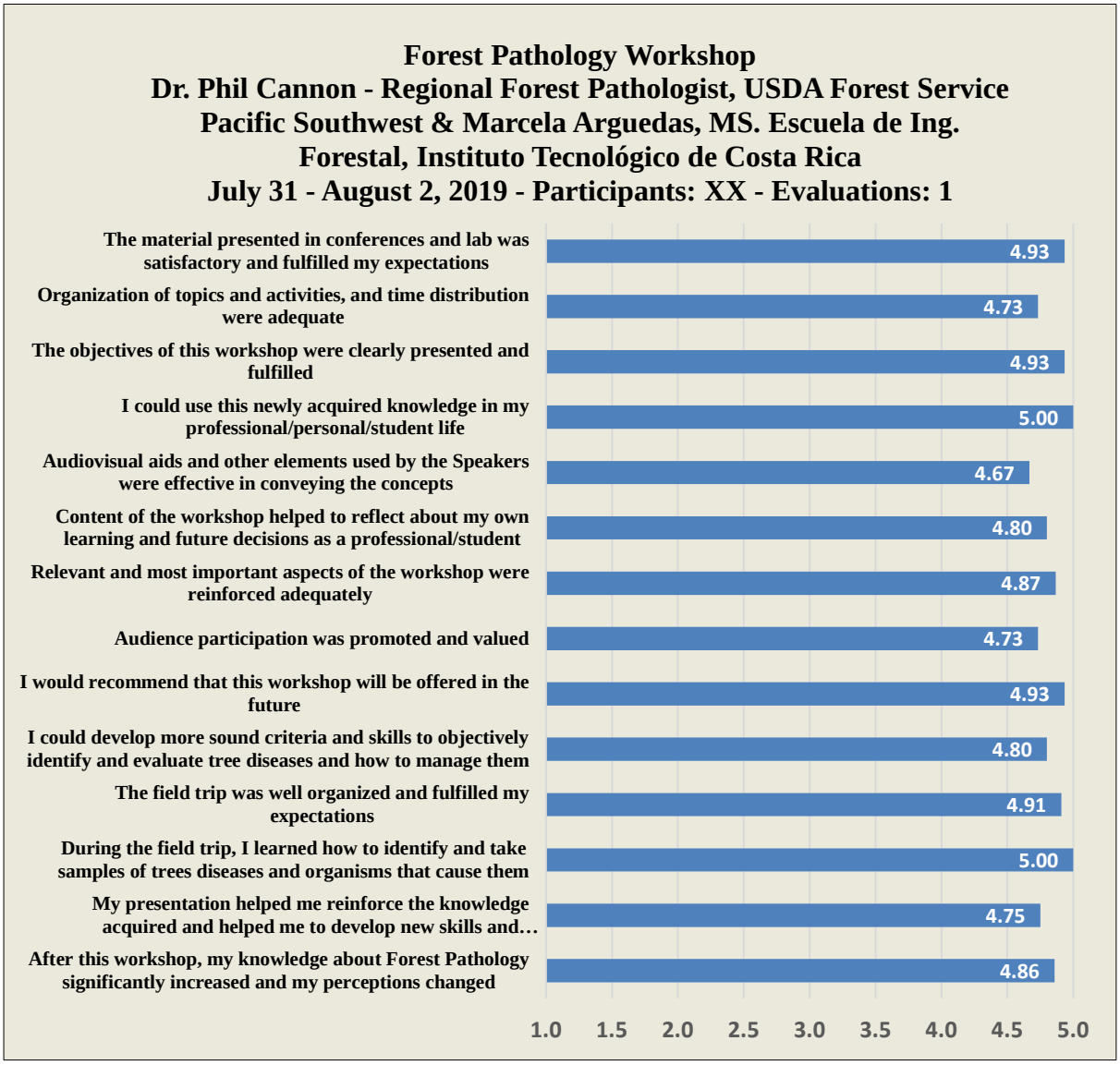
Seguimiento de los discursos sobre patología forestal y finalización del taller

8:15 Un compendio de enfermedades que afectan la teca—Marcela Arguedas
9:00 Angiospermas parasíticos (muérdagos) – Phil Cannon
9:15 Declinamientos forestales – Phil Cannon
9:30 Deterioro de la madera – Phil Cannon
10:00 Descanso
10:15 Enfermedades del vivero – MarcelaArguedas
11:15 Cómo se pueden conducir las pruebas de Koch en árboles - Phil Cannon
11:30 Hongos heroicos - Phil Cannon
12:00 Almuerzo (por su cuenta)
13:30 Fitoplasmas en las palmas- Lydia Rivera
14:00 Breve dia del campo en el campus de la UPRM
15:00 Presentaciones de los equipos sobre las enfermedades forestales encontradas durante el viaje de campo.
16:00 Conversacion abierto sobre que hacer con arbolesdanados por ciclones
16:30 Discusión sobre lo aprendido y las necesidades de Puerto Rico en cuanto a Patología Forestal.
17:00 Cierre del taller.

APPENDIX IIaThe Student Evaluation of the Forest Pathology Workshop

S.No	**Forest Pathology Workshop**	
	General Aspects	**Average**
1	After this workshop, my knowledge about Forest Pathology significantly increased and my perceptions changed	**4.86**
2	My presentation helped me reinforce the knowledge acquired and helped me to develop new skills and understanding of the topics covered	**4.75**
3	During the field trip, I learned how to identify and take samples of trees diseases and organisms that cause them	**5.00**
4	The field trip was well organized and fulfilled my expectations	**4.91**
5	I could develop more sound criteria and skills to objectively identify and evaluate tree diseases and how to manage them	**4.80**
6	I would recommend that this workshop will be offered in the future	**4.93**
7	Audience participation was promoted and valued	**4.73**
8	Relevant and most important aspects of the workshop were reinforced adequately	**4.87**
9	Content of the workshop helped to reflect about my own learning and future decisions as a professional/student	**4.80**
10	Audiovisual aids and other elements used by the Speakers were effective in conveying the concepts	**4.67**
11	I could use this newly acquired knowledge in my professional/ personal/ student life	**5.00**
12	The objectives of this workshop were clearly presented and fulfilled	**4.93**
13	Organization of topics and activities, and time distribution were adequate	**4.73**
14	The material presented in conferences and lab was satisfactory and fulfilled my expectations	**4.93**
		4.9

APPENDIX IIb A Continuing Student Evaluation of the Forest Pathology Workshop



Constitutional Provision for Tribal Development in India

R.Jude Sudhagar*, C.Cinthia Fernandaz** and N.Krishnakumar**

*Agricultural College and Research Institute, TNAU, Kudimiyanmalai

**Forest College and Research Institute, TNAU, Mettupalayam

Constitutional provisions

The Constitution of India provides for uniform rule over the whole country but certain regions of the country are governed by special provisions. These provisions ensure the protection of cultural identifies customs and economic and political interests of the original inhabitants of these areas.

I. Article 15(4) enjoins upon the State to make special provisions for the advancement of any socially and educationally backward classes;
II. Article 16(4) empowers the State to make provisions for reservation in appointments or posts in favour of any backward class of citizens, which in the opinion of the State, is not adequately represented in the services under the State;
III. Article 46 enjoins upon the State to promote with special care the educational and economic interests of the weaker sections of the people and, in particular, the STs and promises to protect them from social injustice and all forms of exploitation.
IV. Further, while Article 275(1) promises grant-in-aid for promoting the welfare of STs and for raising the level of administration of the Scheduled Areas,
V. Articles 330,332 and 335 stipulate reservation of seats for STs in the Lok Sabha and in the State Legislative Assemblies and in services.

Finally, the Constitution also empowers the State to appoint a Commission to investigate the conditions of the socially and educationally backward classes (Article 340) and to specify those Tribes or Tribal Communities deemed to be as STs (Article 342).

The tribes have been given a specific consideration in the constitution of India. For administrative purpose, tribes have been defined as “Scheduled tribes” in the constitution.

Fifth schedule - In this Schedule, unless the context otherwise requires, the expression "State" does not include the States of Assam, Meghalaya, Tripura and Mizoram.

Scheduled Areas. - (1) In this the expression "Scheduled Areas" means such areas as the President may by order declare to be Scheduled Areas.

The President may at any time by order;

a. Direct that the whole or any specified part of a Scheduled Area shall cease to be a Scheduled Area or a part of such an area; increase the area of any Scheduled Area in a State after consultation with the Governor of that State
b. Alter, but only by way of rectification of boundaries, any Scheduled Area;

Administration and control of scheduled areas and scheduled tribes –

Tribes Advisory Council There shall be established in each State having Scheduled Areas therein and, if the President so directs, also in any State having Scheduled Tribes but not Scheduled Areas therein, a Tribes Advisory Council consisting of not more than twenty members of whom, as nearly as may be, three-fourths shall be the representatives of the Scheduled Tribes in the Legislative Assembly of the State:

i. Provided that if the number of representatives of the Scheduled Tribes in the Legislative Assembly of the State is less than the number of seats in the Tribes Advisory Council to be filled by such representatives, the remaining seats shall be filled by other members of those tribes.
ii. It shall be the duty of the Tribes Advisory Council to advise on such matters pertaining to the welfare and advancement of the Scheduled Tribes in the State as may be referred to them by the Governor
iii. The Governor may make rules prescribing or regulating, as the case may be,-
    - The number of members of the Council, the mode of their appointment and the appointment of the Chairman of the Council and of the officers and servants thereof;
    - The conduct of its meetings and its procedure in general;
    - All other incidental matters.

Law applicable to Scheduled Areas

i. Notwithstanding anything in this Constitution, the Governor may by public notification direct that any particular Act of Parliament or of the Legislature of the State shall not apply to a Scheduled Area or any part thereof in the State or shall apply to a Scheduled Area or any part thereof in the State subject to such exceptions and modifications as he may specify in the notification and any direction given under this sub-paragraph may be given so as to have retrospective effect.

ii. The Governor may make regulations for the peace and good government of any area in a State which is for the time being a Scheduled Area. In particular and without prejudice to the generality of the foregoing power, such regulations may-
    a. Prohibit or restrict the transfer of land by or among members of the Scheduled Tribes in such area;
    b. Regulate the allotment of land to members of the Scheduled Tribes in such area;
    c. Regulate the carrying on of business as money-lender by persons who lend money to members of the Scheduled Tribes in such area.

iii. In making any such regulation as is referred to in sub-paragraph (2) of this paragraph, the Governor may repeal or amend any Act of Parliament or of the Legislature of the State or any existing law which is for the time being applicable to the area in question.

iv. All regulations made under this paragraph shall be submitted forthwith to the President and, until assented to by him, shall have no effect.

v. No regulation shall be made under this paragraph unless the Governor making the regulation has, in the case where there is a Tribes Advisory Council for the State, consulted such Council.

Sixth schedule–It is basically about the administration in 'tribal' areas of the state of *Assam, Mizoram, Meghalaya and Tripura*. Autonomous districts and autonomous regions are Subject to the provisions of this paragraph, the tribal areas in each item of Parts I, II and IIA and in Part III of the table appended to paragraph 20 of this Schedule shall be an autonomous district. (2) If there are different Scheduled Tribes in an autonomous district, the Governor may, by public notification, divide the area or areas inhabited by them into autonomous regions.

Administrative classification of tribes

- **Schedule Tribes** – Scheduled Tribes (STs) are official designations given to various groups of historically disadvantaged indigenous people in India,Scheduled Tribes comprise about 16.6 percent and 8.6 percent, respectively, of India's population (according to the 2011 census). The *Constitution (Scheduled Tribes) Order, 1950* lists 744 tribes across 22 states in its First Schedule.

- **De-Notified Tribes**- De-notified Tribes (DNTs), also known as ***VimuktaJati***, are the tribes that were originally listed under the Criminal Tribes Act of 1871, as "Criminal Tribes" and "addicted to the systematic commission of non-bailable offences." Once a tribe became "notified" as criminal, all its members were required to register with the local magistrate, failing which they would be charged with a "crime" under the Indian Penal Code. The Criminal Tribes Act of 1952 repealed the notification, i.e. 'de-notified' the tribal communities. This act, however, was replaced by a series of Habitual Offenders Acts that asked police to investigate a "suspect's" criminal tendencies and whether their occupation is "conducive to settled way of life."The UN's anti-discrimination body Committee on the Elimination of Racial Discrimination (CERD) asked India to repeal the Habitual Offenders Act (1952) and effectively rehabilitate the de-notified and nomadic tribes on 9 March 2007.

  In 2008, the National Commission for Denotified, Nomadic and Semi-Nomadic Tribes (NCDNSNT) of Ministry of Social Justice and Empowerment recommended equal reservations, as available to Scheduled Castes and Scheduled Tribes, for around 110 million people belonging to the de-notified tribes, nomadic or semi-nomadic tribes in India.
- **Particularly Vulnerable tribal Groups**–Particularly vulnerable tribal group (PVTG) (earlier: Primitive tribal group) is a government of India classification created with the purpose of enabling improvement in the conditions of certain communities with particularly *low development indices*. The Dhebar Commission (1960-1961) stated that within Scheduled Tribes there existed an inequality in the rate of development. During the fourth Five Year Plan a sub-category was created within Scheduled Tribes to identify groups that considered to be at a lower level of development. This was created based on the Dhebar Commission report and other studies. This sub-category was named "Primitive tribal group". The features of such a group include a pre-agricultural system of existence that is practice of hunting and gathering, zero or negative population growth, extremely low level of literacy in comparison with other tribal groups.In 2006 the government of India proposed to rename "Primitive tribal group" as Particularly vulnerable tribal group". PTG has since been renamed *Particularly vulnerable tribal group* by the government of India.

Administering authorities

As tribes are more of a state issue, therefore the most important administrative authority in this context is *The Governor* of the state. The President, supreme authority of the country in the tribes' matter who is responsible for identification as well as de-notifying schedule areas also acts on his advice only.

Regarding the regulating authorities then the *Tribes advisory council*, on which advice and policies the local governments work is another major authorities for the tribes. *Judiciary* is also plays an important as there are quite specific laws regarding tribes in India

Reference:

- Handbook of National Commission for Scheduled tribes, 2007, Government of India
- Badal Sarkar, 2014, Constitutional provisions for tribal development in India, Indian Journal of Research 3(2)

Natural Resource Management in Practice: Land Rehabilitation and Improved Livelihoods in Ethiopia

Development issue

One of the biggest problems in Ethiopia in last decade is soil degradation caused by water erosion. Soil erosion leads to the denudation of slopes which are unable to absorb rainwater. The surface runoff damages irrigation systems and floods the agricultural land in the area at the foot of the slopes.

Water erosion appears on the slopes due to huge speed of deforestation and inappropriate agriculture practices as well as unregulated herding. Therefore, the MENDELU´s focus is to improve the land use planning and the implementation of natural resources management in order to improve quality of lives of local inhabitants.

Project information

Currently MENDELU is implementing 2 development projects in Ethiopia. This time, we present the results of “Pilot implementation of Holistic Management and Climate Smart Agriculture” project implemented in Arba Minch Zuria Woreda, SNNPR, Ethiopia since 2016.

The project has been supported by Czech Development Cooperation and in close cooperation with local partners Bureau of Finance and Economic Development, Bureau of Agriculture, Bureau of Agriculture and Natural Resources, Bureau of Administration, Arba Minch University.

Project results

The project´s support targets local population, local community facilitators, and farmers living in several kebeles in Arba Minch Zuria Woreda, group of approximately 3,300 households. The project works also with kebele, woreda, zone and regional officers who are responsible for natural resource management approval or implementation. Improved landscape management is positively affecting approximately 25,000 households.

Mendel University together with local experts create a plan of innovative management of natural resources for several kebeles in Baso River basin. The project used participatory

approach when all the involved actors had a say in the final plan and the experts played a role of facilitators and mentors. Application and acceptance of the plans by locals results in decreasing of erosion and increasing their retention capacity of the upper catchment area and thus improve natural resource management by local residents. A series of anti-erosion measures and watershed constructions were implemented that support land and soil rehabilitation in the area.

Figure 1: Community participation meeting on the project site

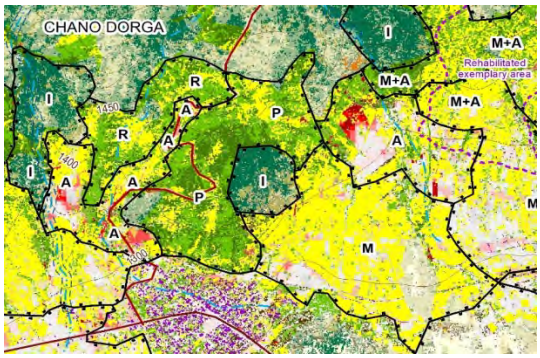


Figure 2: Example of landscape management plan in Chano Dorga

A pilot area was rehabilitated by nature friendly erosion measures and water management structures implemented in the territory of two communities in the upper catchment of the basin. This has a positive impact on both the farmers managing eroded slopes and on the association of farmers producing bananas in the bottom of the basin.

For reforestation of eroded lands were used mostly utility species as *Terminalia brownii*, *Casuarina equisetifolia* and different *Acacia spp*. A practical experiment dealing with soil moisture was set up. Gips sensors measure the moisture in treated area and in area without any physical anti-erosion measures. The continuously collected data confirm the positive impact of retained rainwater on planted seedlings.

Figure 3: Community terrain works on the slopes

Figure 4: Anti - erosion measures in progress

Figure 5: Rehabilitated slopes

Figure 6: Forest and plant nursery in the centre

The project also developed a permaculture center that serves as an education and training facility to spread principles of "climate smart agriculture". The center has been organizing trainings and workshops to target farmers, communities as well as governmental officers and other interested actors in climate smart agriculture, organic farming, moringa plantation, vermicomposting and many others.

Figure 7: Permaculture centre

The capacity building was integral part of the project thus the participatory approach is applied on all activities and all of them are implemented together with local experts and officers. They attend series of training courses and workshops, adopt these innovative methods as their own and, then further disseminate the information to local offices and communities.

Figure 8: Moringa plantation in the centre

Figure 9: Conference on the innovative trends in NRM

The project has organized also a very successful conference where academic and public sphere interacted, and shared ideas and lessons learnt. It was held by Arba Minch University and its goal was to introduce innovative trends in management of natural resources. It focused on interdisciplinary research and practical experience. The participants also visited a rehabilitated area with presentation of different technical solution and anti-erosion measures. Currently the project continues and focuses on development of business skills and production chains for local cooperatives and for permaculture center.

About MENDELU:

MENDELU has a sound record of successful development projects and interventions that respond to the global as well as local environmental challenges for supported by international donors (EU, CIDA, UN, CZDA). Since 1999 the Faculty of Forestry and Wood Technology has implemented complex projects in 4 continents, with specific attention to tropics and subtropics (Ethiopia, Socotra/Yemen, Zambia, Nicaragua, Peru, Cambodia etc.). MENDELU offers vastly experienced team of both men and women, highly professional and passionate, that successfully manage big research projects from program Horizon 2020 and its predecessors.

Contacts:

Contact Information: Ing. Hana Habrova, PhD. HeadofTropicalForestryProgramme hana.habrova@mendelu.cz Ing. Petr Nemec, PhD. Project Manager petr.nemec@mendelu.cz	Mendel University in Brno Zemedelska 1, Brno, 613 00, Czechia www.mendelu.cz Faculty of Forestry and Wood Technology Zemedelska 3, Brno, 613 00, Czechia www.ldf.mendelu.cz

Sustainable Development Goals: Transforming Our World

The following article (Three Page), Feeding the world, is reprinted with permission.

The full citation is

Montagnini, F. and Kjell E. Berg. 2019. Feeding the world. Pp. 98-100 In: F. Carver, H. Gossington, C. Manuel (eds.). Sustainable Development Goals. Transforming our world. Witan Media Ltd, Painswick, UK, United Nations Association – UK, London, UK. 124 pp. https://www.sustainablegoals.org.uk/feeding-the-world/

The article is found in Transforming the World: https://www.sustainablegoals.org.uk

© Jake Lyell/Alamy Stock Photo

Feeding the world

How can we produce enough food for an ever-expanding population without causing irreversible environmental damage?

By **Florencia Montagnini**, Senior Research Scientist, School of Forestry and Environmental Studies, Yale University, and **Kjell E. Berg**, Director, Formcell AB, Bioren Systems

Food production through industrial farming, with heavy use of synthesised fertilisers, herbicides and pesticides, has led to detrimental impacts worldwide. Carbon releases have significantly added to the greenhouse gases (GHGs) present in the atmosphere, possibly magnifying temperature variations and affecting the global climate. The use of heavy machinery compacting soils has led to increased soil erosion and loss of nutrients, and has reduced the ability of roots to penetrate to greater soil depths to absorb water and nutrients.

The planet is losing about 0.3 per cent a year of its capacity to produce food due to soil degradation. Soil erosion poses a major threat to global food security and to the achievement of the Sustainable Development Goals (SDGs). Controlling soil erosion is linked to achieving SDGs 2 (on food security), 6 (on clean water provision) and 15 (on curbing desertification and halting biodiversity loss).

The chemicals employed to eliminate or reduce the presence of weeds, insects and pests also have a major adverse impact on

◀ Tree nursery in Banfora Department, Burkina Faso. As well as making extensive use of trees in agroforestry, Burkina Faso is part of the Great Green Wall project to curb the spread of desertification in the Sahel

beneficial insects, pollinator bees and birds. This in turn affects consumable and other vegetation as well as surface water bodies and groundwater. The total number of insects has plummeted by 60 to 75 per cent in the past 25 to 30 years, and nearly half of insect species are now threatened by extinction. So we urgently need to define more clearly the causes and impacts of using chemicals in industrial agriculture, lawns and gardens.

We need to investigate thoroughly the effects on plant and animal life of the increasing use of genetically modified organisms (GMOs), which enable the application of potent chemicals. The use of GMO crops, which are patented by mega companies, has a negative impact on the ability of farmers to use locally produced seeds. It has also displaced many of the original crop species and varieties that indigenous peoples and their successors had been planting and consuming for centuries. This is a threat to genetic and species diversity, and has serious consequences for human health and cultures.

Reconciling agriculture with biodiversity

Can nature be part of human-dominated landscapes? Land has traditionally been spared to protect biodiversity. However, the areas of land that are available for this purpose are often not large enough to sustain viable populations of wildlife. We need a complementary strategy in human-dominated landscapes: land-sharing.

Reconciling farming and nature is possible in landscapes that truly share space. The Aichi Biodiversity Target 7 of the Convention on Biological Diversity expresses the need to provide the conditions for compatibility between biological diversity and production of goods and services for human society on the same land. In addition, we need to promote biodiversity islands (pockets of protected land in human dominated landscapes) to safeguard the sustainability of current plant and animal species.

Agroforestry systems (AFS) that combine trees and crops on the same land can increase productivity in the short and long term, and are also biodiversity friendly. AFS can help farmers as they seek to adapt to climate change, due to the ameliorating effects of trees on air temperatures. Agroecological systems, which include AFS, are also more resilient to hurricanes. Such systems can create an opportunity to rethink land-use practices, to make land more resistant and resilient to the increased intensity and frequency of storms and other disturbances.

The total number of insects has plummeted by 60 to 75 per cent in the past 25 to 30 years, and nearly half of insect species are now threatened by extinction

Sound agricultural management – including agroecological practices, agroforestry, regenerative agriculture and conservation agriculture – can also increase soil quality and decrease or halt soil erosion. These techniques are being developed and promoted by the UN (including through its Food and Agriculture Organization) and several international, regional and local institutions.

Recommended practices to maintain soil quality include:

- adding organic matter;
- adding ashes from wood burning;
- minimising soil disturbance (for example, practising 'minimum tillage');
- conserving soil and water;
- improving soil structure;
- enhancing biological activity.

This can be accomplished by using integrative nutrient management (for example, composting, mulch farming, planting cover crops), diversifying cropping systems and using mixed production systems such as agroforestry.

How AFS can help achieve the SDGs

If the SDGs are to improve wellbeing for large numbers of people in developing countries, then given current human population growth, land productivity in agriculture and forestry must increase. If we calculate based solely on monocultures, the sum of areas needed to achieve the SDGs at current production levels exceeds what is available on the planet.

But with the appropriate combinations of trees, crops and livestock, agroforestry – a system that integrates forest and agriculture – can offer a range of goods, benefits and services simultaneously. It can therefore provide nutritious food, renewable energy and clean water while conserving biodiversity. By allowing efficient, multifunctional land use, agroforestry supports 'sustainable intensification'.

AFS can make a significant contribution to several of the Global Goals: SDG 2 (on hunger), SDG 5 (on gender equality), SDG 6 (on clean water), SDG 7 (on affordable, clean energy), SDG 10 (on reducing inequalities within and among countries), SDG 13 (on climate action) and SDG 15 (on halting biodiversity loss).

And because of the interconnected nature of the SDGs, AFS make contributions to achieving an even wider range of goals than immediately apparent, including SDG 1 (on poverty), and SDG 3 (on good health and wellbeing). AFS can promote diverse SDGs simultaneously for an enhanced combined contribution to the post-2015 sustainable development agenda.

Increasing sustainable food production

Neither a world free of hunger nor of poverty can be achieved by 2030 without a substantial increase in capital flows in agriculture and food systems. Public and private, as well as domestic and foreign, investment must increase to reach these goals, particularly for the small-scale producers who grow about 70 per cent of the world's food.

Increased funding for agriculture needs to include financing energy alternatives. This is especially true when people's lives are in peril from health hazards caused by inefficient cooking and heating devices, whose use accounts for nearly 50 per cent of roundwood (unprocessed timber) consumption worldwide.

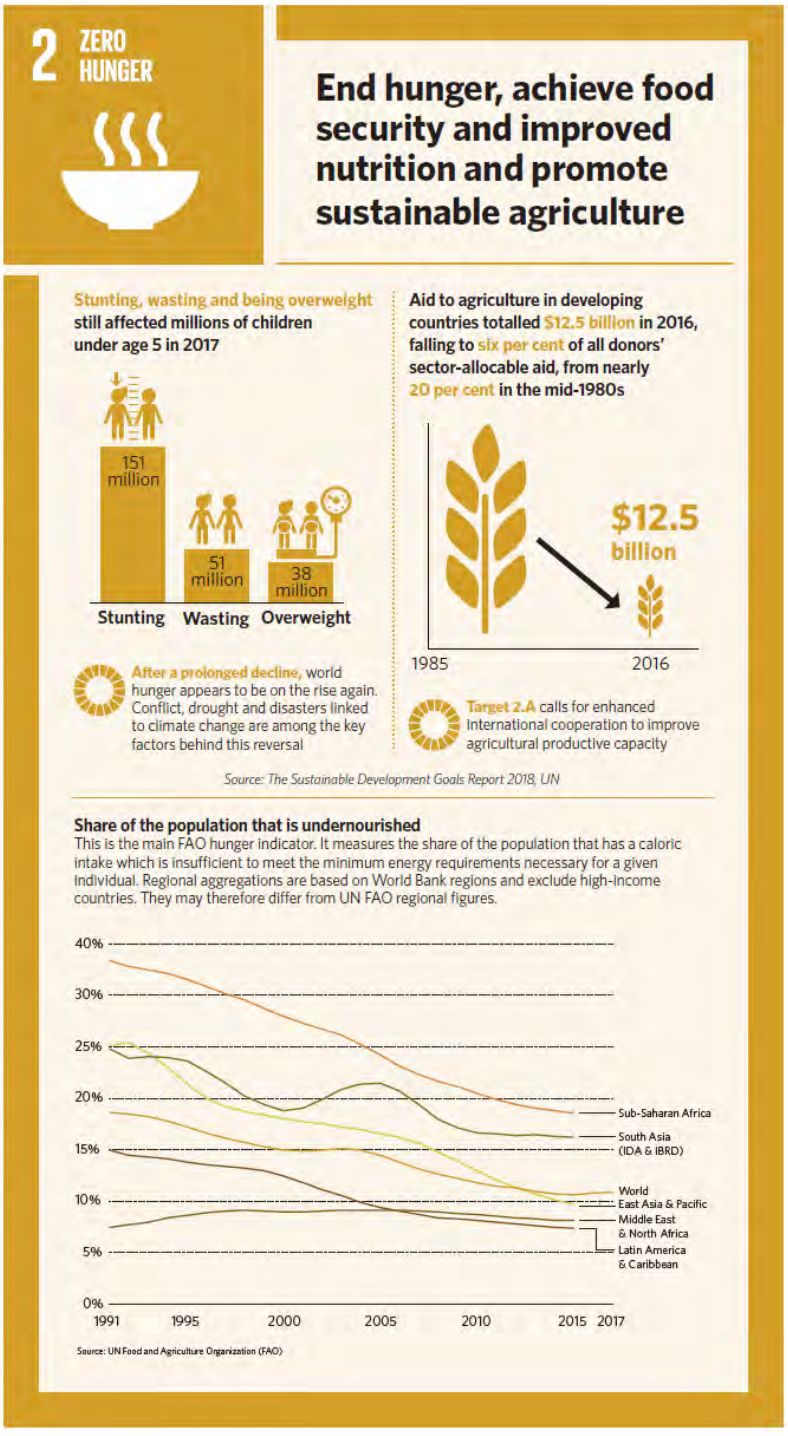
A relatively modest expenditure to promote the use of more efficient cook stoves and alternative fuels would have a major impact on decreasing tree cutting, reducing GHG emissions, increasing carbon sequestration and saving millions of lives.

In addition, safe water supplies for consumption and food production must be secured and promoted worldwide.

Several international programmes and projects, non-governmental organisations and many academic and government entities are conducting research for development aimed at decreasing rural poverty and hunger while maintaining landscape integrity and ecosystem services. These programmes work on topics such as:

- identifying the most suitable systems and management techniques that can contribute to achieving SDGs in target regions;
- how to integrate the traditional knowledge of smallholders with scientific knowledge on environmental and agricultural strategies to promote the most suitable systems for each situation;
- how smallholders can access markets for their products, allowing them to capture more of their value, especially for people who are socially or economically marginalised;
- how AFS and other sustainable food production systems can be scaled up from local situations to regional and international applications;
- how to ensure land tenure and ownership for indigenous people that have used and occupied lands for hundreds of years.

We must ensure these efforts are well supported. The risk to ecosystems worldwide from protecting monocultures with high doses of potent chemicals is clear. To be able to feed all the people, we must urgently switch to sustainable food production systems and practices. ●



ANNOUNCEMENTS/ EVENTS/MEETINGS/OPPORTUNITIES

Call to Submit to a Special Issue "Land, Women, Youths, and Land Tools or Methods"

Land (and its resources) is the most influential factor for development in the Global South. The youth, men, and women (and their households) rely upon it for their livelihoods, and for maintaining their living conditions in both urban and rural areas.

This Special Issue builds a knowledge base of research that presents emerging land tools or methods that can improve understanding of land–women–youth–policy relationships.

Guest Editor of the Special Issue is Dr Uchendu E. Chigbu,ue.chigbu@tum.de, of the Chair of Land Management, technical University of Munich (Germany).

Details about the special issue are also, including details about article submission and the journal, LAND, are available on the journal's website here
https://www.mdpi.com/journal/land/special_issues/land_women

IUFRO WFSE events atXXV IUFRO World Congress

in Curitiba, Brazil 29 September - 5 October

In this congress IUFRO Special Project World Forests, Society and Environment (WFSE) will organize a subplenary and a technical session. Both events will focus on the findings and conclusions of IUFRO WFSE project's forthcoming book "Sustainable Development Goals: Their Impacts on Forests and People".

The **subplenary(A9c)** will present the main findings and conclusions of IUFRO WFSE project's forthcoming book "Sustainable Development Goals: Their Impacts on Forests and People" that addresses the potential and likely impacts of efforts to achieve each of the 17 SDGs on forests and forest-related livelihoods and development. It will discuss the important interconnections and interlinkages among the SDGs and potential or anticipated trade-offs and synergies among the SDGs from the perspective of forests and livelihoods, and shed light on how the implementation of the SDGs may influence existing forest-related development scenarios, and affect the roles of forests in sustainable development in the future. It will address the context factors, distinct forest related development pathways, the necessity to accept related different trajectories for forest-related development, including the need to deal with trade-offs, and the possibility of universal principles for sustainable development. The subplenary will also offer critical reflections to improve current understanding of the impacts of SDG implementation on forests for visualizing the most effective pathways to SDG implementation that could preserve forest ecosystem services while contributing to enhancing people's livelihoods and low-carbon development options in different contexts.

The **technical session (A9l)** will include 11 presentations. They will especially focus on the interrelations among forest and livelihoods and the following SDGs: SDG 1 (No poverty), SDG 2 (Zero hunger), SDG 3 (Good health and well-being), SDG 4 (Quality education), SDG 5 (Gender equality), SDG 8 (Recent work and economic growth), SDG 9 (Industry, innovation and infrastructure), SDG 11 (Sustainable cities and communities), SDG 16 (Peace, justice and strong institutions), SDG 17 (Partnerships for the goals) and the potential synergies among the SDGs addressing Health, Gender, Equity and Justice.

Both events are scheduled for Wednesday 2nd October, 2019.

NEW FOREST BUSINESS FRONTIERS

1-3 June 2020, Hotel Sheraton, Sopot, Poland

Sessions:

- Timberland Investments
- Applied Science
- Certification
- New technologies
- Wood Industry
- Impact Investments in the Forest Sector

What to expect?

- Presentations and panels with industry leaders and CEO's
- Industry insights on global investment trends and opportunities
- Exposure for potential customers, investors, business partners
- Innovative and applied research methods for your business
- Inspiring speeches from delegates from around the world
- Abundant networking opportunities

Learn more at: www.fba-events.com

SAF INTERNATIONAL WORKING GROUP NEWS

SAF National Convention

Louisville, Kentucky
October 30-November 3, 2019
Goods from the Woods

From cellulosic nanotech to cross-laminated timbers and mass plywood, wood-based products are rapidly evolving and impacting our lives for the better. Today, in light of increasing global demands for wood fiber, as well as the ongoing loss of fiber to insects, disease, and wildfire, the role of foresters in managing the nation's forest resources has never been more important. Simultaneously, multiple social demands for ecosystem services from forested landscapes oblige multiple professions to interweave goals and objectives. The 2019 SAF Convention will highlight mega trends such as advanced wood materials and new products from cellulose, while acknowledging the legacy of American wood use in music, food, shelter, and culture. We hope you will leave convention with a renewed appreciation for how forestry and our affiliated professions are driving the world's transition toward a sustainable, de-carboned economy.

Convention and registration information:

https://www.eforester.org/safconvention/Default.aspx

Meet the 2019 Society of American Foresters Gregory Award Winner

Poonam Ghimire, a Nepalese student pursuing M.Sc. Forest Sciences at Albert Ludwigs University of Freiburg, is this year's Gregory Award winner. She will receive funding to attend the 2019 Society of American Foresters National Convention in Louisville, Kentucky at the end of October. At the convention she will join in the Diversity Ambassadors' activities as well as attend numerous technical sessions, and networking events.

Poonam earned her BSc degree in 2017 from the Tribhuvan University (Institute of Forestry), Nepal through the World Wildlife Fund (WWF) Nepal, Jennifer Headley Memorial Scholarship. Her undergraduate research paper on 'Solid Waste Management in the Urban Setting: Hetauda Sub-Metropolitan City, Hetauda, Nepal' was the first ever research on the topic and was conducted in request of the Hetauda Sub-Metropolitan city to create baseline data for the possibility of waste conversion into energy and conversion of a current dumping site into a park.

After completing her master's degree in Germany, Poonam plans to return to Nepal and serve as a forest officer to connect the voices of people on the grass-root level to the policy making bodies, with integrity, accountability and transparency. She would also like to start the Combined Heat and Power (CHP) bioenergy plants using the forest products in a sustainable way. In the long term, Poonam would like to complete her PhD and work as a professor to share her knowledge and inspire the new generations to work for the forestry, environment and sustainable development.

If you are attending the National Convention, please try to connect with Poonam and welcome her to the US, offer suggestions for her continued success, and encourage her in pursuing her dreams.

Bob Sturtevant

International Forestry Working Group

Society of American Foresters

G. Robinson (Bob) Gregory was a pioneer in forest economics and resource development, but always thought of himself as a forester. Bob had a special interest in assisting low-income countries develop their forest resources in thoughtful ways for the good of society. With his wife Ann, Bob traveled much of the world consulting for the Ford Foundation, the United Nations Food and Agriculture organization, and host countries on matters related to forest development. Ann's intuition and social awareness of cultural attributes of each country were integral to Bob's success in partnering with individuals, governments, and companies in various cultures and countries.

The Gregory Award seeks to mark the achievements of Bob and Ann Gregory and further their interest in international relations by providing economic assistance to outstanding students or professionals from outside of the US and Canada to attend the annual convention of the Society of American Foresters (SAF) and have meaningful engagement with foresters on the North American continent.

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.

International Society of Tropical Forestry News

1. An ISTF Consortium for Tropical Forestry Wisdom?? If you are a retired (tropical) forester, and you would like to be resource person for others to contact with questions, would you please send a message to tropicalforesters@gmail.com ? Please include your name, preferred email address for contact, and a two-line description of your expertise. The list of available resource people will be included in a near-future ISTF Update.

2. ISTF Chapters. We now have 3 proposals in process for new ISTF Chapters: Rwanda, Nepal, and Liberia! If you are interested in starting an ISTF chapter but have not told us yet, please fill out this survey

(https://docs.google.com/forms/d/e/1FAIpQLSehc5LDeycz-91TY6SLZKFaAVs3lePFTSKjmtWgmArgJIQwg/viewform)

The support documents for developing ISTF chapter proposals can be accessed at this link (https://drive.google.com/open?id=1v37p7yimTQynFLp0yvz8AwS8pfJaoYL_).
If you have any questions, please contact tropicalforesters@gmail.com.

3. IUFRO Survey. At the XXVth IUFRO World Congress in Curitiba, the Science Meets Stakeholders Dialogue will discuss how forests and forest products across the entire value chain can most effectively contribute to avoiding global warming. To help IUFRO prepare for the Dialogue on the MITIGATION role of forests and forest products, please complete the survey at https://www.surveymonkey.com/r/iufro2019-stakeholder-predialogue-survey by 31 August2019.

4. Will you be going to the XXV World Congress of the International Union of Forest Research Organizations? IUFRO2019 will be held 29 Sept – 5 Oct 2019 at Curitiba, Brazil. See the website http://iufro2019.com/ for more information. ISTF is organizing or co-organizing six technical sessions for the Congress. There will be an ISTF member meeting at the Congress. If you will be attending, please fill out this form, so that we can keep you informed of ISTF-related events at the Congress, and link you with other ISTF members who will be there. For example, we can inform others about your presentation! Here are the ISTF-linked sessions to watch for:

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

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

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

SESSION C1c: Improving high-value Meliaceae yields in plantations

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

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

5. SAVE THE DATE. Watch for the upcoming 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

6. Looking for help with ISTF Website. ISTF is looking for volunteers to help with developing our website. If you have web expertise and are interested, please send a message to tropicalforesters@gmail.com

7. Keeling prize for innovation in addressing climate change. This prize of $25,000 is awarded to 10 projects per year in the areas of Carbon Capture & Utilization, Energy Access, Finance, Transportation, and Social & Cultural Impacts. Application opens 1 November 2019 for the next round. See https://www.kcurveprize.org/ for more information.

8. Do you know of tropical forest data in need of rescue? These may be datasets only on paper or in older digital formats. Such datasets can be invaluable for understanding how tropical forests change through time, including the cumulative impacts of change in land use and climate, and changes in patterns of biodiversity and carbon storage. These datasets can also make a substantial contribution to forest management for production and conservation. Many of the forests (e.g., in Nigeria and Ghana) represented in historical datasets no longer exist, so these data are the only record of the natural vegetation of the area. If you know of any legacy tropical forest datasets in need of saving, will you please let us know? We want to help get them appropriately curated and available. Sheila Ward tropfordata@gmail.com, Gillian Petrokovskygillian.petrokofsky@zoo.ox.ac.uk

9. Looking to connect on high-value Meliaceae species? Join the IUFRO Working Party 1.02.04 on the sustainable management and genetics of the Meliaceae! This Working Party serves as a forum for the exchange of information on the sustainable management and genetic resources of Meliaceae, for all interested parties and countries. To join, go to http://lists.iufro.org/mailman/listinfo/wp10204/

10. Asia-Pacific Forestry Week 2019: Forests for Peace and Well-being. The Asia-Pacific Forestry Week (APFW 2019) was be held in Incheon, the Republic of Korea on 17-21 June 2019. More information can be found at http://www.apfw2019korea.kr/. ITSF had a side meeting was organized by two board members: Maria Paula Sarigumba (ISTF Secretary) and Patrick Durst (ISTF Asia-Australia-Pacific Representative).

11. Trees are much more than the lungs of the world. See this commentary by ISTF member Roger Leaky at https://news.mongabay.com/2018/01/trees-are-much-more-than-the-lungs-of-the-world-commentary/ . Roger also recently published Multifunctional Agriculture: Achieving Sustainable Development in Africa – see https://www.elsevier.com/books/isbn/9780128053560. Also check out his Facebook page on Living with the Trees of Life https://www.facebook.com/Living-with-the-Trees-of-Life-410283185686956/. Roger is the vice-chair of the International Tree Foundation https://internationaltreefoundation.org/.

12. Publication on urban trees in Kumasi, Ghana. Emma Baah Agyapong, ISTF member, has a publication on urban trees in Kumasi, Ghana freely available at https://academic.oup.com/jue/article/4/1/juy019/5150093. Agyapong EB, Ashiagbor G, Nsor CA, van Leeuwen LM. 2018. Urban land transformations and its implication on tree abundance distribution and richness in Kumasi, Ghana. Journal of Urban Ecology. doi: 10.1093/jue/juy019

13. Special issue of Forest Ecology and Management. Peter Ellis and Jack Putz, ISTF member, are guest editors of a special issue of Forest Ecology and Management on Reduced-impact logging for climate change mitigation (RIL-C). The issue is available at https://people.clas.ufl.edu/fep/files/RIL-C-Special-Issue-Forest-Ecology-and-Management-2019.pdf

14. Resources for Tropical Forestry. We need to develop the link library for ISTF, in preparation for the prospective new website. To start, let us focus on "how to" guides for various aspects of tropical forestry. If you have open access publications that explain how to carry out anything relevant to tropical forestry, from clonal propagation to reforestation to…, please send a message to tropicalforesters@gmail.com. Grey literature (government/organization/institution publications) is especially useful for this sort of thing. ISTF can handle publications in English, Spanish, and French. An already-compiled list of resources for tropical forestry and forests and links to those resources is available at this link

(https://drive.google.com/open?id=1kyuZX_kBgsCD-tDQTD0p1ONoOQyS7UnC3owivDDIBgI).

The links include websites, elists you can join, and sources of (free) publications. If you have additions to make to this list, please send a message to tropicalforesters@gmail.com.

An additional list of recent links related to tropical forestry will be sent out as an addendum to this update.

15. ISTF permanent committees. Thanks to all of you who have come forward to serve on the standing committees. The Board is developing the strategy for incorporating members on the Governance and Mission Committees. Many have volunteered for these committees and this needs to be thought through carefully. Thank you for your patience while the Board works out the strategy.

16. ISTF Board. The ISTF officers are: President: Warren K. ("Keith") Moser; Vice-President: Ruth Metzel; Secretary: Maria Paula Sarigumba; Treasurer: Mike Sterner; Tropical Africa Representative: Daniel Kofi Abu; Tropical America Representative: Rene Zamora-Cristales; Tropical Asia-Pacific-Australia Representative: Patrick Durst.

17. ISTF membership. ISTF now stands at ~1240 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 (ISTF). 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 1240 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 form at GoogleForms .

Questions? Email tropicalforesters@gmail.com

Sheila Ward

ISTF Coordinator

FROM THE ARCHIVES

Photograph of blue gum timber production in Southern Tasmania in the early 1900's.

Harvesting blue gum in Tasmania in the early 1900s. Photo from the Open Access Repository: Photographs of blue gum timber production in Southern Tasmania in the early 1900's. University of Tasmania. Beattie, John Watt 1900,

RECENT PUBLICATION AND RESEARCH NOTES

UN Forum on Forests Background Analytical Studies

The UN Forum on Forests Background Analytical Studies can be found at:

https://www.un.org/esa/forests/forum/current-session/background-analytical-studies/index.html

This link includes Campos, J. (2019). “Forests, inclusive and sustainable economic growth and employment”.

The six Global Forest Goals can be found at:

https://www.un.org/esa/forests/news/2017/01/six-global-forest-goals/index.html

New book on forestry in Northern Africa, by Jean-Paul Lanly

The « *Association des Forestiers Tropicaux et d'Afrique du Nord* » (AFT, Society of Tropical and North African Foresters, based in Paris and opened to francophone foresters having experience and/or interest in forestry under warm climatic conditions) has recently published, in cooperation with the International Association for Mediterranean Forests (AIFM), a book in French entitled « *Vivre et travaillerenforêt au Maghreb – Regards croisés* » (« Live and work in Maghreb's forests – Crossed views »), published by Editions L'Harmattan, Paris (473 p., ISBN : 978-2- 343-17140-1).

The concept of the book is the same as that of the first one published by this Society, « *Vivre et travaillerenforêttropicale* » (« Live and work in tropical forests », 2016, Editions L'Harmattan, Paris, 300 p., ISBN : 978-2-343-08382-7), that is a collection of testimonies from foresters serving, or having served in given countries, in that case Algeria, Morocco or Tunisia. In the book, twenty-five Algerian, Moroccan and Tunisian foresters, as well as some French ones who served in these countries, have thus written about their professional life, be it during their whole career or only during one or several assignments, in some cases just recounting a few stories, events or simple anecdotes which they think worth telling. Each testimony is about 15 pages long in average with photographs.

These narratives are preceded by a substantial introduction on the history of man-forest relationships in Northern Africa over the ages, first, before the period of French domination (which started in the middle of the 19th century in Algeria, the end of it in Tunisia and the beginning of the 20th century in Morocco), then during that period which ended in 1956 in the two « Protectorates » (Morocco and Tunisia) and in 1962 in Algeria, and finally since the independence of the three countries.

Through this type of publications, AFT intends to illustrate for an interested public, in a lively, nontechnical manner, the forestry profession, its importance in sustainable development the world over, particularly in the South, for both sustainable socio-economic development and for environmental conservation.

The case of North Africa, more that of many other regions of the world, is exemplary. Indeed, in the three Mediterranean countries of Algeria, Morocco and Tunisia, foresters of the public sector, be they field staff, researchers or teachers, cover a large array of activities and responsibilities which go much beyond forest management *per se*: soil and water

conservation and watershed management, desertification control, nature conservation and wildlife and protected areas management, and, actually, rural development in poor and marginalized zones of mountainous and sub-desertic regions often abandoned by the other public agencies.

The book can be ordered on line at :https://www.editions-harmattan.fr

Or by writing at :L'Harmattan

7 rue de l'Ecole Polytechnique

75005 Paris (France).

It costs 39 € (plus mailing).

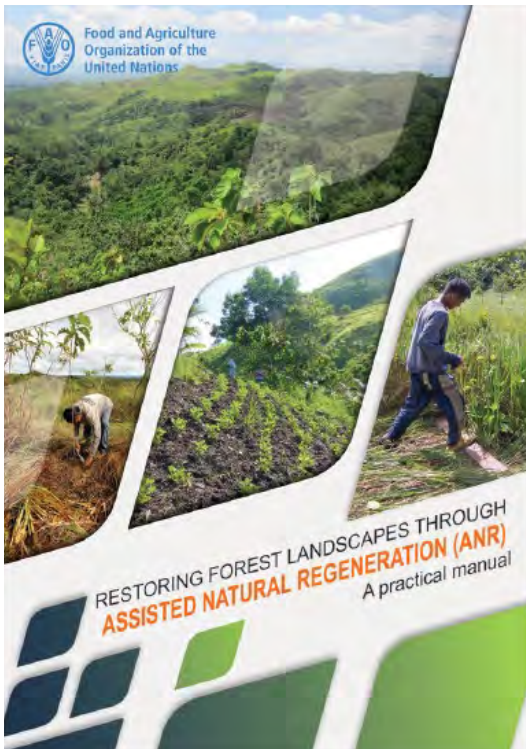
Farmers' knowledge, attitudes and perceptions towards timber out-grower schemes in selected districts of Malawi

Munthali, Maggie G.; Mng'omba, Simon; Chisale, Harold; Njoloma, Joyce; Nyoka, Betserai I.; Sato, Gertrude

Timber out-grower schemes have proved to be one of the most profitable enterprises for rural households. No wonder, several analysts and researchers regard them as an alternative model to avoid problems of displacement and create 'win-win' outcomes for both rural communities and private investors in forestry. However, understanding farmers' knowledge, attitudes and perceptions towards tree out-grower schemes plays a key role in farmers' adoption of the interventions. This study examined these farmers' attributes towards out-grower schemes in selected districts of Malawi. Data were collected from 300 farmers who were randomly selected between September and October 2017 through semi-structured interviews and focus group discussions. The results revealed that 82% of the respondents participated in timber out-grower schemes, piloted by WVI and ICRAF. Based on a median score of 4.75 (IQR 4–5), respondents were strongly agreed on their knowledge on timber out-grower schemes as a basis for adopting the intervention. Using the cumulative Cube-root frequency method of stratification, the results revealed that more than half (51%) of the respondents belonged to the high category, and thus had high knowledge of timber out-grower schemes, whereas 32% and 17% had very high and medium levels of knowledge, respectively. The study also revealed that 79.3% of the respondents had a positive attitude towards out-grower schemes. Pearson correlation analysis revealed a positive, significant relationship between marital status ($r = 0.081$), household size ($r = 0.062$), education ($r = 0.051$) and knowledge of the respondents on timber out-grower schemes. A significant positive relationship was also observed between marital status ($r = 0.156$), household size (0.178), education (0.002), ethnic group (0.151) and attitudes of the respondents towards timber out-grower schemes. However, a negative relationship between knowledge and attitude was revealed ($r = -0.534$). The study therefore concludes that socio-economic factors, such as gender, education, ethnic group and household size, should be considered in upscaling timber out-grower schemes in Malawi

Link: https://www.tandfonline.com/doi/abs/10.2989/20702620.2019.1615236

Restoring forest landscapes through assisted natural regeneration (ANR) - A practical manual

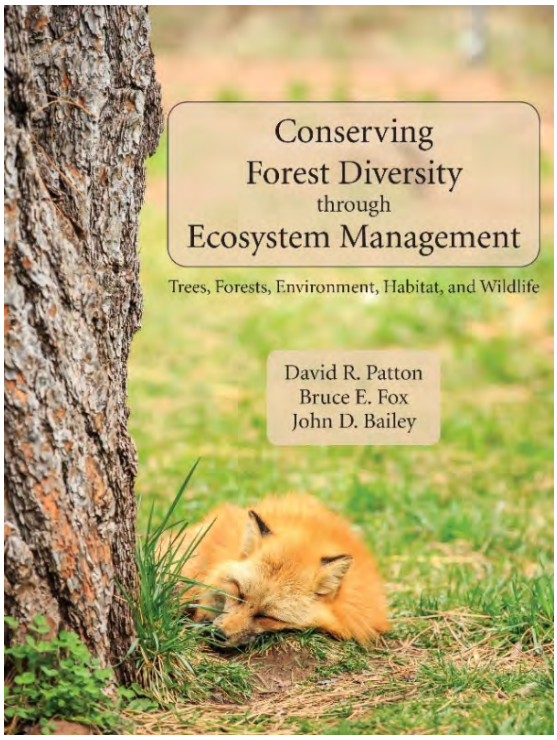


Case studies and experiences with natural regeneration from the region have shown that natural regeneration significantly reduces the cost of restoration in areas that meet certain conditions. Native species that are adapted to the prevailing conditions re-establish on their own with some assistance, achieving accelerated growth in accordance with natural succession, leading to the recovery of native ecosystems. Restoration strategies based on natural regeneration also provide low-cost opportunities for conserving biodiversity and enhancing ecosystem services, including carbon sequestration and watershed protection. This manual describes procedures from almost 20 years of FAO experience with assisted natural regeneration (ANR) in the Philippines and more recently in Indonesia, Cambodia and Lao PDR. In each of these countries, the method was applied for different objectives and convincingly validated ANR's cost effectiveness. There is an increasing recognition of the benefits and advantages of ANR in light of the ambitious global, regional and national forest restoration targets, and there are considerable opportunities to expand the application of ANR through various restoration related initiatives. It is hoped that this manual can serve as a field reference in guiding the application of ANR for forest restoration.

FAO. 2019. Restoring forest landscapes through assisted natural regeneration (ANR) – A practical manual. Bangkok. 52 pp.

This publication can be downloaded at http://www.fao.org/3/ca4191en/ca4191en.pdf

Conserving Forest Diversity through Ecosystem Management
Trees, Forests, Environment, Habitat, and Wildlife
David R. Patton, Bruce E. Fox, John D. Bailey



Forestry, wildlife, and other natural-resource professionals manage ecosystems. Ecosystems bring together diversity in a way that considers all life-forms within a unified system. Patton, Fox, and Bailey present introductory students with an integrated, balanced approach to ecosystem management based on the concept of diversity—a natural phenomenon of life with different levels of recognition that can change over time and space.

Applying decades of teaching, research, and management experience, the authors introduce readers to each major life-form. Sections on significant forces that have shaped our landscape and how it is managed orient students in the field. Insightful approaches to the planning process are highlighted. Specific instruction on effective management practices includes inventory design, decision support system development, and database organization. Carefully curated library recommendations and appendices comprised of invaluable data sets prepare readers to navigate an extremely complex planning environment.

Waveland Press,
279 pages, $57.95 list
ISBN 10: 1-4786-3785-4
ISBN 13: 978-1-4786-3785-1

https://www.waveland.com/browse.php?t=743

Amazon Statistics

A set of statistics about the Amazon in easy-to-read from put together by the Federation of Industries of the State of São Paulo is available at:

https://www.fiesp.com.br/amazoniavoceprecisasaber/

It is available in Portuguese, Spanish, English, French and German. Links to pdfs are at the bottom of the page. When you click on a link the pdf automatically downloads.

TROPICAL NOTES:

Recent findings of ecology or management of forest and fauna that tropical foresters should know and understand

Isabel Mariana Fernandez, Frank H. Wadsworth and Library Staff

International Institute of Tropical Forestry

USDA Forest Service

San Juan, Puerto Rico

Frank Wadsworth has put together past Tropical Notes in one pdf volume which can be found at http://www.orrforest.net/saf/TropicalForestryNotes1to20.pdf

---

Three decades with 10 rainforest species

There is no consensual ecological theory that accounts for the coexistence of so many species with similar morphologies and the same fundamental requirements of light, nutrients, water, and physical space. Long-term studies, rare in rainforests, capture typically abrupt changes in forest structure and light environments, major physical damage, and tree responses to these events, including long-term climatic variation. The data are unique in years of continuous annual measurements, the number of monitored individuals, in-depth documentation, and unrestricted access.

D. B. Clark and others. Three decades of annual growth, mortality, physical condition, and microsite for ten tropical rainforest tree species. [Ecology 92 (8) 1901, 2018].

Intercropping rubber

In northeastern Thailand, to alleviate rural poverty, the government promoted intercropping with new rubber plantations. Rubber, because of a long immature period, is processed at a loss. Intercropping of the rubber during this period compensates for the loss of income. Twenty-two farmers favored the intercropping to achieve the total annual income during the immature period, using cassava and rice as intercrops. Rubber-cassava generated a gross margin of 11,340 B/year for 3 years. Management costs were reduced 59% over a 6-

year period of rubber immunity. The cash-income ranged up to 26.8% of the mean household annual income.

D. J. M. Hougni and others. The household economics of rubber intercropping during the immature period in Northeast Thailand. [Journal of Substainable Forestry 37(8) 787 -803 2018].

Rotation for lumber in Kenya

An optimum lumbering rotation for three species, pine, cypress, and eucalyptus. Application from data of the Kenya Forest Service gave the Faustmann optimal biological harvest age at 25 years for pine and cypress and 14 years for eucalyptus optimal rotation period for management of lumbering forests in Kenya.

[Journal of sustainable forestry. 37 645-660 2018]

Baobab propagation

The baobab (*Adansonia digitata* L,) is an African tree that rural communities depend on as a source of food, medicine, and income. Developing vegetative propagation could enhance domestication of the species and the supply of its products. Top Cleft grafting in October had the highest success rate, (66.6%) and 33.3% in November. Side veneer grafting in October attained 63.3% success in October and 30.0% success in November. Baobab is easily amenable for grafting when done at the right time and with the correct size of scions. To promote the species in agroforestry grafting use scions from mother trees with desired attributes.

H. Jenya and others. [Journal of Sustainable Forestry 37 (6) 632-644 2018]

Handicraft forestry in Puerto Rico

The production of handicrafts is a major form of cultural expression and a significant source of income in developing countries. The local handicraft sector in Puerto Rico identifies essential elements for small-scale forest enterprises. Sawyers and artisans harvested, processed, and traded. Artisans in Puerto Rico, as citizens of the US have access to the largest handicraft market in the world. Lack of institutional effectiveness is a major

constraint. Linkages are needed between all potential support organizations to provide technical assistance, marketing, and financial services to the artisans.

J. F. Montana and others. [Journal of Sustainable Forestry 37 257-269 2018].

Sawdust for wood/cement composite

Construction material rising costs and global demand for economically sustainable and environmentally friendly building resources have necessitated the use of sawdust/cement composite. The use of sawdust increases green building resource base and reduces environmental pollution. Sawdust suitability from *Triplochitonsleroxylon* (T) *Entandrophragmacylindricum* (E), and *Klainodoxagabonensis* (K) for wood/cement composite was determined from their chemical constituents and their composite's physico-mechanical properties. T was minimum on total extractives, (6.12%), lignin, (29.89%) and holocellulose (56.38%) and K the maximum. (9.31%), (31.59%), and (57.5%), respectively. Ash content was highest for T (7.6%) and lowest for K. (1.53%) T was the strongest (modulus of elasticity MOE =696.1Nm2) and moisture absorption MA = 8.8%) than E (625.9 Nm2) and (9.5%). K boards proved incompatible with cement. *Triplochitonsleroxilon* sawdust is suitable for wood-cement composites.

C. A. Boasiako and others. Suitability of sawdust from three tropical timbers for wood-cement composites. [Journal of sustainable Forestry 37 (4) 414-428 2018]

Mangroves for coastal Bangladesh

In alignment with UN Sustainable Development Goals focused on coastal resources, Bangladesh has established mangrove plantations to protect 120,000 ha of coastland. Mangroves enhance coastal stability and protecting coastal settlements from storm surges and promoting coastal accretion. The mangrove plantations confirm the important role mangroves play in the sustainable development of coastal resources.

J. Chow and others. Mangrove management for climate change adaptation and sustainable development in coastal zones. [Journal of Sustainable Forestry 37 (2) 139-156 2018].

Unstable forest behavior in New Guinea

On the north coast of New Guinea active subduction zones are uplifting lowland basins and exposing relatively young sediments to weathering. There were few areas of high biomass, with most of the forest comprised of small diameter stems of less than 30 years of age. The frequent natural disturbances extend understanding of forest vegetation on unstable terrain.

J. B. Vincent and others. Tropical forest dynamics on unstable terrain: a case study from New Guinea [Journal of Tropical Ecology 34 (3)157-175 2018].

Seasonality of bird sounds in lowland forest

A study on Mount Cameroon showed that in lowland rain forest the bird community vocalized year-round, but species richness, as well as the vocal activity of the community varied greatly during the year. This variation coincided with the seasonality of rainfall. The highest number of species (31.5 on average) at the beginning of the driest period, followed by a gradual decrease in singing with increase in rainfall (minimum 14.5 species).

J. Vokurkova and others. Seasonality of vocal activity of a bird community in an Afrotropical lowland rain forest [Journal of Tropical Ecology 34 (1) 53-64 2018].

Australia's forest biodiversity

A recent major development has been national inventory databases on Australia' native forest-dwelling vertebrate fauna and vascular flora for reporting in the Australia's State of the Forests Reportseries. Although these databases are incomplete, nearly 17,000 species records of vascular plants and over 2,000 vertebrate species records have been assembled. Of the 2,212 records of forest-dwelling vertebrate species, half (1,101 species) are forest-dependent species that require a forest habitat for at least part of their lifecycle. Eucalypt open forest and eucalypt woodland are the most important habitat types for both forest-dwelling and forest dependent vertebrate species.

S. M. Davey and others. Reporting Australia's forest biodiversity, forest dwelling and forest dependent native species. [Australian Forestry 81 (2)196-209 2018].

ABSTRACTS AND KEY MESSAGES

Non-Timber Forest Products (NTFPs) as a Means of Livelihood and Safety Net among the Rurals in Nigeria: A Review

Non-timber forest products are an important part of the benefits derived from Forests in Developed and developing countries. Non-timber forest products (NTFPs) which play an important role in sustaining livelihoods of communities living around forest areas have been given minimum attention regardless of its contribution to the livelihoods, capacity to generate employment opportunities, as well as offering greater prospects for NTFP based enterprises. This review, therefore, highlighted benefits from its direct provisioning to households and the economy. NTFP based enterprises in Nigeria benefits both the rural and urban people, so the promotion of sustainable use of NTFPs could lead to a win-win situation for poverty reduction and biodiversity conservation. Several findings revealed that adult, mostly females, middle aged with sufficient energy are involved in gathering and marketing of NTFPs. This therefore, gives rise to the need for inclusion and encouragement of women and youth to be more involved in NTFP based enterprises with appropriate regulations in place. In approaching the NTFP regulation, it is important for the Government to take into considerations the financial, environmental, ecological and social costs and benefits of such actions, capacity of the government in implementing the actions and the likelihood of compliance by the relevant stakeholders.

Citation

Esther Olufunmilayo David, Kazeem Akanni Jimoh, Samuel Olusola Oyewole, Ademola Emmanuel Ayeni. Non-Timber Forest Products (NTFPs) as a Means of Livelihood and Safety Net among the Rurals in Nigeria: A Review. American Journal of Service Science and Management. Vol. 6, No. 1, 2019, pp. 27-31.

Email: Hadassahdavid0@gmail.com (E.O. David)

http://www.openscienceonline.com/journal/archive?journalId=710&issueId=7100601

Carbon Sequestration Potential From *Gmelina arborea* (Roxb.) Stands in Omo Forest Reserve, Ogun State, Nigeria

Ige, P.O

Forestry Research Institute of Nigeria, P.M.B. 5054, Jericho, Ibadan, Nigeria

E-mail: igepetero@gmail.com. Phone No: +2348035826907

Gmelina arborea plantation establishment in Omo Forest Reserve, Ogun State, Nigeria started in 1966 with annual target of 500ha to serve as raw materials for Iwopin Pulp and Paper Mill. Unfortunately, the mill has been moribund over decades ago but Ogun State Forestry Plantation Project (OSFPP) has since then continues to manage the afforestation project to address grievous environmental disasters, sustainable timber production, protect human health and provide long-term environmental security. Having a better understanding of the total carbon sink from the afforestation projects is fundamental to assess its global carbon benefit. Inventory data on the species stands established from 1981 to 2015 were used. According to IPCC and FAO, the sequestered carbon stock based on inventory data was calculated by using four comparable volume-derived biomass models. Results show that the carbon sink contribution from these afforestation projects was 0.82 Pg C by the end of 2017 and 0.43 Pg C on average from 1981 to 2017 with a cumulative rate of 0.015 Pg C/a. The financial value of carbon sequestration from these projects was estimated by its value in carbon taxes of Finland and is potentially ₦91 billion from 1981 to 2017. Hence, although OSFPP make only modest contributions to offsetting industrial growth in timber production, if the carbon sequestered by *G. arborea* alone is valued according to some markets, is a significant fraction of the total project costs.

Keywords: Afforestation, Climate change, Trees, Nigeria

Elevational changes in vascular plants richness, diversity, and distribution pattern in Abune Yosef mountain range, Northern Ethiopia

Kflay Gebrehiwot, Sebsebe Demissew, Zerihun Woldu, MekbibFekadu, Temesgen Desalegn and Ermias Teferi

Email: kflay77@gmail.com

Abstract

The aim of this research is to investigate the patterns of vascular plant species richness, diversity, and distribution along an elevation gradient in the Abune Yosef mountain range, Ethiopia. Preferential systematic sampling was employed to collect vegetation and environmental data along the elevation gradient. We found that plant species richness declines monotonically from low to high elevations. Specifically, vascular plant species richness and diversity were lower in the Afroalpine grassland (high elevation) than in the Dry evergreen Afromontane forest and Ericaceous forest (low elevations). In contrast, endemic vascular plant richness was significantly higher in the Afroalpine grassland than in the Dry evergreen Afromontane forest and Ericaceous forest. Elevation showed a significant impact on the richness, diversity, and endemism of vascular plants. According to Sørensen's coefficient, the similarity between Dry evergreen Afromontane forest and Ericaceous forest vegetation types is higher (32%) than the similarity between Ericaceous forest and Afroalpine grassland (18%). Only 5% similarity was recorded between the Dry evergreen Afromontane forest and Afroalpine grassland. Growth forms showed different elevational richness patterns. Trees and liana increased monotonically up to 3300 m. Shrub and herb richness patterns followed a hump-shaped and inverted hump-shaped pattern along the elevation gradient. The elevation patterns of vascular plant species richness, diversity, and growth form in the present study may be attributed to differences in management intensity, spatial heterogeneity, microclimatic variations, and anthropogenic disturbances.

Citation*:* Kflay Gebrehiwot, Sebsebe Demissew, Zerihun Woldu, Mekbib Fekadu, Temesgen Desalegn, ErmiasTeferi, 2019. Elevational changes in vascular plants richness, diversity, and distribution pattern in Abune Yosef mountain range, Northern Ethiopia, Plant Diversity, 41: 220-228.doi: https://doi.org/10.1016/j.pld.2019.06.005.

IMPORTANT URLs

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 asdatabases, as part of the GFIS system.

Cámara Forestal DE BOLIVIA

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