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Caparo: the last relict of the Trade-wind forests of South America and a unique Venezuelan ecosystem

The Venezuelan political, economic, and social crisis has been subject of countless coverage in the international news. This terrible crisis is severely affecting the country at all levels, including the Venezuela's science sector and specifically forest-related sciences and its natural ecosystems and resources. According to FAO (2015), Venezuela, one of the 17th world megadiverse countries, occupies place 14th in the ranking of countries with highest deforestation rates. Old growth forests in the western and central Venezuelan plains have long disappeared due to unregulated and non-planned farming and agricultural development, and destruction is now extending to the middle and high montane forests and those located in the Venezuelan Guayana region.

The Venezuelan forestry sector is largely disconnected from initiatives and/or programs that are being implemented in other parts of the world, particularly REDD (Reducing emissions from deforestation and forest degradation), REDD+(extended REDD considering the role of conservation, sustainable management of forests and enhancement of forest carbon stocks), and other government-based forums. This is in part due to the decoupling of government entities that manage the sector, with the aforementioned initiatives, but also with state and private forestry developments and remarkably with forest research institutions, especially universities. In 2016, another drawback occurred for Venezuelan forests with the creation per decree of the "*Arco Minero del Orinoco* ", a project aiming to boost mineral exploitation in the region of the Orinoco Belt in an area comprising about 12% of Venezuela's territory. This "special economic zone" is putting at risk the Venezuelan Amazon's biodiversity, indigenous cultures and water resources.

This time, Caparo, the last known relict of the Trade-wind forests of South America, a particular biome that once covered a great portion of the Venezuelan and Colombian plains, is critically threatened. This area is part of the Caparo Forest Reserve (CFR), created in the early 1960s to support the development of a national forest industry through the implementation of long term management plans, a truly pioneering effort for the tropical region. CFR is located in the alluvial plains of Western Venezuela and originally had an area close to 180,000 hectares. As in most of the region, Caparo has lost most of its diverse and rich forests in the last three decades. Yet, within a highly fragmented landscape, a small piece of land with no more than 7,000 ha of different ecosystems, including a diverse array of forest-types, savannas and a small area of forest plantations still stands. Created in 1970 as an experimental area for research, Caparo Experimental Station (CES) has been administered by the Universidad de Los Andes through time in agreement with Venezuela's governments. For the most part, it has been the university by means of its professors, employees and students the solely responsible for the preservation and control of the land. The School of Forestry and Environmental Sciences in particular has been the primary stakeholder managing and conducting multiple research projects, while maintaining continuous education efforts to fulfill CES mission over time.

A group of Venezuelan scientists, at home and abroad, are desperately calling for help and collaboration to save this unique area, and this press release aims to drive the attention to the problem that CES, a symbol of the historic role that Venezuela had (and still has) for scientific research in tropical forest ecology, silviculture and sustainable forest management, is facing today.

At least a decade of continuous threats has been the rule in Caparo. Groups of organized communities often accompanied by the support of local and regional governments, frequently with the backing of national institutions, have put CES under a permanent state of alert. Until now, the solely presence of our Universidad de Los Andes has been fundamental in preventing the complete transformation of the land. Early in 2018, a group of about 260 people illegally occupied different areas of CES demanding access to land for their livelihoods. Despite a local court instructed the immediate eviction of the illegal settlers, none of them have left and there are already reports of illegal logging and hunting in the area.

Only after a sound campaign driven by the University of Los Andes, its students and professors, and other partners and professionals in Venezuela and abroad, the head of the Ministry of Eco-socialism and Water finally met the illegal settlers to discuss the situation at the end of the week of 20.04.18. There, the Minister Ramón Velásquez Araguayán publicly acknowledged the high value of CES and the ecosystems represented in the area for the conservation of biological diversity. However, the eviction of the illegal settlers from the CES was not executed. Meanwhile, camps continue to be established and some areas to be deforested. A voluntary eviction was accepted by the Minister, which will only happen after a land is allocated to the occupiers beyond the CES by the National Land Institute. When this is going to take place is unknown. In the meantime, clock is ticking and time is running out for the preservation of Caparo. CES is the habitat of hundreds of species of plants, animals and insects, in many cases highly threatened and considered highly vulnerable to extinction, and within the next few weeks, this important habitat could be totally degraded, potentially ending in the total loss of Caparo's forests.

We demand all official institutions to immediately execute the court's order for the eviction of all groups that are currently threatening several areas of CES. Also, it is urgently that the authorities in charge do everything in their power to resume the discussions regarding the Zoning and Management Plan of the Caparo Forest Reserve from 2012. For reasons that are not well known, these conversations stopped and additional pressures towards the final occupation of Caparo's remaining forests have been increasing over the last 5 years, including the total occupation of the main camp administered by Universidad de Los Andes. In the last draft version of the plan, CES was allocated as a reserve for biodiversity conservation and we demand that this is taken into consideration immediately.

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For detailed information about the state of the forest science in Venezuela, visit the following link:
https://www.change.org/p/venezuela-s-environmental-authorities-caparo-last-relict-of-the-trade-wind-forests-in-sa-and-the-forest-science-in-venezuela

Photo 1: Illegal camps at the CES .Author: Marherir Pino, date: 20.04.2018.

Photo 2: “Saqui saqui“, a 3 meter diameter tree, (*Bombacopsis quinata*) at the Caparo Experimental Station (CES). Author: Marherir Pino, date: 20.04.2018.

Photo 3: Deforested area at CES. Illegal settlers are using the wood to build the camps. Author: Marherir Pino, date: 20.04.2018.

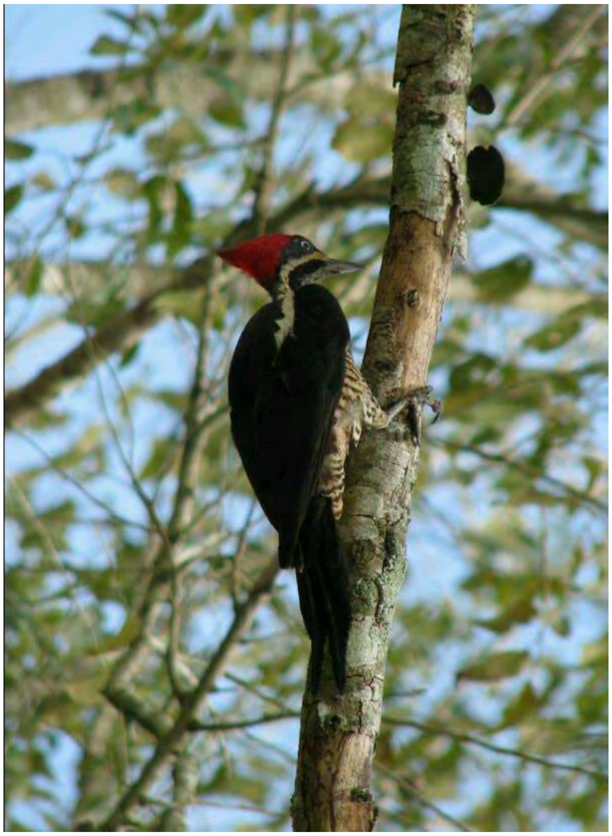

Photo 4: a lineated woodpecker (*Dryocopus lineatus*) in the canopy of the Caparo forests.
Author: Ciro Soto, February 2018.

Photo 5: Stripe-backed Wren couple (*Campylorhynchus nuchalis*) in the canopy of the Caparo forests. Author: Ciro Soto, February 2018.

Photo 6: Spider monkey *(Ateles hybridus)* in Caparo forests. Author: Diana Duque.

Photo 7: *Tamandua tetradactyla* in Caparo forests. Author: Diana Duque.

Photographs: Authors of the pictures agreed with their use for article publications.

Eco-restoration- A result of protection from fire and grazing in Silent Valley National Park, Kerala, India

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Ecological restoration is defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (SERISP, 2004). Naturally it happens through regeneration of woody species locally exist. Regeneration is the process of sylvigenesis by which trees and forests survive over time to bring back the vegetation to near natural system. Management of natural forests thus relies mostly on natural regeneration. Successful management therefore depends on better natural regeneration of valuable species. Continuous protection was provided in Silent valley National Park by the park authority, after it was declared as National Park in 1984.

To understand the process of eco-restoration, a study on natural regeneration of trees in Silent Valley National Park was carried out during 1990 and 2007-08, revealed that the protection provided had an advantageous effect on tree regeneration. It is found that several trees have regenerated in the grasslands amidst the West Coast Tropical Evergreen Forest (as per Chand Basha, 1999) in different parts of the park. It is considered that all these grasslands were formed due to the earlier disturbance caused by man especially fire before establishing the National Park precisely during 70s. These grasslands are located in Valiyaparathodu, Chembotti, Poochapara, Poonchola, Kummattamthodu and Aruvanpara areas in the National Park. After several years of protection, now these grasslands comprise trees, especially pioneer types, which have regenerated naturally, giving an appearance of a mosaic (Photo1, 2, 3, 4 & 5) within grasslands, with tree canopies scattered. Each tree in the grassland (Photo 3) acts as refugia for young seedlings of wet evergreen species, which require shade during early stages.

The tree species recorded in the grasslands in their order of dominance are *Wendlandia thyrsoidea, Symplocos racemosa, Ligustrum perrottetii, Glochidion ellipticum, Olea dioica, Phyllanthus emblica, Maesa indica, Psydrax umbellata, Neolitsea scrobiculata, Callicarpa* *arborea, Elaeocarpus munronii, Elaeocarpus serratus, Syzygium cumini, Ziziphus rugosa, Symplocos cochinchinensis, Apodytes dimidiata* etc. These species can be considered as pioneer one in open grassland situation. Most of the species have smaller fruits which birds have transported from nearby vegetation or they are the characteristic ones of savannah formations. Studies on role of birds in dispersal of fruits and seeds are numerous, especially in species and plants which yield smaller fruits (Howe, 1986; Jordano, 2000; Herrera, 1995; Balasubramanian et al. 1998; Corlett, 1998; Loiselle and Blake, 1999; Stiles, 2000; Mishra and Gupta, 2005). Bats and hornbills are the agents for distributing larger fruit producing species (Corlett, 2004; Datta, 2001; Whitney et al. 1998; Kinnaird et al. 1996; Vanitharani et al. 2004; Mikich et al. 2004; David and Atkore, 2010).

Regeneration and establishment of tropical evergreen species depend mostly on the rainfall and continuous moisture availability in the soil covered with leaf litter. Generally, most of the evergreen species produce fruits and seeds coinciding with rains. Some of the species having orthodox seeds produce fruits during other seasons, so that the particular behaviour of seeds, i.e. long viability, make them survive during unfavorable season, due to their hard seed coat. Fleshy or arillate fruits tend to be favoured and dispersed by animals. Species generally observed within wet evergreen forests like *Palaquium ellipticum, Elaeocarpus tuberculatus, Litsea floribunda* and *Litsea oleoides* could also be recorded in various stages of growth under the shade of pioneer species and evidences of degeneration of grass species below the canopy (shade) of the tree species could also be noticed during the studies. The forest around the grasslands acted as seed source for the regeneration of trees and the seeds being dispersed in these areas by wind or birds mainly bulbuls, which prefer the small edible fruits of some of the above mentioned species.

From this study it is clear that mere protection from grazing and fire itself helps in re-vegetation of the disturbed areas. Establishment of protected areas is of such actions to achieve this. If properly managed, degraded and secondary forests have the potential to regenerate for significant environmental benefits (ITTO, 2002). Such potential trees and shrubs can be used for restoration experiments in degraded forests of similar kinds.

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Photo 1. Status of tree regeneration in grassland of Silent Valley National Park (Panchalikkunnu grassland near Poochipara) during March 1990.

Photo 2. Status of tree regeneration in grassland of Silent Valley National Park (Panchalikkunnu grassland near Poochipara) during January 2008.

Photo 3. Individual tree as refugia within grassland for other shade loving species.

Photo 4. Status of tree regeneration in grassland of Silent Valley National Park (Poochipara grassland) during March 1990.

Photo 5. Status of tree regeneration in grassland of Silent Valley National Park (Poochipara grassland) during May 2007.

Forestry Paraguay

Ken Taffe

In a time long ago and land far away worked a forestry Peace Corps Volunteer. The time was the late 70's in Paraguay, South America, the volunteer was Ken Taaffe. At that time Paraguay, a subtropical country located south of the equator, had just formed a Forest Service. Though I was less than a year out of forestry school, I had more formal training than any Paraguayan working for the service. I was the first volunteer to work for the forest service and was tasked with writing management plans on their national forests, conducting research, teaching, and more.

In reality, getting these tasks all done would require experts with many years' experience, plus the full cooperation of the Paraguayan government. Instead, I did conduct some research, developed a volume table, and set up permanent inventory plots. Regardless I consider my biggest accomplishment was starting a newly minted "forester" on a technical path. The Peace Corps requires that there be a host country counterpart to help out the volunteer and to learn from the volunteer. My counterpart was a Hugo Huespe, a recent agronomy grad with a specialty in forestry.

Hugo, Ken, and a forest technician in Paraguayan forests. I am drinking Terere, a Paraguayan tea made from Ilex Paraguayensis.

We worked together. He kept me away from political landmines (I still managed to find those mines, in spite of Hugo's efforts) while I made sure we were technically correct.

Hugo took advantage of scholarships to study forestry in Chile, Germany, and Japan. With this training he became a professor at the new Forestry College, later becoming dean of the school. During this time, he set up his own consulting firm conducting GIS studies and large scale tree plantings. This past year his firm planted ~ 2000 acres of Eucalyptus. His firm has its' own tree seedling nursery, plus the tractors to plant and maintain these plantations. Most of these are on former Ag land. A popular option is to convert native pastures to a Silvo pasture system of high energy grasses and Eucalyptus. The photo below shows 2 year old Eucalyptus. The cow can now graze the grasses without damage to the trees. These trees grow so rapidly, that the can be thinned in year 3 with a final sawtimber harvest in 12 years.

Hugo and Ken 39 years later and a few pounds heavier under two year old Eucalyptus.

Adapted from The Cruiser, Spring 2018, newsletter of the NJ Chapter of SAF.

Addressing a Pine Bark Beetle Outbreak in Belarus

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May 5, 2018

Background

The native forests and older plantations of Scots pine (*Pinus sylvestris*) in Belarus are currently suffering from dieback and an associated outbreak of bark beetles, particularly in the southern region of the country (Fig. 1). The same forest health problem is affecting pine forests in Ukraine, which borders Belarus to the south. The principal pest species involved is the native bark beetle, *Ips acuminatus* (Coleoptera: Curculionidae: Scolytinae). This bark beetle often initiates attacks in the upper bole of mature trees (Fig. 2) and may infest twigs as small as 2 mm in diameter. The lower boles of infested trees are subsequently attacked by second generation beetles of the same species or other insects, principally the bark beetles *Tomicus minor* and *I. sexdentatus* and the ambrosia beetle *Trypodendron lineatum*.

The outbreaks have been attributed to host-tree stress from recent droughts and a receding water table, factors associated with global climate change. According to forestry officials in Belarus, the forest health problem was first detected in 2008. Timber losses were estimated at 38,531 ha in 2016. Despite direct control efforts (felling and harvesting infested trees), the losses increased to 130, 829 ha in 2017. As of March 31, 2018, an additional 53,947 ha had become infested and the outbreak has shown no sign of declining.

To help address the problem, the United Nations Food and Agriculture Organization (FAO) hosted a Regional Workshop on Combating Dieback of Pine Forests from April 25-27, 2018 (Fig. 3). The workshop, attended by foresters from Belarus and Ukraine, was held in and around the city of Gomel in southern Belarus where the dieback has been most severe. Bark beetle specialists from several European countries and the United States were invited to review the situation, make presentations on bark beetle management based on their experiences, and provide recommendations for better coping with the dieback problem.

Following participation in the regional workshop, the authors offered the following pest management recommendations to Belarus, based on their observations during the regional workshop and their many years of experience managing bark beetles of the genus *Dendroctonus* and *Ips* in the southern United States and Central America (Billings) or *Ips* spp. in Europe (Faccoli).

Integrated Pest Management Recommendations for *Ips acuminatus*

Basically, an operational integrated pest management (IPM) program for tree-killing bark beetles consists of several key components, namely a) prevention, b) monitoring/prediction, c) detection, d) evaluation, and e) suppression (direct control).

A. Prevention

Prevention consists of silvicultural treatments designed to minimize the occurrence and effects of bark beetle infestations within a forest stand or over a wide area. These systems usually are based on measurements of stand characteristics, such as pine density, age, percentage of other tree species, soil conditions, altitude, slope, aspect, etc. Identifying hazard on a landscape scale by remote sensing and satellite imagery also is now feasible.

Recommendations: The Forest Institute in Gomel should develop a hazard rating system for *I. acuminatus* attacking Scots pine by analyzing differences between infested and nearby uninfested pine stands. Likely indicators of susceptibility to *I. acuminatus* in the case of Scots pine stands would include pine basal area, stand age, and site index. Efforts should be made to develop susceptibility classifications on a landscape scale using free satellite imagery available from Landsat 8 and Sentinel 2 satellites.

Once high hazard stands are identified, susceptibility to bark beetles should be reduced by means of periodic thinning (stand density reduction) and by harvesting trees before they become overmature (age reduction). A lower stand density (20 m^2/ha) would favor tree survival and increase resistance to bark beetles during periods of drought. High hazard areas at the landscape level should be targets for more frequent monitoring with pheromone traps and aerial detection flights.

Where practical, pure pine stands should be managed to diversify species composition. For example, once beetle infestations are harvested, reforestation of cleared sites should favor hardwoods and/or non-pine conifers. Similarly, pure pine stands should be separated by rows of hardwoods or non-pine conifers to interrupt the continuity of a single tree species over large areas. Pine stands of different age classes would discourage large infestations, as *I. acuminatus* infests only mature trees.

The Forest Service should establish demonstration areas throughout Belarus to evaluate various silvicultural practices (thinning to various densities, mixed versus pure stands, young versus old stands, etc.) and their long-term effects on forest health and pest populations. In summary, good forest management is good pest management in the case of bark beetles, largely regardless of the bark beetle species.

B. Monitoring/Prediction

Researchers have documented that *Ips acuminatus* in Europe has two generations per year, but the attack dynamics vary between the generations. In the south-eastern Aps, the first (spring) generation begins to emerge from overwintering sites (mainly the litter) when air temperatures reach 14^{o} C, although peak emergence occurs with mean air temperatures of ca. 18^{o} C. This generation of beetles is responsible for initiating new infestations (spot proliferation), which may range from a few to several dozen trees. These new infestation spots become detectable several weeks later when the foliage of attacked trees fades to yellow, then red. When broods from the first generation complete development and emerge, they begin a second generation by typically attacking trees on the periphery of the same spot in which they developed. This behavior leads to infestation expansion (spot growth). Interestingly, a similar pattern of attack that varies with season has been documented for *Dendroctonus frontalis* in the southern United States and Central America.

The Belarus Forest Service has developed an effective pheromone trap at low cost (Fig. 4) and produces its own pheromone for *I. acuminatus*. Pheromone traps are used to detect first generation emergence of overwintering beetles and monitor the flight of subsequent generations.

Recommendations: Continue to utilize locally-produced pheromone traps and pheromone lures to monitor *Ips* populations. Pheromone traps should be placed in the field when ambient temperatures in the spring allow bark beetle emergence (14^{o} C in the south-eastern Alps). Determine the relationship between numbers of *I. acuminatus* in pheromone traps during the first generation and amount of subsequent damage. Once a direct correlation is established, a prediction system can be developed for better forecasting pending outbreaks and the need for detection and control programs for the current year. Identify any insect predators that could serve to improve the prediction system. Weather stations should be set up and monitored throughout the year at various locations of the country to record ambient temperatures and rainfall. These data, reflecting the general health conditions of the pine trees and hence their susceptibility to bark beetles, should be correlated with the occurrence and severity of *Ips* outbreaks to improve predictions of pending pest outbreaks.

C. Detection

Currently, all new bark beetle infestations in Belarus' forests are detected by ground crews. New infestations are found by observing trees with fading or red crowns following captures of beetles in pheromone traps during the spring (April).

Recommendations: Given the very flat terrain characteristic of pine forests in Belarus, it is essential to utilize aerial detection methods to detect all infestations early in their development. Small high-winged aircraft or helicopters flying at 400-800 m above the forest canopy in parallel flight lines are currently the most efficient and effective means of detecting new infestations in regions with flat terrain. New infestations, characterized by groups of pine trees with fading (yellow) or red foliage, are plotted on to electronic maps using digital aerial sketch mapping equipment.

Detection flights should be timed to detect new infestations created by first generation beetles. Schedule flights 6-8 weeks after peak trap catch of first-generation beetles or as soon as ground observations reveal that the foliage of freshly-attacked trees has faded. One detection flight per year in early summer should be sufficient for detection purposes, because beetles from the second (or possibly third) generation are likely to attack trees on the periphery of established spots and create few new infestations.

In the long term, research by the Forest Institute should focus on developing detection protocols using satellite imagery or drones. Satellite data from Landsat 8 and Sentinel 2 (the latter with 10 m resolution) are useful for monitoring bark beetle infestations on a landscape scale and are available at no cost. This imagery can be used to detect red-crowned trees and is useful for documenting the distribution and impact of bark beetle infestations across the landscape. Recent developments with more sophisticated satellites such as Rapid Eye and TerraSAR-X offer promise for detecting bark beetle-infested trees in the green foliage stage, but such imagery is currently expensive to purchase.

D. Evaluation

Once a new infestation is detected in Belarus, ground crews identify the infested trees based on foliage color. Binoculars are used to search for bark beetle galleries in tree crowns, where the bark beetle colonization first occurs. Felling of a tree with fading crown allows identification of the initially-attacking bark beetle and associated bark beetles based on morphology or their distinctive gallery patterns.

Recommendations: All infested spots should be examined to estimate the number of infested trees and species of bark beetles present. The bark beetle species with the most advanced brood stages is likely to be the species initiating the attack. Priority for control should be assigned to infestations having more than 10 infested trees in stands of large tree diameter and those accessible for immediate treatment and harvest. Infestations that cannot be harvested or treated before the second generation of beetles emerges should be revisited in the field. Examine green-crowned trees adjacent to previously infested trees to identify trees colonized by second-generation beetles.

E. Suppression (Direct Control)

Direct control of bark beetle infestations in Belarus consists principally of felling currently-infested trees and either debarking them or harvesting them. The harvested sites are then replanted with Scots pine.

Recommendations: Prompt treatment and harvesting should continue to be the most recommended means of direct control. Sanitation cutting has to be carried out as soon as foliage discoloration appears and should be extended to the nearby apparently healthy trees. Priority should be given to spots containing more than 10 infested trees to reduce potential for spot growth as the second generation of beetles emerges. Cutting conducted during the autumn or early winter has proved to be ineffective for reducing beetle populations because most of the adults hibernate outside the bark in litter. Harvesting infested and buffer trees by helicopter may be feasible in high value sites or those areas with no road access.

When prompt salvage removal is not feasible, the preferred approach is to fall a buffer of uninfested pine trees (10 m wide) around infested spots created by the first generation of beetles. Drop the trees in toward the center of the spot. Leave these trees in the field and place pheromone baits on the uninfested felled trees to attract beetles of the second generation. Harvest, debark or destroy (chip) all infested trees before the second generation broods emerge. Simply debarking *Ips*-infested trees is sufficient to destroy eggs, larvae and pupae, which develop between the bark and the wood.

To the extent feasible, pile up all the infested branches and twigs in the center of the treated site and either remove them from the site or burn them when conditions permit and before the beetles emerge. The following spring, place a pheromone trap in the center of the harvested spot to catch any beetles remaining in the treated infestation. Inspect standing trees in adjacent stands periodically for new infestations following control treatment.

Since the Belarus Forest Service makes its own pheromone traps and *I. acuminatus* pheromone at low cost, it may be worth evaluating the effectiveness of mass trapping as a direct control measure. The effectiveness of mass tapping for *Ips* spp. remains controversial. Results may vary with insect species, geographical area, season of the year, stage of outbreak, density of traps per hectare, effectiveness of the pheromone, and other factors. Baited trap logs of pine (set out vertically or horizontally within infestations) also may be effective in concentrating emerging beetles. Trap trees and logs should be harvested, debarked or sprayed with insecticides before the next generation of beetles emerges.

Application of topical sprays or systemic insecticides also offers an alternative method of suppression. Chemicals of known effectiveness against bark beetles (lindane, permethrin, deltamethrin, bifenthrin, etc.) can be sprayed on the bark of felled trees or vertical pine log sections or standing trees may be injected with systemic insecticides (emamectin benzoate or fipronil) and then baited with *Ips* pheromones to create effective trap trees. Insecticide sprays may have adverse effects against any bark beetle predators attracted to the pheromone-baited host trees and isn't recommended as the primary control measure.

A computerized data base should be maintained in which the following data are documented for each detected infestation: date of detection, GPS coordinates, causal agent(s), host species, number of infested trees, date of direct control, total area affected in hectares, and volume of affected trees (infested and felled buffer trees).

Conclusion:

The Forest Service in Belarus has taken an active approach to address the current pine dieback situation now affecting the country. Further investigations by the Forest Institute in Gomel into the various factors causing the pine dieback as well as basic and applied studies on behavior and management of *I. acuminatus* populations in Belarus are needed. Hopefully, incorporation of management approaches discussed in the workshop and herein will improve the effectiveness of pest management programs. Clearly, however, controlling pine bark beetle populations *per se* is unlikely to solve the pine dieback problem that eastern Europe countries are experiencing if forest stands are not managed to adjust to global climate changes.

Figure 1: Stand of *Pinus sylvestris* affected by pine dieback near Gomel, Belarus.

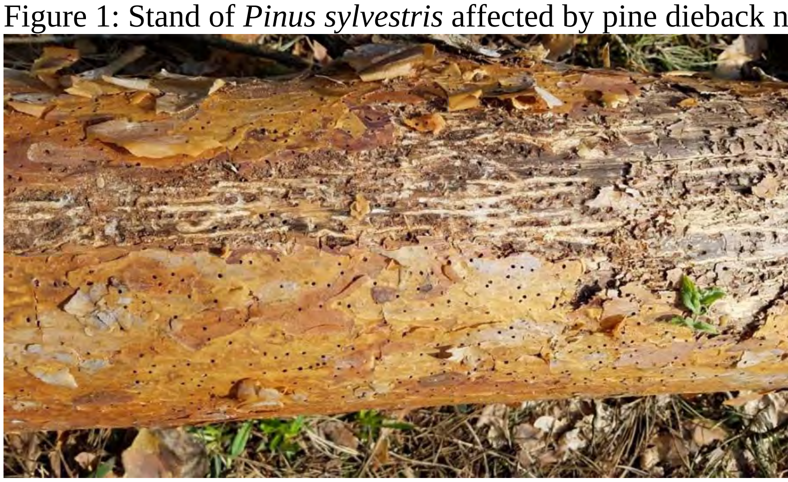

Figure 2: Galleries and emergence holes of *Ips acuminatus* in upper bole of *Pinus sylvestris*.

Figure 3: Participants in FAO regional workshop to combat pine dieback in Belarus.

Figure 4: Workshop participants examine a locally-produced pheromone trap used to monitor flights of *Ips acuminatus* in Belarus.

Curve Species Area of Lowland Forest of Tanjung Tadah, West Bangka, Indonesia

Lastri Dwi Saputri[1], Akrima Risyda[1], Cindy Ika Putri[1], Lanita Sakila[1], Tiwi Mandasari[1], Tuning Wiji Jepari[1], Eddy Nurtjahya[2]
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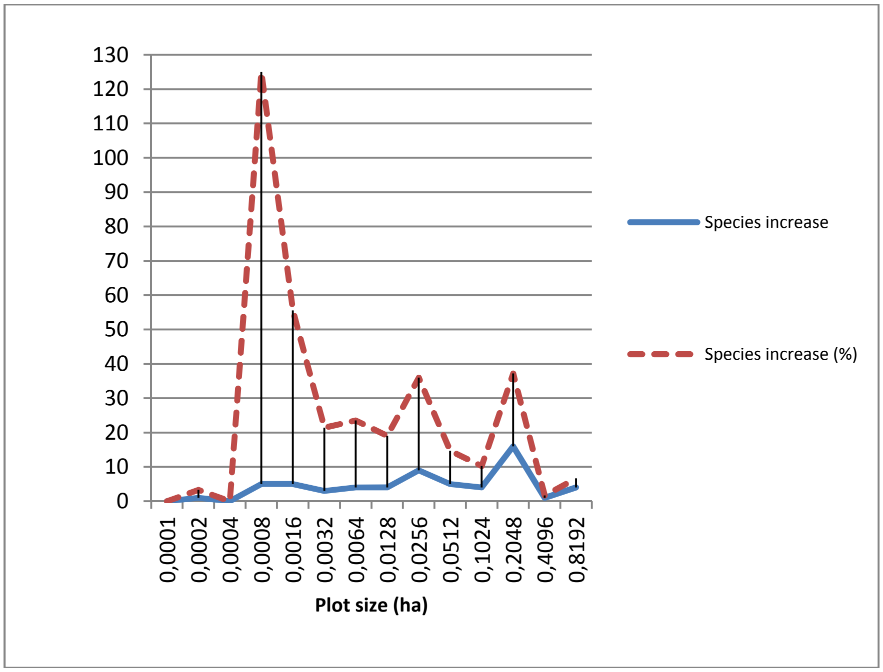
The Tanjung Tadah Nature Park (TWA) is a conservation area in the village of Air Menduyung, Simpang Teritip Bangka Barat Subdistrict with an area of ± 3,538 ha (Perda 2014) at 116° 51'44.423"E and 2° 7'21.063"S. TWA Tanjung Tadah has various habitat types, one of which is lowland forest. The lowland forest of Tanjung Tadah Nature Park is one of the districts of Sub DAS Rambat (Bangka Pos 2016), and has become the foundation for conserving the environment in soil conservation and water resources.

In addition to the sea, the easiest access to reach this location is through the Village Water Menduyung and Village Kundi because of the settlement of residents to the area not too far, can be reached only about 5-10 minutes using land vehicles to the outside TWA Jering Menduyung west.

Bangka Belitung University team consisting of Lastri Dwi Saputri, Akrima Risyda, Cindy Ika Putri, Lanita Sakila, Tiwi Mandasari, Tuning Wiji Jepari with a field supervisor, Eddy Nurtjahya conducted the species species curve (Table) to determine the minimum area that describe the plant community on 28 February 2017.

Minimum plot area is 64x128 m^2 or 0.8192 ha or the end addition of 6.67% plant species.



TWA Tanjung Tadah lowland forests have heterogeneous environmental characteristics with distribution systems or random type distribution. The dominant species in this forest is *pules* (*Xerospermum noronhianum* (Blume) Blume - Sapindaceae and other 56 species. The number of individuals in each of the habitats of poles and trees indicates that the number of tree habitus more is 67 stems while the number of pile habitus is only 43 stems. pine and tree habitus and size of the largest diameter of black trees (*Dipterocarpus grandiflorus* (Blanco) Blanco - Dipterocarpaceae of 212.7 cm, this indicates that the standing structure in the lowland TWA Tanjung Tadah forest is very good.

Compared with some minimum plot areas in Bangka from 2005 to 2017, the minimum plot area in the lowland forest of Tanjung Tadah Nature Park is higher than that of other forests, since not many people use wood in the forest so that species diversity in Air Menduyung is better.

The lowland forest of Tanjung Tadah Nature Park is not much different with Rimbe Forest, Dalil village.

At a glance, our activity can be seen at **https://www.youtube.com/watch?v=IpBxIKtN7Vc**

Togo Research on Mangroves

RESEARCH ABSTRACT:

In Togo, the building of harbor facilities, the construction of the hydroelectric dam plant of Nngbeto, urban growth and activities relating to the installation of fish farms, and the expansion of croplands are the major causes of a drastic degradation of mangroves. For a better management of this ecosystem, assessment of the current structure of mangroves, their spatiotemporal dynamics and socioeconomic issues related to mangroves were performed. Data from forest inventory, structured interviews and Landsat images of 1986 and 2014 were used. Inventories have identified 23 plant species distributed among 23 genera and 17 families dominated by *Rhyzophora racemosa* and *Avicennia germinans*. The hierarchical classification of forest inventory samples has identified three groupings of mangrove plants. Investigations show that stakeholders use wood from the mangrove for energy and fuelwood purposes. From 1986 to 2014 the land use/land cover patterns in the study area has undergone tremendous changes. Floodplains and tannes find their areas increased by 39.91 % and 46.06 % respectively, while wooded vegetation cover in whole lost 47.19 % of its area. Anthropogenic pressures would be the main cause of the degradation affecting mangroves ecosystem services and productivity. However, due to the ecological importance of mangroves, there is a need for an appropriate management plan including the contextual realities of mangroves landscapes.

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Additional information: Fousseni, F. et al. 2017. Écologie et dynamique spatio-temporelle des mangroves au Togo. VertigO - la revue electronique en sciences de l’environnement, 17(3). Biodiversités et gestion des territoires.

Using Pine Needles for Off-Grid Electricity Production in Rural India

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Electricity is one of the important driving factors for the economic development of India. Rapidly growing demand for electricity to sustain development has put tremendous pressure on country's energy infrastructure. As approximately 70% of the Indian population still lives in rural areas without any or limited access to electricity, the problem of inadequate energy infrastructure assumes greater importance. Rural electrification is vital for improving socio-economic condition of villages. This article examines the use of pine needles as a feedstock for gasification-to produce electricity.

A consistent access to electricity in rural areas can yield enormous benefits in education, health, irrigation, food preservation, crop processing, forest preservation, and small-scale industries. According to Indian government statistics, in August 2013, a total of 32,227 villages in India were without electricity. A village is considered to be electrified if 10 percent of all the households of the village has electricity access and if electricity is provided to public spaces such as schools, health centers, community centers and dispensaries. However, even for villages listed as electrified, the quality of electricity access - duration of access in a 24-hour day and synchronized voltage frequency and phase that allows electrical systems to function in their intended manner – remains poor.

As seen in **Table 1**, close to 45% of the rural population relies on other sources than electricity for their lighting needs. A similar situation prevails regarding cooking-fuel and livestock-fodder needs. A majority of the rural population depends on adjoining forests for fuelwood and livestock fodder, which leads to forest degradation.

Table 1.

2011 Census: Sources of Lighting: All India

Sources	**Households (%)**		
	Total	**Rural**	**Urban**
	100	100	100
Electricity	67.2	55.3	92.7
Kerosene	31.4	43.2	6.5
Solar	0.4	0.5	0.2
Other oil	0.2	0.2	0.1
Any other	0.2	0.2	0.2
No lighting	0.5	0.5	0.3

Any rural electrification initiative faces more challenges in the remote rural areas of India. Extension of the central electricity grid to such areas is either financially not viable or practically not feasible as these locations are geographically isolated and sparsely populated. In most of the Himalayan region of North-India, reliable access to electricity remains an issue due to poor quality of transmission lines and interrupted electricity supply. The concept of generating electricity at one location and then distributing it over a large area is not suitable for hills due to problems in laying and maintaining long lengths of transmission lines through forests and mountains. Moreover, village household density in hilly regions is more scattered and there is no commercial or industrial load. Distributed electricity generation and consumption at local levels is more reliable, requires less capital and can be setup in remotest villages.

Off-grid Electrification

One way to set up small off-grid electricity generation units in Himalayan region is to generate electricity from pine needle collected from local pine forests. The pine forest in North-India stretches for 3000 km across the lower elevations of the Himalaya range for almost its entire length from the North- Indian states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Sikkim, to Nepal and Bhutan. The large volume of pine needle covering the forest floor presents environmental hazard. During the summers, pine needles strewn over the forest floor increase the risk of forest fires and prevent vegetation growth due to soil acidification as they decay. Forest fires destroy grazing ground for cattle and pollute the environment and natural resources. However, the pine needles have great potential as a highly combustible alternative fuel due to their high resin content. Even though pine needles ignite very easily, they are difficult to manipulate during the burn and release large amount of volatiles during combustion. In addition, pine needle in loose form cannot be run through a gasifier-based combustion system that converts biomass into combustible gases such as carbon monoxide, hydrogen, and methane. Some gasifier manufacturers in India have been successful in managing the pine-needle combustion process.

The densification of pine needle is achieved by chopping them into pieces and squeezing them into dense cubes before being fed into the gasifier. The needle cubes are then burnt with limited oxygen supply at 800 degree Celsius to generate producer gas (a mixture of carbon monoxide, hydrogen and methane) which, after cleaning and cooling, is fed into a generator to produce electricity. The pine needles that remain unburnt are converted into charcoal - a by-product which can be used in place of wood and kerosene as cooking fuel. A 120 KW pine needle based gasifier system can support around 110 rural households for their electricity and cooking fuel needs.

Pine needle densification

Pine needles must be collected for an entire year's electricity generation before the monsoon season

Pine needle gasifier under construction

Village women returning from forest after collecting cattle fodder

On average, rural women in India spend up to four hours per day in collecting fuel-wood and cooking. If women are employed to collect pine needles for four hours a day, they can earn approximately $300 in four months in the pre-monsoon period, which is a significant improvement over the rural household income of $1,000 per year. Some studies in South India have indicated that 20 of 120KW systems using renewable resources rather than fossil fuels can save 60,000 tons of CO_2 annually. Another advantage of using pine needles is in the reduction of forest fires, because, if 70% of the needles are removed from the forest floors, fires would not spread. Yet another advantage results from substituting charcoal for wood. Although charcoal is a dirtier fuel, less charcoal is needed for household cooking requirements - 3 Kg of charcoal versus 10 Kg wood per household.

As such, the opportunities for using pine needles for off-grid electrification in India are being researched by the authors. Implications of study results are global in nature as many rural areas in developing countries are without electricity from a national grid but have wood- based feedstock that could potentially be used to generate electricity.

TREES: MUCH MORE THAN THE LUNGS OF THE WORLD

There are two important answers to the question "why do we need more trees in farmland?" One global and one local. Globally, trees are often recognized as the 'lungs of the world' because they exchange oxygen and carbon dioxide with the atmosphere. However, this is an understatement. If we think in these terms, trees are also the kidneys of the world as they regulate the flow and use of water by intercepting rain and releasing it slowly to the ground where it can either run off into rivers, or enter the groundwater. Plants can then absorb it for use in photosynthesis. This absorbed water is then transpired back to the atmosphere and blown on the wind until it falls as rain somewhere else. Thus, trees are also like the skin of the world being the interface between the vegetation and the atmosphere for the exchange of gases and water. Similarly, trees are like the intestines of the world exchanging nutrients between the soil and the vegetation, fueling the nutrient and carbon cycle. Finally, they are like the heart of the world, as they drive the ecosystems that make the world healthy and function properly. They do this by providing a very large number of niches for other organisms to inhabit, both above and below ground. Recent evidence has reported 2.3 million organisms on a single tree – mostly microbes - but also numerous insects and even bigger animals like mammals and birds. Others also live in the soil or, due to the microclimate created by the physical stature of the tree, on the associated herbs and bushes. It is all these organisms that provide the ecological services of soil formation and nutrient recycling - feeding off each other and creating an intricate web of food chains. All this is important for the maintenance of nature's balance that prevents weed, pest and disease explosions. They also provide services like pollination, essential for the regeneration of most plants, not to mention the very topical regulation of carbon storage essential for climate control.

At the local level, in addition to these 'bodily functions', trees produce a wide range of products useful to us, and often traded in local markets. There are literally tens of thousands of trees that produce edible and/or useful products – sources of items of day-to-day importance for us. So, we can also think of trees as shops, civic services and industries. Thinking in this way, a treed landscape becomes similar to a town made up of supermarkets full of everyday needs; a bank providing annual interest on investment; a drug store or health clinic for medicines; a water tower; an art gallery; a zoo full of wildlife; a guardian of culture like a museum; a hotel providing rest for migrants; a tourist centre for over-wintering or summer breeding habitat; a nightclub for nocturnal creatures; factories for fertilizers, pesticides and drugs; an energy provider, and even a sky-scraper affecting the flow of wind around the other buildings.

Using this analogy, we can see that by destroying trees we destroy facilities and functions important for life. Conversely, by planting trees we can multiply the products and services we need for a 'good life' in many different ways. In some places, trees are grown in large monocultural plantations, so replicating the concept of a housing estate or industrial complex. This can be very productive but isn't necessarily good for the environment. Alternatively, they can be grown at different densities and in different species configurations and for different products in association with food crops, livestock and cash crops. This mixed cropping is known as 'agroforestry', a farming system which thrives off diversity and maximises the availability of all the different benefits of trees and their services. In this way, agroforestry is highly beneficial to us – *Homo sapiens* - a dominant species in this agroecosystem. Agroforestry harnesses numerous environmental, social and economic benefits for our complex lifestyles. This is especially important in the tropics and sub-tropics where poverty-stricken subsistence farmers struggle to feed their families and scratch a living off highly degraded land. In this situation, it can be described as: hunger busting, as it can improve food crop yields on exhausted soils; farmer-friendly as it has numerous social benefits including enhanced livelihoods; wildlife-friendly as it provides habitat; climate friendly as it mitigates climate change and controls water flows; wealth-promoting by producing marketable products for businesses and industries, and health-giving by producing nutritious and medicinal products. So, we could create a NEW green and much more sustainable, economy.

Looking to the future, there are easily enough useful tree species for agroforestry to play all the above roles in any corner of the inhabited world, very few of which have been cultivated to date. Interestingly, each of these species contains inherent 3- to 10-fold genetic variability, at any one site, so it is easy to find and propagate individual trees that display an infinite number of useful and marketable traits suitable for a new array of businesses and industries. However, we have hardly begun to identify the economic possibilities and need to do much more to explore all this potential. Maybe, if we pursue this line of thinking, we can create useful and environmentally healthy rural landscapes which are as diverse as their urban counterparts and creating win:win:win scenarios combining better land husbandry, social empowerment and income generation. I believe, agroforestry has a bright future, but we need to learn how to manage this resource so that all people can share the benefits in harmony.

I hope this colloquial expression of the value of trees explains why agroforestry is becoming increasingly recognized as being critical if we are to manage our planet sustainably. This is particularly vital where currently the land has been deforested and degraded because trees are considered to get in the way of modern mechanized agriculture in which monocultures are the order of the day.

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rogerleakey@btinternet.com and www.rogerleakey.com , www.internationaltreefoundation.org
For further information, see: "*Living with the Trees of Life – Towards the Transformation of Tropical Agriculture*" (CABI, 2012), "*Multifunctional Agriculture – Achieving Sustainable Development in Africa*" (Elsevier, 2017).
Multifunctional Agriculture: A Solution at Last: Plan 'B' for Africa (http://scitechconnect.elsevier.com/multifunctional-agriculture-solution-planb-africa/)

Figure 1. Multifunctional tree-based farming landscape showing a species rich landscape mosaic of different tree and staple crop species.

Figure 2. Some of the fruits and nuts of agroforestry tree species (1-7) and some products (8-23) currently being marketed.

A Great Story of Little Lady Who has Preserved Green Breath of Bang Kachao

Preecha Ongprasert
Chief of International Special Program Section
International Forestry Cooperation Office
Royal Forest Department of Thailand

If you had a short time for escaping from rushing life in a big city, a 2,000 ha of Bang Kachao, Phra Pradaeng District of Samut Prakarn Province will be one of among the first recommended choices to visit. The rich area of biodiversity, culture, and norms of people as well as traditional way of living among fruit orchards of those locals can purify the breath of visitors when visiting the "Best Urban Oasis of Asia" addressed by Time Magazine in 2006.

Ms. Prempree Trirat, Chirman of Suan Pa Ket Nom Klao Urban Community Forest within Bang Kachao reminded the old days of Bang Kachao… "In 1991, the Government on that day would like to conserve this green area by purchasing approximately 200 ha of lands from local inhabitants. After purchasing, those lands were abandoned and not allowed the locals to use the lands for public purposes. The lands became to be dense jungles and dumping sites for garbage which causing harmful from mosquitoes and some poisonous snakes." As a consequence, Ms. Prempree realized that the problem will getting worse if no one paying attention to solve such problems, she then asked collaboration from her community to tidy the purchased areas that belong to the government including plant more trees to increase biodiversity.

Until 2007, when the Royal Forest Department (RFD) started urban community forestry program within Bang Kachao, she then volunteered to help in conserving and proposed to establish this area to be a pilot site for urban community forestry program. Her proposal was approved by RFD afterward and that pilot site was named as "Suan Pa Ket Nom Klao Urban Community Forest", the first urban forest community of the country with approximately 10 ha of total area. She has got a trust from her community to be a Chairman of that Urban Community Forest since then.

Nowadays, she has been devoting herself as a leader of volunteer group along with members of the community to look after this urban community forest through variety of activities. For example, activities conserve rare species of local flora and fauna, provide seedlings for visitors to plant within the community, encourage young generation to form youth group for continuing of conservation from generation to generation, establish a forum as a center for all members of local communities within Bang Kachao to discuss about the conservation of this area, etc. This urban community forest has been well-known not only national level but also international level. Visitors from all ages come to visit this area as a place for relaxation, outdoor learning for environment, testing authentic Thai dishes from local professional women group. The area has also famous as a site for conducting activities of many business companies under Corporate Responsibility Program (CSR) so far.

In 2012, APFNet launched an urban community demonstration project in Thailand and the project was commenced within the following year, this urban community forest has chosen as a major site for establishing learning sites for both members of community and visitors. Various activities have been implemented such as, interpretation signboards, tracking routes for biking, enrichment planting for enhancement of biodiversity, promoting eco-tourism, etc. Successful can be observed from numbers of visitors into the urban community forest that have been increasing more than 10 times comparing to the year before the project commenced. Those visitors coming to visit, plant trees, relax, and enjoy nature within this urban forest and also mentioned about how to use the information from social media that have been sharing among the users lately about this site. The increasing numbers of visitors also help to enhance revenue of women professional group to prepare authentic Thai dishes to welcome all visitors. Those local menus are now a famous story for this area and also recommended by may authors of articles and social media regarding to recommend others to make a weekend trip to Bang Kachao.

Although the interpretation of signboards implementation are now under development, but Ms. Prempree and her colleagues are willingly to take the visitors to tour around the this urban forest and never get tire from informing them about the background and information about this forest.

Although it seems to be a very hard work for her as a chairmen of this urban community, Ms. Prempree is so proud of herself and other members of community a part of helping hands to preserve this area. Her pride can be found from her words as “It is a delightful for a little lady who has an opportunity to be a small part of conserving this green area for delivering pure air to more than ten thousands outside for breathing…..it is my duty to do this job”

Ms. Prempree Trirat


Her Visitors


Bird’s eye view of Bang Kachao

CENTER FOR PROTECTED AREA MANAGEMENT
COLORADO STATE UNIVERSITY

2018 Short Course Guide / ***Guía de Cursos Cortos 2018***

XXVIII Curso Internacional de Manejo de Áreas Protegidas (dado en español)

3 de julio al 4 de agosto, 2018

. Ofrecido en colaboración con la Oficina de Programas Internacionales del Servicio Forestal de los Estados Unidos, este curso se centra en los desafíos involucrados en la planificación y gestión de áreas protegidas. Enseñado totalmente en español, el curso de 32 días combina clases, ejercicios en grupo y viajes al campo a áreas protegidas de diferentes categorías, tipos de usos y desafíos de gestión en Colorado y Utah. Temas cubiertos incluyen planificación y gestión de sistemas de áreas protegidas; corredores de conservación y zonas de amortiguamiento; manejo de recursos naturales; mitigación de impactos de proyectos de desarrollo; financiamiento de la conservación; gobernanza, colaboración y resolución de conflictos; interpretación ambiental; turismo y recreación; investigación, monitoreo y evaluación; cambio climático; y liderazgo personal y profesional. Para más información y para el link para postularse visite http://conservation.warnercnr.colostate.edu/. El costo, excluyendo pasajes y visas, es $6,395. La fecha límite para postularse es el 2 de febrero de 2018

VIth Mobile Seminar on Tourism in Protected Areas (given in English)

September 6-22, 2018

The Mobile Seminar on Planning and Managing Tourism in Protected Areas is an intensive, 2.5-week field-based training event for professionals working to promote sustainable tourism and outdoor recreation in protected areas globally. It is given in partnership with the US Forest

Service International Programs. Seminar themes include planning and zoning for public use and tourism in protected areas; legal, financial and policy frameworks; institutional arrangements and governance including public-private partnerships; interpretation and environmental education; and tourism infrastructure. The seminar travels through Colorado, Wyoming, Montana and South Dakota and makes visits to national parks, forests, monuments, state and local parks, a guest ranch, and a tribal reservation. The seminar visits Yellowstone, Grand Teton, Badlands and Rocky Mountain national parks, Black Hills National Forest; Devils Tower National Monument and Mount Rushmore National Memorial. Cost excluding airfare and visas is $5,395. To apply and for more information visit http://conservation.warnercnr.colostate.edu/. Deadline to apply is May 11, 2018.

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Decision Support to Address Multiple Ecosystem Services in Forest Management Planning

IUFRO Units 4.04.04—Sustainable Forest Management Scheduling, IUFRO Unit 4.03 Informatics, Modelling, and Statistics and IUFRO Unit 4.03.03. Information management and information technologies are sponsoring a Special Issue of *Forests* (http://www.mdpi.com/journal/forests) on Decision Support to Address Multiple Ecosystem Services in Forest Management Planning

We welcome the submission of manuscripts for publication in this Forests special issue (SI). This SI aims at contributing to our understanding of how we can enhance forest management planning, in integrating a wide range of ecosystem services (ES) and assuring a sustainable supply (e.g. products and services listed in the Millenium Ecosystem Assessment). We welcome manuscripts that focus on 1) models to help forest managers check the impact of management options on the provision of ES, 2) methods to help forest managers develop plans targeting the supply of ES, 3) methods to help forest managers analyze tradeoffs between a multitude of ES, 4) methods to help forest managers assess the sensitivity of the supply of ecosystem services to uncertain parameters, 5) multiple criteria decision support systems and 6) approaches to map the demand for ES and the quality and quantity of ES supply. Papers submitted for publication in this Special Issue will undergo a rigorous peer review process with the aim of prompt and wide dissemination of research results and applications. More information at: http://www.mdpi.com/journal/forests/special_issues/Decision_Support_to_Ecosystem_Services

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2018 SAF National Convention

Portland, Oregon • October 3-7, 2018

https://www.eforester.org/safconvention

ASSISTANCE WITH TRANSLATIONS FOR THIS NEWSLETTER

I am a retired forest ecologist who has been involved in various aspects of tropical forestry in Africa, SE Asia and Central America (rural/extension forestry; environmental impact of logging; assessment of reduced-impact logging; taxonomy of tropical trees; general conservation of tropical forests) for nearly 40 years. As a result of foreign residence and my Swiss/Canadian background, I also happen to be multilingual (German; French; Spanish). As my field days are over, it has occurred to me that one contribution to this Newsletter (and to tropical forestry) could be to assist some readers with announcements or short articles for the Newsletter translate these into English – for free, on (reasonable) short notice and with simple exchanges of e-mails. If you have such a need, feel free to contact Dr. Robert-Carl Zimmermann at 1940zcr@gmail.com. Je m'adresse particulierement a mes anciens collegues en Afrique francophone.

SAF World Forestry Committee News

2018 Gregory Award

SAF is pleased to announce that Dana Marie Mejia has been selected as the 2018 Gregory Award winner. She has a Bachelor of Science in Forestry from the University of the Philippines Los Baños, and currently works for the Center for Environmental Law and Policy Advocacy in Laguna, Philippines. We look forward to welcoming her to the National Convention in Portland, Oregon on October 3-7. Thank you to the many members of the SAF International Forestry Working Group who stepped up to assist with reviewing applications. Please consider giving to the Gregory Award Fund to help support future expansion of the award: http://bit.ly/SAFGregory.

For information please contact Danielle Watson with questions.

Join an SAF Working Group

** Especially Because SAF Has Edited the Working Group Lists **

This newsletter goes out to people beyond SAF members, but if you are on the working group list you receive this newsletter. When SAF updated their website the membership list was reduced to 28 members. Your editor was surprised to find he wasn't on the list of IFWG members, so he had to sign up again.

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:

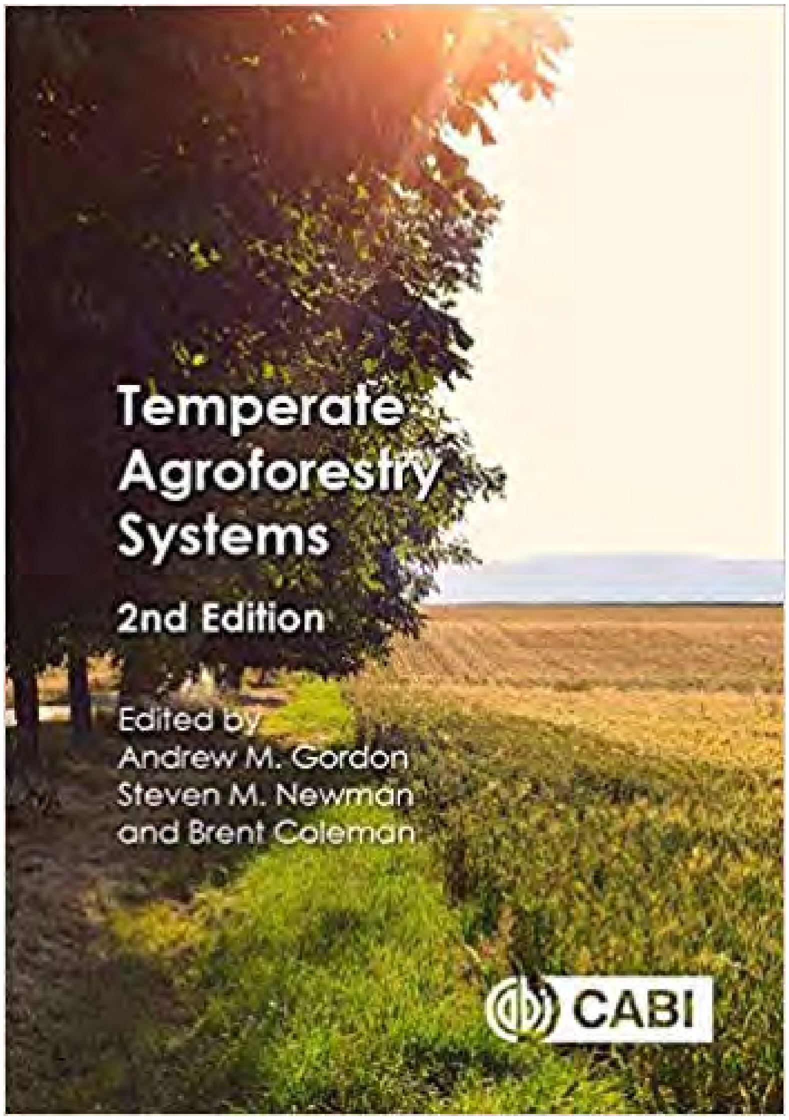
If you want to join, or rejoin, this working group, we are B3, the International Forestry Working Group. Please pass this information along to SAF members who might be interested in joining a working group – especially B3, the International Forestry Working Group.

From the archives:

The nine balsa logs used to build the Kon-Tiki raft.
https://ngyimhontom.wordpress.com/2012/09/26/the-kon-tiki-expedition-a-tribute/

Book Review

Gordon, A.M., Newman, S.M., and Coleman, B. (2018). *Temperate Agroforestry Systems.* CAB International, Wallingord, UK. 328pp.



Kyle Rose, Ph.D
Assistant Professor of Forestry
Department of Natural Resources Management
New Mexico Highlands University

This review is structured in two parts. The first part discusses the book as a whole and gives my general review of the book. The second, longer section describes individual chapters and I hope is useful to anyone considering buying the book teaching or research purposes.

Review of book as a whole: structure and themes

The 2nd Edition of *Temperate Agroforestry Systems*, edited by Gordon, Newman, and Coleman, purports to make significant updates to the previous edition. It is a well-produced textbook with good build-quality, sturdy pages, crisp images, and few typos. Unfortunately, I have not read the previous edition and cannot comment on that claim that it is significantly updated for regions that are represented once again in the 2nd Edition. Generally, the literature reviews include recently published research and likely are significantly updated. The structure remains the same as the previous edition. It is arranged as a series of regional overviews of agroforestry covering ten regions of the temperate zone across the globe, bookended by an overview of agroforestry systems beforehand and a synthesis chapter afterwards.

Before summarizing and reviewing individual chapters, I will comment on the structure of the book and its utility for practitioners, researchers, and students. The book's preface does not stipulate which of these groups are the primary intended readers. After consuming the book, it seems that the primary beneficiaries of this book, because of its structure and not its content, are practitioners and researchers. The book reads more like a history book and proposal than a textbook where the purpose is to teach about agroforestry systems in the temperate zone. If one were to set out to do the latter, chapters might be based on systems, rather than regions. The current structure results at times in repetition of concepts, and the explanation of those concepts, throughout the book. This occurs in such a way that the concepts do not necessarily build throughout the book (except in the last chapter, the synthesis chapter) and it would be hard to structure readings for students in a class that teaches the principles of agroforestry, rather than a class surveying systems throughout the world.

For practitioners and researchers, however, the book is valuable, easy to read, and interesting. It gives a good starting point for brainstorming new systems for a given region that can draw explicitly on the lessons learned in other temperate regions. In many chapters, the discussions of systems are complex and thorough (e.g. UK, Europe, and Indian Himalaya Region). In others, they describe previously unsuggested, novel systems (e.g. Chile) that are just now being developed.

The editors', and individual chapter authors', focus on proposing the future research agenda for global temperate agroforestry and the argument that temperate agroforestry research and implementation be done in a coordinated way to address both regional (e.g. water quality issues) and global issues (e.g. climate change) represent the feature of the book that will likely be seen as the most important outcome from producing this book. Throughout the book and despite its regional focus, chapter authors returned to global issues and the role that agroforestry could play in solving global issues through lessons learned regionally. In many chapters (e.g. Canada, USA, UK, and Europe), the policy environment within which agroforestry is both researched and adopted was thoroughly discussed. Many of these sections describing policy could be helpful starting points for those in need of help presenting to local representatives how government can help encourage the spread of agroforestry-based solutions to regional problems.

Review of individual chapters

Chapter 1, as stated, is a short chapter that provides a basic overview of agroforestry systems, focusing a lot on their foundation, in many cases, in historical practices. It ends with the admission that some practices described throughout the book are not necessarily "agroforestry systems," but rather related to agroforestry. The truth of this statement becomes even more clear as one proceeds through the book and reads the disparate understandings of the meaning of "agroforestry," most notably in Australia (Chapter 8), where agroforestry is defined as: "the commitment of resources by farmers, alone or in partnerships, towards the establishment or management of trees and forests on their land." This underlines an advantage of the book as whole in which the diversity of opinions expressed the book can energize individual regions to think differently.

Chapter 2 discusses Canadian systems. This chapter and the chapter on European agroforestry (Chapter 5) are the most in-depth reviews of regional research, as seen in the extensive and valuable reference lists for each chapter. Its place in the book is logical because it spends considerable time discussing motivations for the use of agroforestry systems and practices and the policy environment within which adoption takes place. It also reviews the relevant literature regarding agroforestry in Canada, regional differences within Canada, notable advances, and impacts on the environment. As with many of the chapters focused on more advanced economies, the motivations revolve around ecosystem services and the focus is on cumulative impacts.

Chapter 3 looked at the part of North America pertaining to the US (except Alaska). This chapter was included descriptions of five primary agroforestry practices in the US (alley cropping, riparian buffers, silvopasture, forest farming, and windbreaks), but focused on discussing how agroforestry should be viewed, primarily as a supplement or enhancement to commercial agriculture, and practiced in the US. A large portion of the chapter discusses opportunities for expansion of agroforestry in the US. Among other topics, they discuss 1) biofuel and biomass production on marginal lands (e.g. marginal floodplains) and within windbreaks and riparian buffers; 2) specialty crop production and the need for development of knowledge networks essential to existent agricultural industries (e.g. State pecan growers associations) in order to foster adoption; 3) opportunities for agroforestry tools to be used in production of local and organic crops to take advantage of rising success of farmer's markets and the value of organic foods; 4) agroforestry for provisioning, regulating, and cultural ecosystem services where farmers can use agroforestry to be part of efforts to sequester carbon, rehabilitate water and air quality, and conserve biodiversity. The chapter ends with discussion of knowledge network formation and federal agroforestry policy and program initiatives.

In general, Chapter 3 gives a good overview of agroforestry practices and opportunities in the US. It functions well as an introduction to agroforestry in the US for students, but also reads as a primer for state and federal representatives on why agroforestry is important to future agricultural efforts in the US and how to encourage its adoption further to realize those ecosystem benefits.

In Chapter 4, the authors discuss agroforestry in the UK. In typical English fashion, they began stating the dearth of available historical texts on the subject of agroforestry in the UK, but proceeded to provide a fascinating selection of texts dating back to 1679 tracing some of the development of agroforestry from principles to systems up to 1950. Uniquely to the book, the authors discuss briefly permaculture and its relationship to agroforestry where trees can reduce energy required for production and be integrated into forest gardens that can provide forage opportunities year-round. A majority of the chapter discusses experimental and scientific agroforestry in the UK, in which integrated orchard systems and silvopastoral systems play the largest roles. This chapter delves deeper into individual studies than that seen in Chapters 2 and 3. The productivity estimates for systems in the UK are discussed helpfully with mentions to policy.

A recently published book, the chapter on UK agroforestry includes a discussion of the policy environment before and after Brexit. Maybe the most optimistic outcome suggested was that cheaper land prices, driven by the reduction in subsidies to rural development, could lead to younger and new farmers entering the industry. The authors suggest multiple potential new "climate smart models" for development of a sustainable agricultural industry where agroforestry plays a key role. Also notably, Chapter 4 discusses the local land tenure context within which agroforestry must operate. Do trees increase land value in the UK? The answer is predictably complex. Unfortunately, "land tenure" and related terms appears to be used only once in the Index as a stand-alone term. This occurs in Chapter 4 where the authors helpfully discuss its relationship to agroforestry in the UK. Tenure, predictably important for adoption of agroforestry practices in the tropics likely deserves more mentions in this textbook. Finally, the authors conclude Chapter 4 with a discussions of market effects and a helpful reminder of the importance of thoughtful use of Land Equivalence Ratios (LERs), both during study design and the reading of consequent research papers. Without appropriate design, LERs can be misleading.

Chapter 5 discusses the "European Way." It is by far the largest section of the book and most in-depth literature review, covering in extensive detail European silvopastoral, silvoarable, and linear systems (defined as areas lining other features, such as roads or fields in this chapter); lessons learned and how the policy environment influences adoption of agroforestry practices; and how agroforestry will influence EU Energy and Climate Change initiatives. It's interesting that they note that the EU definition of agroforestry technically excludes shrubs (tree species incapable of growing to at least 5 m in height) and currently has a maximum density of 100 trees ha^{-1}, which the authors suggest likely refers to final stocking, but has not been adjudicated. This is one of the few chapters that discuss fire risk and its interaction with agroforestry, non-timber forest products, and tree establishment problems and possible solutions. It also includes a good discussion of the policy environment in the EU and some of the most useful figures to use when teaching students. Lastly, they discuss the potential to use honey locust (*Gleditsia triacanthos*) pods as forage in Europe. This brings up one significant issue with the book that deserved more attention: invasive species. What role do agroforestry researchers have in "weeding out" potentially invasive species when designing systems to optimize profit and ecosystem services for the landowner and society, at large?

Chapter 6 looks at a new region for the 2nd Edition: The Indian Himalayas. To some, it may seem a small geographic region to cover, but it is home to approximately 40 million people that live off the land. Thus, systems and practices can have significant cumulative impacts. It is a temperate region with high-than-usual biodiversity: about 8000 plant species (about 30% endemic), 816 of which are tree species and 1740 of which are of medicinal value. They really have a lot of potential tools available to them. Although many of the motivations are tangible (food, fuelwood, etc.), this region is also motivated by more abstract ecosystem services (e.g. watershed protection) for the farmer. The chapter goes over some key agroforestry systems in the region (e.g. tree fodder), includes more photos than most chapters (some chapters could probably use more), and includes a longer discussion of the potential for using sea buckthorn (family Elaegnaceae) for income generation.

Chapter 7 reviews agroforestry in China, where agroforestry has a long, documented history of more than 2000 years. The Ming dynasty recommended planting sesame as weed control in the year before installation of the tree plantation. Being China, the fascinating focus of the chapter was on large-scale, climate-mitigating strategies that include trees. Not all of them are necessarily agroforestry and are accurately defined as afforestation. Nevertheless, the chapter discusses large-scale, uniform installations of agroforestry systems that were historically collectively owned (the word "tenure" is not used, but obviously implied). They include a discussion of the rational for research (environmental protection, primarily) and long descriptions of centrally-planned agroforestry projects. This chapter has very little discussion of economics from the perspective of the adopter.

Chapter 8, on temperate Australia, is a well-written overview that provides a contrast to some other regions and starts a series of chapters that are primarily silvopastoral in focus. It has some of the best figures and photos of the book. It opens with a good discussion of motivations for farmers to grow trees in the region mostly for environmental reasons rather than commercial tree growing (top 5 motivations listed are mostly associated with how trees interact with other factors on the farm rather than providing direct economic benefits). Of most notable interest to me was their unique way of thinking about agroforestry relative to forestry activities where "agroforestry is the commitment of resources by farmers, alone or in partnerships, towards the establishment or management of trees and forests on their land." Thus, if farmers grow trees, it's agroforestry in Australia. This illustrates one of the principle benefits of this book and its structure – getting to read from a diversity of perspectives. Reading through the book, you get a feel for regional priorities and how the policy environment changes agroforestry practice and adoption. Again diverging from other chapters, this chapter includes two case studies. Lastly, this is one of only a few chapters that discusses aesthetics and genetic resources. The latter is one that probably will become more important over time and I guess will get more attention in the 3rd Edition (if there is one).

Chapter 9, on New Zealand, is again primarily focused on silvopastoral systems (deciduous and evergreen) and presents similar motivations to temperate Australia. It includes helpful figures and photos and has much less discussion of adoption and policy than other chapters.

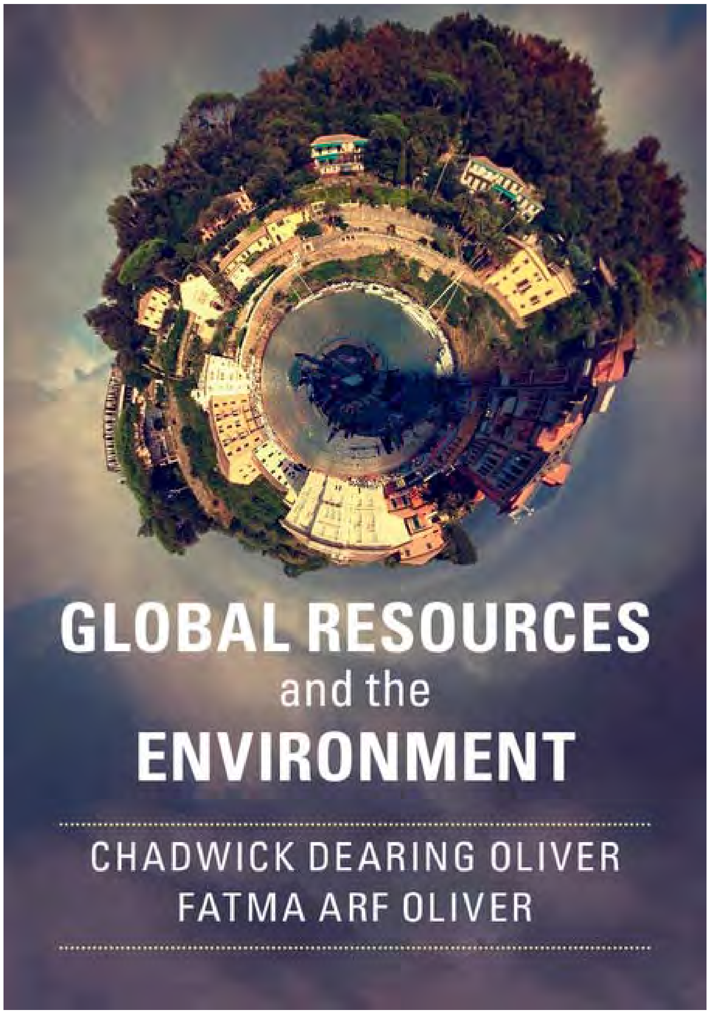
Chapter 10, on Chile, is another chapter that goes in a different direction stylistically and thematically, although much of it is again silvopastoral in emphasis. It does describe the role of the largest regional research center, The Center for Investigations in Agroforestry (CIAF), and its research program. The unique part of this chapter is its long overview of a potentially novel system that produces Chilean white strawberry as its principle cash crop. It presents a long history of the strawberry and how desirable it was in Europe and how hard it was to propagate originally, but no results were available at the time of publication, so it was a curious subject to dedicate multiple pages to in the chapter.

Chapter 11, on temperate agroforestry in Argentina (Patagonia), was again about silvopastoral systems. Importantly, it did talk about nutrient cycling, which was not explicitly discussed frequently in the book. This chapter, much like the one on European agroforestry, included some mentions of potentially invasive species (*Pinus* spp.) but did not mention any of the potential consequences of this. This discussion, nevertheless, was one of the few that mentioned timber as a driving motivation.

Finally, Chapter 12 was the synthesis chapter that looked at the key themes of the other chapters, the current limits on agroforestry worldwide, and opportunities for the future. The major new change since 1997? Climate change. Hence, this was the focus of much of the book: what does agroforestry have to offer in mitigating the effects of it and/or helping farmers adapt to the new and changing environment. If I were going to use this book to teach a class on agroforestry, I might use this chapter as the beginning of the course because it does a good job discussing the reasons that agroforestry is important and summarizing systems throughout the temperate regions of the world. I would then use the other chapters to look at key themes (e.g. the policy environment of Canada, China, and the EU; silvopastoral systems in Australia, New Zealand, the EU, and Chile).

The authors in Chapter 12 spend considerable time discussing land equivalent ratios in contrasting systems, illustrating the development of quantitative measures of agroforestry impacts. They then ask what is needed for the future and say the next step is to develop quantitative measures of sustainability and stability. They also propose that agroforestry research has not yet answered the question, “Could agroforestry provide maximum food productivity per unit area compared with the highest yielding monoculture?”

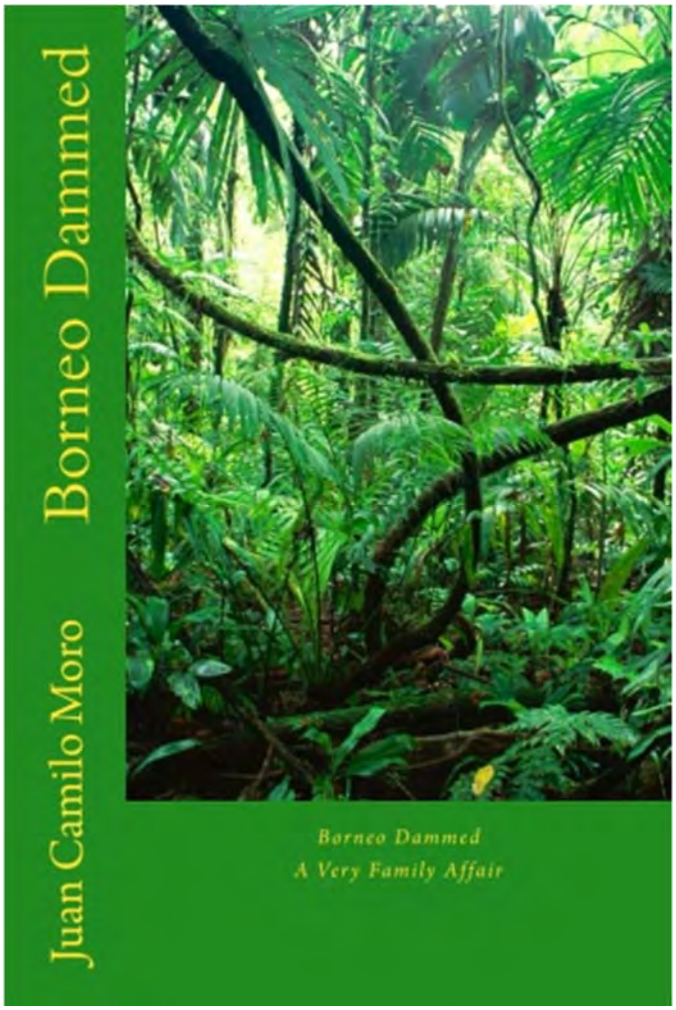
They discuss new opportunities (e.g. research networks, company-led initiatives, and monitor farms) and end with a reminder that agroforestry’s advantages are ecological, environmental, and economic. They state that its importance is likely to grow and provide good list of questions for the future development of outcome-based (rather than output-based) research. For example, they ask, “If agroforestry could only do one thing to reduce the flood risk in a watershed that feeds a city what should that be and what framework is needed to make the approach transferrable?” This question, like the others, is a large question where the answer will require interdisciplinary teams to answer. It is appropriate that this book (with its global focus) ends with the commendation that researchers move from focusing on outputs from the farm to outcomes at the landscape-level, despite the importance of outputs and solving problems at the farm-scale.



New Book, coming out in Summer, 2018.

Global Resources and the Environment, by Chadwick Dearing Oliver and Fatma Arf Oliver; Cambridge University Press. (www.cambridge.org/9781316625415) This book will be available this summer in hardback and paperback. ~520 pages.

The book uses detailed analysis of data and many figures to integrate people, the environment (climates, landforms, and biodiversity), and resources (water, agriculture, energy, minerals, and forests) from a dynamic systems perspective. It allows the many resources to be understood and integrated in a single volume. See website above for Table of Contents and other information. The book is not prescriptive, but it does suggest both opportunities and dead ends for the future. Given appropriate knowledge, actions, and flexibility—and integrating among the resources--people throughout the world can have an increasingly prosperous future. It is intended for the mid-career professional and interested, educated layperson; however, it can also be used for graduate/ undergraduate courses.



Borneo Dammed, Juan Camilo Moro, 2017.

Join a pioneering environmentalist/forest ecologist (who resembles Harry Flashman with a conscience) and subjunctive-employing Bornean natives on a fast-paced but delightful romp through post-Woodstockian jungles. The story unfolds from Kuching in the early 70s, treks into the ulus, and dips back to Kunming in the 40s and Canton even earlier. With appearances by melodious gibbons, World War II hump fliers, Bornean White Rajahs, Ken Kesey, Firesign Theatre, and Chang Kai Shek, the pages are peopled with reformed headhunters, a besotted Lutheran farm boy, various exotic temptresses (one who channels the Flying Nun), and an over-powered and under-braked classic British motorcycle with a malfunctioning magneto. Motor scooter aficionados will be thrilled by the cameo appearance of a Cushman M53 Airborne. With lyrics from WWII love songs, the Stones, and Jim Kweskin, along with some ribald halyard shanties, you'll soon be singing along.

Quality Nursery Facilities and Staff.

Haase, D.L. and Davis, A.S. (2017). Developing and supporting quality nursery facilities and staff are necessary to meet global forest and landscape restoration needs. *Reforesta*, 4:69-93.

Abstract: Seedlings are the foundation for many terrestrial ecosystems and are a critical consideration and investment for implementing global forest and landscape restoration programs. Global leaders have pledged to restore millions of hectares during the next decade, necessitating many millions of established plants. Although natural regeneration and direct seeding will likely meet a portion of that need, large quantities of high-quality, nursery-grown seedlings are also required. Insufficient plant quantities or poor-quality plants result in unsuccessful outplanting programs. Such failures have considerable economic and environmental consequences and will result in an inability to meet restoration goals. Nonetheless, the importance of restoration nurseries is often overlooked when making large-scale restoration commitments. Technology already exists to produce high-quality plants to meet a variety of goals. This technology cannot be applied, however, unless adequate resources and training are made available by overcoming political and socioeconomic barriers. In this article, we discuss the important role of nurseries to meet global restoration commitments and review three case studies where increased support to nursery programs resulted in improved restoration success.

Link: http://journal.reforestationchallenges.org/index.php/REFOR/article/view/72

Balancing economic benefits and tropical forest conservation with sustainable logging

Roopsind, A., Caughlin, T.T., van der Hout,P., Arets, E., and Putz, F.E. (2017). Trade-offs between carbon stocks and timber recovery in tropical forests are mediated by logging intensity. *Global Change Biology* 2018:1-13.

In a recently published paper in Global Change Biology (https://rdcu.be/OZTf) discuss how tropical forests provide critical ecosystem services for life on Earth including climate protection by storing large amounts of carbon. One big challenge is that these forests are located in poor countries where improvement of human livelihoods is paramount. A new study published in the journal Global Change Biology led by researchers from Boise State University sheds light on how to balance timber production and carbon storage in tropical forests. The researchers used field data and mathematical models to determine thresholds for logging intensity, after which tropical forests managed for timber begin to lose their ability to recover their carbon stocks and supply timber. The focus on timber stand management is warranted by the fact that half of all remaining tropical forests are being logged.

The study was based on over two decades of data from Guyana, a biodiverse country that is globally important as a forest carbon reservoir. The results provide novel insights into logging practices compatible with maintenance of the carbon and timber values of these forests. The researchers found that recovery rates of forests after logging, even with the application of the highest standards of logging practices known as reduced-impact logging (RIL), depends on the presence of old growth. Overall, the benefits of RIL diminish at high logging intensities. An additional experimental treatment, the liberation from competition of small commercial trees, successfully increased timber yields but the forest stored 20% less carbon.

Professor Jack Putz from the University of Florida, the senior collaborator on the study, pointed out major challenges for tropical forest management are identification of logging intensity thresholds and development of post-harvest treatments that are compatible with maintenance of ecosystem services. "Our study highlights the importance of remnant old-growth trees and the consequences of management intensification. Success at intensification may allow forest managers to meet societal needs for timber in smaller areas, albeit at the cost of other ecosystem services such as carbon and biodiversity in these areas. But intensification may also spare more pristine forests from disturbances associated with logging."

Building Research Capacity

Putz, F.E., Ruslandi, and Roopsind, A. (2018). An experiential, adaptive, inexpensive, and opportunistic approach to research capacity building in the tropics. *Biotropica*.

Based on intensive field courses on tropical forest management and conservation in Belize, Guyana, Indonesia, and Mexico, we recommend a pedagogical approach designed to help fill scientific mentor gaps where they impede publication by relatively inexperienced scientists. Participants in these 8–12 day field sessions were provided what instructors judged to be novel research topics but then were tasked with refining hypotheses, developing and implementing field studies, analyzing data, rehearsing formal oral presentations, and preparing complete manuscript drafts. Over the subsequent months, the manuscripts were revised for submission to peer-reviewed journals; to date, six were published, one is in review, and two others are close to submission. These were the first publications of most of the participants, some of whom are evaluated by their home institutions partially on the basis of their publication records. These low cost workshops were fun and benefited participants and instructors alike.

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

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Forest thinning and its potentials

Forest thinning, the removal of part of the trees, provides additional space for the trees left, in light, soil , water, and nutrients, It is reflected in added growth of the trees remaining. Applied to uniform, closely spaced homogeneous plantations, thinning may double the diameter growth rate, shortening the rotation to maturity by up to half. Incidentally, such thinning may so diffuse the fuels as to reduce the intensity of subsequent fires. In heterogeneous natural forests with variation in tree species and size thinning may additionally permit forest quality improvement by favoring certain species or tree sizes. Early thinning, before commercial products ensue, has long influence in subsequent forests.

L. Rytter. Growth dynamics of hardwood stands during the pre-commercial thinning phase. [Forest Ecology and Management 302:264-272 2013].

Logging in bamboo in Amazonia

In southwest Amazonia forests are dominated by bamboo (*Guadua* spp.) No differences in composition, aboveground biomass, stand density, or woody seedling and bamboo culm density were detected between paired logged and unlogged sites. Commercial timber volume was reduced by almost two thirds in logged plots. Management goals are jeopardized by the few crop trees remaining after logging.

C. A. Rockwell and others. Logging in bamboo dominated forests in southwestern Amazonia: Caveats and opportunities for smallholder forest management.[Forest Ecology and Management 315:202-210 2014].

Timber harvest effect on timber regeneration

Initial responses to logging were assessed in Ghana on five occasions up to 7 years after logging. Seedling recruitment initially enhanced by logging during the first year was of pioneer species. After the first year non-pioneer tree species dominated. Composition of recruits initially differed between logged and unlogged sites but after three years these converged. At 7 years most of the tallest trees were pioneer timber species, yet most of the trees were non-pioneers. Logging, if properly controlled, need not impair timber tree recruitment.

Duah-Gyamil and others. Can harvesting for timber in tropical forest enhance timber tree regeneration? [Forest Ecology and Management 314:26-27 2014].

Eucalyptus plantation susceptibility to climate change

Eucalyptus plantations, one of global forestry's most valuable resources, are widely grown and so have significant exposure to climate change. The use of appropriate genotypes could minimize vulnerability to climate change. Fortunately about 41% of Eucalyptus are in climates with less than the 2 degrees C of expected change, and since they are on short rotations the recommendation of appropriately grown genotypes should be simple.

T. H. Booth. Eucalyptus plantations and climate change. [Forest Ecology and Management 301:28-34 2013].

Eucalyptus clones for production

Organized forest production, by the private sector in Brazil since the late 1960's, includes 4.9 million ha of eucalyptus plantations. In 2011 their roundwood yield was more than 143 million m^2. Most plantations are in regions of water, nutritional, or frost stress. Mean annual increment ranges from 25 to 60 m^3, varying with the level of the stress. Cloning adapts plantations to various tropical and subtropical regions of Brazil. Matching clones (genotypes) to sites may sustain or increase productivity. Clonal plantations have been fundamental in regions under water and nutritional stresses. Clonal plantations with interspecific hybrids strongly contributed to improve site-genotype adaptations.

J. L. de M. Goncalves and others. Integrating genetic and silvicultural strategies to minimize abiotic and biotic constraints in Brazilian eucalypt plantations. 301: 6-27 2013].

Rattan production

Rattan comes from many species of slender palms (*Calaamus* and others) from Southeast Asia, Indonesia, the Philippines and other south Pacific islands. Many are prostrate and need support. Studies of six rattan species in Cambodia and Laos showed that it takes 2 to 8 years to produce a 5m commercial cane. Different species exhibited the fastest growth (230 cm/yr) and the slowest growth (78 cm/yr). Mean growth for sustainable operation can be found by monitoring 50 to 60 trees over a period.

C.M. Peters and others. Growth of wild rattans in Cambodia and Laos. Implications for management. [Forest Ecology and Management 308: 23-30 2013].

Fifty years after logging in Borneo

Comparison was made with primary forest (Pasoh Reserve). Faster growth in the logged forest reflected the greater light there. Lower recruitment in the logged forest (appears to oppose greater light there). Supports other conclusions that 50 years is not enough time. Finding the original composition may not be the objective. *If a second timber harvest were the objective a level of timber tree sizes would be preferable.*

R. Article. Effects of 50 years of selective logging on demography of trees in the Malaysian lowland forest.[Forest Ecology and Management 310: 531-538 2013].

B**romeliad production**

Epiphitic bromeliads, particularly from cloud forests, fall in large quantities and have a market as ornamentals. A study over five months in Mexico indicated that from 16,000 to 56,000 rosettes per hectare per year are found in commercially acceptable condition. Since these are fallen, they have no harvesting impact. With recovery of the illicit trade there should be a reliable traffic for export.

T. Toledo-Aceves and others. Bromeliad rain: An opportunity for cloud forest management. [Forest Ecology and Management 329:129-136 2014].

Genetic diversity indicators

Prospects for biodiversity loss have led to indicators of genetic diversity. These have been based on genetic, ecological, and numerical parameters. Indicators covering diversity- productivity-knowledge- and management is proposed for trees, reflecting their degree of approach to sustainable growth.

L. Graudal and others. Global to local genetic diversity indicators of evolutionary potential in tree species within and outside forests. [Forest Ecology and Management 333:35-51 2014].

Tree conservation

The common loss of genetic diversity is but the beginning of threats to species survival. Action to deter such loss is commonly centered on seeds and their durability. Preceding this are tests of seed tolerance of dry and long-time conditions. Once the temperature and moisture preferences of tree seeds are known, seed storage becomes a principle source of confidence concerning the conservation of tree species diversity. Allied to this are practices that conserve genetic diversity. Continued progress calls for more education.

H. W. Prichard and others. Innovative approaches to the conservation of forest trees. [Forest Ecology and Management 333:88-98 2014].

Forestry practice genetic impacts

Understanding the impacts of forestry practices is critical to genetic diversity. Selective practices, whatever the purpose, reduce genetic diversity. Although selection may lead to experiments with more productive strains, genetic diversity may be sacrificed to a point that past diversion is lost and species may become threatened.

W. Ratnam and others. Genetic effects of general forestry practices: global synthesis and perspectives. [Forest Ecology and Management 333: 52-65 2014].

Genetic concerns for native species.

The genetic diversity of species native to locations includes diversity adapted to local ecosystems and therefore harmonious therewith. It is readily apparent that native species are adapted to their former ecosystems. Recommendations for researchers, policymakers, and practitioners are that native species are best for large projects where gametic diversity otherwise might be neglected or lost. Use of other species may not produce a self-sustaining ecosystem. Forest restoration that uses native species may be assured of long-time harmony in genetic diversity. The case for native species concerns sourcing of forest regenerative material, fostering ecological collectivity, and measuring the success of restoration.

E. Thomas and others. Genetic considerations in ecosystem restoration using native tree species. [Forest Ecology and Management 333:66-75 2014].

Forest resources and climate change

Tree populations and their genetic diversity are adapted to their habitats which are a mixture of gradual change and recent rapid changes. Tree populations rely on adaptability to meet changes. However, the present changes are more rapid than ever and leave the trees genetic resources less adapted and more subject to pests, or diseases. They must adapt their genetic diversity to the new circumstances. However, if this change is rapid it may call for climate-related responses.

R. I. Alfaro and others. The role of forest genetic resources in responding to biotic and abiotic factors in the context of anthropogenic climate change. [Forest Ecology and Management 333:26-37 2014].

Optimum riparian zones for management

Riparian forests along streams support biodiversity in both terrestrial and aquatic ecosystems. Groundwater discharge areas within these are considered hotspots. Forest ecosystem functions are enhanced in the hotspots, something commonly overlooked in timber production planning, which may recognize only fixed-width riparian areas. Site-specific riparian management following maps with detailed information about wetness and soil water flow paths within riparian zones call for wider buffers at groundwater discharge areas and more narrow buffers on sites without groundwater flow paths producing heterogeneous riparian zone widths.

L. Kugierova and others. Towards optimizing riparian buffer zones. Ecological and Biogeochemical implications for forest management. [Forest Ecology and Management 334:74-84 2014].

Neighborhood effects on tree growth

Measures of space filling were related to a tree's growth. In addition the characteristics of vecinos were reflected differentially. What became clear was the effects of the vecino on the free space of a target tree. Considering multiple neighbors was found more effective than single neighbors. The relationship found was more than simple competition, it reflected references by species. Neighborhood life even effected the size of trees. Diameter growth at 60% of tree height is closely related to competition.

D. Seidel and others. How neighborhood affects tree increment – new insights from terrestrial laser scanning and some methodical considerations.[Forest Ecology and Management 336:119-128 2015].

Logged montane forests of Kilimanjaro

Since Tanzania has prohibited further logging in the area since 1984 there is more than 30 years of results evident. An outstanding timber tree is *Ocotea usambarensis (Ocotea).* There remain disturbance-indicator species, late successional species, and timber species. Stem density is high due to many small trees. Ocotea still showed a high overall density but lower abundance of harvestable trees. The relative abundance of small Ocotea (>50 cm) appears promising for future recovery. With a cutting cycle longer than 40 year, there appears an option of sustainability, keeping recruitment as active as so far.

G. Rutten and others. Forest structure and composition of previously selectively logged and non-logged montane forests of Mt. Kilimanjaro. [Forest Ecology and Management 337:61-66 2015].

Bracken fern service

After deforestation by fire bracken fern (*Pteridium* spp.) dominates for long periods, apparently inhibiting succession. Here, presumably due to unfavorable conditions, tree recruitment is absent. The effect of bracken and associated litter was determined with three Bolivian timber species recruitment, survival, and first year growth. Tested were three species of *Clusia*. Vegetation removal increased temperature and litter removal decreased humidity at the ground level, reducing seedling survival. Results highlight overlooked benefits of bracken in preventing harsh conditions. Although the contribution to forest restoration is not proven, there appears to be a basis for recommending seeding of shade tolerant tree species within bracken fern thickets.

S. C. Gallegos and others. Bracken fern facilitates tree seedling recruitment in tropical fire degraded habitats. [Forest Ecology and Management 337: 135-143 2015].

Reduced competition for light in dense forests

Sharing of light is responsible for the slow growth of a multitude of small trees in dense French Guiana forests. Searching for exposure to sunlight is evident behavior of the leaves of tropical forest tree crowns. Light alone explained only 3.5% of the growth variability, whereas 35% was explained by species, including that of niche adaptability. The need to share light in naturally dense forests relates to common annual increments of up to 50 m^3/ha/year. Silvicultural reduction of density in basal areas to 24 m^3/ha/yr. releases light and the growth rate of both large and small trees. By crown classes, if dominants grow 100, codominants grow about 90, intermediates 60 and suppressed, 25, the differences clearly related to degree of illumination. The explanation of growth variability of only 3.5%, is seen as evidence of vertical niching, which is combined with that of reproduction.

M. Laurans and others. Vertical stratification reduces competition for light in dense tropical forests. [Forest Ecology and Management 329:79-88 2014].

Hunting effects in selectively logged forest

Hunting places importance on the sustained production of the larger trees in timber forests. Hunting, depending on the species hunted, places higher priority on their regeneration, survival and return to the canopy. Hunting may reduce some of the seed distributors at the expense of regeneration of the large and dense wood species of timber value. There may be circumstances where hunting pressure and sustainable timber production have common needs. One of these is the preservation of the forest from other uses.

C Rosin and others. Does hunting threaten timber regeneration in selectively logged tropical forests? [Forest Ecology and Management 331:153-164 2014]. .

Natural forest tree growth in Bolivia

Seven timber species of the Bolivian Cerrado were measured. Very wide differences were found, ranging from 35 to 140 years to harvestable size. Trees of the same species with so large a mean range clearly represent different growing conditions. Some are probably crowded in dense forests such as would not be awaited under any circumstances. A study should be concentrated on the trees of fastest growth. Their growing conditions may be obvious and applicable to more trees. Even genetic variation may explain some of the growth. *No attempt to sustain productivity should call for explanations for the fast growth. Mere reduction of stand basal area to about 24 m2/ha should reduce the rotation to one half.*

L. Lopez and others. Cumulative diameter growth and biological rotation age for seven tree species in the Cerrado biogeographical province of Bolivia. [Forest Ecology and Management 292:49-55 2013].

Additional Tropical Articles
Laura Burmann, RPCV Senegal, MS student, Michigan Technological University

Rainfall Effects on Wintering Birds in the Caribbean

The abundance and survival of migratory birds can be affected by the annual rainfall in either the breeding site or wintering site of several species. Excess rain in the breeding ground sites could potentially lead to nest flooding or chicks becoming chilled. In contrast, drought in the wintering sites diminishes food resources for migratory birds, resulting in malnourished birds and delayed migration. Timing of increased rainfall can also be the cause for declines in migratory species abundance. For example, increased rainfall during the first six months of the year in Guánica favors permanent resident insectivores, which increases competition for migratory birds wintering in the region. Populations of migratory birds could be in danger due to rainfall variability that results from climate change.

Wunderle, J.M. and Arendt, W.J. (2017). The plight of migrant birds wintering in the Caribbean: Rainfall effects in the annual cycle. *Forests.* 8(4): 115. DOI:10.3390/f8040115

Rubber Tree Plantations and Fruit-feeding Butterflies

In the Brazilian Atlantic Forest, species richness of fruit-feeding butterflies was monitored in rubber tree plantations that implemented two different management schemes and was compared to primary forest and forest fragments within rubber tree plantations. Plantations with intense management practices suppressed understory growth, while low-maintenance plantations didn't suppress understory growth. 85 butterfly species were captured throughout a year within the forest and plantation matrix. Species richness was higher in low-managed plantations and in forest fragments than in intensely-managed plantations and primary forest. These findings suggest low maintenance management practices or mixed landscape use in order to support species richness of fruit-feeding butterflies near Atlantic forest fragments.

Cambui, ECB; de Vasconcelos, RN; Mariano-Neto, E; Viana, BF; Cardoso, MZ. (2017). Positive forestry: The effect of rubber tree plantations on fruit feeding butterfly assemblages in the Brazilian Atlantic forest. *Forest Ecology and Management.* 397:150-156.

Indigenous Management of Coffee Plantations Promote Biodiversity

Shaded coffee plantations managed by indigenous communities in Oaxaca, Mexico support greater biodiversity than conventional plantations. Traditional agroecosystem practices employed by indigenous communities conserve tropical deciduous trees within the coffee plantations for mixed uses, including food, firewood, medicine, construction material, and other purposes. Tree species and forest composition in the region varies depending on environmental and topographic conditions, management, and distance to community (with closer ranges being managed more intensely). These variations in shaded coffee plantations contribute to biodiversity conservation as opposed to the homogenized sun-grown coffee, which is becoming a global trend.

Juárez-López, B.M., Velázquez-Rosas, N., López-Binnqüist, C. (2017). Tree diversity and uses in coffee plantations of a *Mixe* community in Oaxaca, Mexico. *Journal of Ethnobiology*. 37(4):765-778

Impact of Mercury on Earthworms in Tropical Forest Soils

Data from research performed in Rio de Janeiro show mercury levels to be thirteen times higher in earthworm tissues than in the forest soils from which they were collected. Endogeic species may be at higher risk than anecic or epigeic species due to their prolonged exposure and higher mobility through the element. Ex situ experimentation showed a higher Hg resistance in *P. corethrurus* (native) than *E. andrei* (exotic), despite its endogeic habit. Understanding critical Hg levels is important for assessing future implications. Earthworms can reduce trace elements from soils through bioaccumulation, but may be cause for concern of biomagnification in earthworm predators.

Buch, A.C., Brown, G.C., Correia, M.E.F., Lourençato, L.F., Silva-Filho, E.V. (2017). Ecotoxicology of mercury in tropical forest soils: Impact on earthworms. *Science of the Total Environment*. 589:222-231

Decline of Figs in Panama

Trees of the genus *Ficus* (fig), especially species *F. insipida and F. yoponensis*, are keystone resources and are an important food source for frugivores on Barro Colorado Island, Panama. Figs trees on the island have been in steady decline over the last several decades due to natural succession of secondary forests shifting to old-growth forests. These maturing pioneer trees are being replaced by shade-tolerant species. This transition can have a cascading effect on the entire ecosystem and result in a decline of frugivorous species. Potential conservation efforts may include planting fig trees in areas where natural regeneration is limited.

Albrecht, L. Stallard, R.F., Kalko, E. (2017). Land use history and population dynamics of free-standing figs in a maturing forest. PLoS One, San Francisco. 12(5): e0177060. DOI:10.1371/journal.pone.0177060

Botanical treatments to reduce seed weevil damage of Sal seeds

Sal (*Shorea robusta*) tree has important economic value in India, particularly for its seed, which is used to produce soap products. The sal borer epidemic has put this resource in threat. In an effort to control the seed weevil, *S. rugicollis*, research was undertaken to test the effectiveness of several different botanicals in suppressing weevil reproduction in the Sal seeds. Botanica oils and leaf powders of *A. indica* (neem) and *P. pinnata* (Indian beech) were used, in addition to castor oil and *A. squamosa (sweetsop)* extract and leaf powder. The most effective treatment was found to be neem oil, followed by methanolic leaf extract of *A. squamosa.*

Choubey, V., Bhandari, R., Kulkarni, N. (2012). Effect of botanicals on the seed weevil, *Sitophilus rugicollis. Journal of Entomological Research.* 36(3):259-262

Genetic barrier between populations of *Afzelia quanzensis* (pod mahogany)

A mountain range spanning Zimbabwe is separating two populations of *Afzelia quanzensis* (pod mahogany), which are suffering low genetic diversity. Research was conducted to guide potential conservation efforts. Samples were collected in the region from 5 sites north of the mountains and from 4 sites south of the mountains. Analysis revealed genetic diversity to be relatively low across all sites, although significant population differentiation was observed. Two gene pools were identified, one in the south and the other in the north. The Kalahari-Zimbabwe axis is acting as the sole barrier between these gene pools.

Jinga, P. and Ashley, M.V. (2018). A mountain range is a strong genetic barrier between populations of *Afzelia quanzensis* (pod mahogany) with low genetic diversity. *Tree Genetics and Genomes*. 14(1):1-10

Asiatic Bamboo longhorn intercepted in Italy

Chlorophorus annularis (Bamboo longhorn), commonly found throughout Asia and other tropical and subtropical oriental regions, had been sighted for the first time in Sicily in May, 2017. C. annularis typically infests cut and dried bamboo, laying eggs in tunnels that were burrowed beneath the outer layer. The life cycle of the pest is typically 1 year, although it can take two or more years, making it difficult to detect the species during international inspection of bamboo products C.annularis intercepted in Sicily was found having emerged from a bamboo ladder that was imported and sold in a local market. Bamboo suspected of being infested can be submersed in hot water at 56°C for 30 mins or frozen to −20 °C for 7 days. It should be noted that C.annularis can also infest some cultivated crops, such as Citrus spp., Gossypium, Liquidambar spp., Saccharum officinarum L., Vitis spp., and Zea mays L.

Suma, P. and Bella, S. (2018). First interception of the Asiatic Bamboo longhorn, Chlorophorus annularis (F., 1787) (Coleoptera, Cerambycidae) in Italy. Pytoparasitica. 46:63-68

Medicinally significant tree, Fontainea picrosperma

Fontainea picrosperma has gained the interest of researchers since it was discovered that its seed produces an alleged anti-cancer agent, known as tigilanol tiglate. F. picrosperma is a rainforest tree native to northern Australia. Its seed is the sole source of the novel compound, since tigilanol tiglate cannot be easily synthesized. For this reason, understanding the floral and reproductive biology of the tree may ensure a sustainable seed crop for commercial production of the agent. Researchers describe the characteristics of this dioecious tree and note that maximizing production of tigilanol tiglate may rely on improving pollen dispersal from male and female trees.

Grant, E.L., Wallace, H.M., Trueman, S.J., Reddell, P.W., Ogbourne, S. M. (2017). Floral and reproductive biology of the medicinally significant rainforest tree, Fontainea picrosperma (Euphorbiaceae). Industrial Crops and Products. 108:416-422

FORESTRY IN SCOTLAND AND THE UK

As Reported in *Scottish Forestry* (SF) the journal of the Royal Scottish Forestry Society (www.rsfs.org), Carol Crawford, Editor (editor@rsfs.org.uk)
Compiled by Richard Reid, SAF, Clarkston, WA
From the Spring/Summer 2018 issue, Vol. 72, No. 1

Principal articles:

What alternative tree species can we grow in western Britain? 85 years of evidence from the Kilmun Forest Garden. (P. 24)

W.L. Mason (email Bill.Mason@forestry.gsi.gov.uk), F. MacDonald, M. Parratt and J.P. McLean.

Nearly 300 tree species have been planted at Kilmun Forest Garden in Argyll since 1930, mostly in small plots allowing the collective performance of an individual species to be evaluated. Results from the mid-1990's showed that about 60 species had formed productive closed canopy stands with a number of conifers all showing health and potential productivity equivalent to that of Sitka spruce, the major species grown in the forests of western Britain. Since 2000 there has been increased interest in the collection at Kilmun partly because it allows the comparison of long term growth of a wide range of species at a time when species diversification is being encouraged as a means of adapting to climate change. Accordingly, existing plots have been remeasured , some have been sampled for their timber properties and a number of new plots have been established. There are now around 200 different species in the collection, or which 145 are in good health. Growth measurements show the continuing good performance of about 18 conifer and broadleaved species at between 45 and 85 years of age; these species would be prime candidates for use in diversifying spruce dominated planted forests in western Britain.

"...recent work has suggested that home grown timber of both noble fir and western hemlock is capable of meeting the strength requirements for use in construction."

The future of peatland forestry in Scotland: balancing economics, carbon and biodiversity (P.34)

R.J. Payne (email richard.payne@york.ac.uk), A.R. Anderson, T. Sloan, P. Gilbert, A. Newton, J. Ratclife, D. Mauquoy, Wl Jessop, R. Anderson

From the 1940's to the 1980's large areas of conifer forest were planted on Scottish peatland. Many of these plantations are now reaching harvesting age and critical questions surround what should be done with them next. Options include restocking plantations for a future rotation, restoration of plantations ro open bog; and a "middle way" option which attempts tp retain trees but without the negative consequences of commercial forestry. Each of these options faces practical issues and difficult trade-offs between the economic value of forestry, biodiversity, and the value of peat as a store of carbon which mitigates climate change. The future of peatland forestry in Scotland is likely to be a patchwork of each of these possibilities. Decisions on which option is right for which site need to be made soon but doing so will be difficult given large gaps in the underlying science.

> *"Trees are likely to have much greater primary production than natural bog vegetation and. unlike the intact bog, a drained bog is likely to produce little methane."*

A short article of interest--genetics and policy
Beech and sycamore in Scotland's native woods
Kate Hall (email Kate.hall@snh.gov.uk)

There is controversy as to whether beech trees should be considered native to Scotland and the place of this species in Scotland's native woods. The policy debate centers around the use of beech and sycamore in native woodland restoration projects.
A team examined the DNA of over 800 beech trees at 12 locations across Great Britain and made direct comparisons with trees growing in mainland Europe. They discovered that almost all the beeches growing in Great Britain that were tested are derived from Great Britain populations as opposed to mainland European populations. The researchers claim that this challenges the attempt to maintain any boundary between native and non-native range beech in Britain. The study maintains the question of what is native and what is not and what to do about species whose status is less clear cut. The subsequent discussion in the article is relevant where ever restoration to a native situation is contemplated. (RR)

From the RSFS web site: **Scottish Secretary: Future of forestry in Scotland looking bright**

With an increase of funding resulting in more woodland creation, buoyant timber prices and a strong demand for wood, Rural Economy Secretary, Fergus Ewing says conditions for growth have never been better in the forestry sector.

Mr Ewing increased the Forestry Grants Scheme budget from £40m to £46m and this is enabling the approval of more woodland and tree planting projects.

Added to this, the timber market is currently seeing record prices being paid for timber, which is demonstrating that, from planting to harvesting, forestry is clearly thriving. Speaking at the opening of the Royal Scottish Forestry Society Annual Excursion in Inverness , Mr Ewing said:

“Our overall ambition is the continued growth of the industry, increasing the already substantial contribution that forestry makes to Scotland’s economy, environment and people.

“Getting the right trees in the right place is at the heart of forestry growth and it is very encouraging to see woodland creation activity on the increase. During 2017, more than 800 Forestry Grant Scheme contracts were awarded, including 300 woodland creation projects.

“We have already approved 9,000 ha of private sector schemes for planting next year (18/19) and Forest Enterprise Scotland is expecting to create around 650ha on the National Forest Estate. We are also assessing a further 2,500ha of schemes that have been submitted by private sector applicants.

“Taking all this together, we are now seeing the highest level of woodland creation activity since 2001.

”This is a transformation from where we were just a few years ago – one which this government has invested significantly in making happen. I’m especially pleased to see the National Forest Estate playing a key role and continuing with new planting, felling and generating income.

“I welcome the role that RSFS members play in contributing to this growth and success.”

Note from the editor

Feel free to send this newsletter on to others.

Many thanks to the many contributors to this issue, our largest ever with contributions from around the world. The next issue is scheduled for September 2018.

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

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

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

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

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

Unasylva

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

Global Forest Information Service (GFIS)

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

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