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Contributed Articles

Daniellia oliveri, a lesser-used species of Ghana: opportunities and its relevance to sustainable forest management.

Jerry Oppong Adutwum[1], Junji Matsumura[2] and Jacqueline Joyce Twintoh[3]

1 Graduate School of Bioresource and Bioenvironmental Sciences, Kyushu Univ., 744 Motooka Nishi-ku, Fukuoka 819-0395, Japan
2 Department of Agro-Environmental Science, Faculty of Agriculture, Kyushu Univ., 744 Motooka Nishi-ku, Fukuoka 819-0395, Japan
3 Forest Products and Marketing Division, CSIR-Forestry Research Institute of Ghana, UP63 Kumasi.

Introduction

The Ghanaian forestry industry has been limited to a few economic, prime species to the neglect of more than 90 tree species that reach merchantable height classified as lesser-used species. Their extinction coupled with demand for wood products has led to wood users and the timber industry to consider utilizing a wide range of lesser-used species. Daniellia *oliveri* is a member of lesser-used species. Traditionally, its use has been restricted to fuelwood and firewood which is not so profitable for forestry. Its popularity and cost have skyrocketed recently. Marfo et al (2017) found that *D. oliveri* was among the top ten moving species on the local timber market in Ghana. It is now being processed as lumber which is intended for structural applications. In the period of their study, about 5000m3 valued at $546,321 was supplied to the market. The rise in popularity among wood users is a concern for its sustainable utilization and management as its wood properties are poorly known. Soon *D. oliveri* would be a shrinking resource with no active planting. As a countermeasure, it has become imperative to generate scientific information on the wood properties which is essential for successful commercial exploitation. Youngs (1989) argued that limited utilization of lesser-used species has been a negative factor in the management of tropical forests. As recognized by the Ghana's government in 1995, research and promotion of lesser-used species should be supported. This is because the use of lesser-used species will not only increase the resource basket in the country but also will reduce the pressure

on traditional (prime) timber species which are declining in both quantity and quality. Thus, knowledge on wood characteristics and properties of lesser-used species is important. Providing technical knowledge about lesser-used species and assurances regarding supply, coupled with effective promotional strategies, would facilitate the acceptance of lesser-used species wood products on the local and international markets (Poku 1999). It is envisaged that knowledge of wood properties of this little-known species will contribute to an understanding of their present and potential value, not only as a resource to be harvested but to be protected to ensure perpetual supply and survival of the entire ecosystem. The objectives of this work are to describe, based on literature review, the anatomical characteristics, physical and mechanical properties and use of timber of *Daniellia oliveri*. The opportunities for the development, areas of new research and development of *Daniellia* are highlighted.

Description of *Daniellia* wood, common names and distribution

Daniellia oliveri (Rolfe) Hutch & Dalz. belongs to the family LEGUMINOSAE: CAESALPINIOIDEAE (Estrella et al 2010). Described initially as *Paradaniellia oliveri* (Rolfe, 1912) was later treated as synonymous with *Daniellia* by Hutchinson and Dalziel (1928). The genus *Daniellia* has about 10 species of medium to large trees restricted to tropical and subtropical Africa. It is the most widespread species growing in wooded grassland (savannah) and drier deciduous forest from Senegal to South Sudan and Uganda. It is a deciduous, medium-sized tree up to 25–45m tall with bole straight and cylindrical, reaching up to 200 cm in diameter, without buttress (Schmelzer and Louppe 2012). In terms of common and trade names, *D. oliveri* is commonly referred to as Senya and Faro (African balsa) (ITTO, undated). Senya is classified as unrestricted under CITES status even though there exist no data on its status and availability in the forests of Ghana.

General description of timber

Schmelzer and Louppe (2012) described the grain as interlocking with medium to coarse texture while similar characterization by ITTO (undated) states that the grain is straight to slightly interlocking. The wood has a clearly demarcated heartwood reddish-brown with greenish-brown streaks. Microscopic features are fully described by Wheeler (2011) and summarized as:

> Growth ring boundaries indistinct or absent
>
> A diffuse-porous wood -The average tangential diameter of vessel lumina is 100-200>=200?m. Perforation plates are simple with alternating intervessel pits, average diameter 7-10?m, vestured.
>
> Vessel-ray pits have distinct borders, similar in size and shape to intervessel pits throughout the ray cells
>
> Ray cells are 1 to 3 cells wide and are procumbent
>
> Axial parenchyma is marginally banded
>
> Fibres are thin-to thick-walled -Average fibre lengths 900-1600>=1600?m.

Properties and Use

Senya according to International Association of Wood Anatomy (IAWA) can be described as medium density wood. The density of Senya is variable ranging from 400-580 kgm-3 (Sallanave, 1985; Rijsdijk and Laming, 1994) and 510 to 680 kgm-3 at 12% moisture content (MC) (Schmelzer and Louppe, 2012). Bolza and Keating (1972) reported air-dry density in the range of 0.58-0.72 gcm-3 at 12% MC. It has a clearly demarcated heartwood which is pale pinkish brown to reddish with greenish-brown streaks. Its whitish sapwood is 10-18 cm wide.

The wood dries slowly with slight seasoning degrade (ITTO undated). Kiln drying is reportedly slow but without degrade. *Daniellia* shrinks on average 6.6% in the tangential direction and 3.3% in the radial direction. The tangential and radial shrinkage are classified as low on the Zhang and Koubaa scale (2001). The low transverse dimensional changes are best suited for applications where dimensional stability is critical (Chauret et al 2006). Referring to its strength properties, Schmelzer and Louppe (2012) reported the following data: modulus of rupture ranging from 56-114 Nmm-2 and modulus of elasticity between 6280 and 9700 Nmm-2.

Daniellia oliveri is regarded to be a non-durable wood according to Fortin and Poliquin (1976) with a natural durability index of 5 (ITTO, undated). The wood risks of decay attacks at any processing stage, from logs up to final products. The wood is susceptible to termites, fungi, marine and pinhole borers attack. Heartwood is susceptible to lyctus attack (ITTO, undated). However, sapwood has partial permeability and heartwood resistant to impregnation preservatives (Fortin and Poliquin 1976). Steam bending is reportedly difficult according to ITTO (undated).

The wood is easy to work, both with hand tools and machine cutting (Schmelzer and Louppe 2012). Its blunting effect is slight (ITTO, undated). Planing, sanding, moulding, boring, mortising, is easy with no problems with nailing (ITTO, undated). It glues well if basic technical rules are adhered to (ITTO, undated). Among the reported uses of the wood are; can be used as musical instruments (http://plants.jstor.org/stable/10.5555/al.ap.upwta.3_165), for flooring, joinery, interior trim, furniture, boat building, plywood and papermaking (Schmelzer and Louppe, 2012). It can also be used for both rotary and sliced veneers if treated according to ITTO (undated).

Need to update the available information and research on Daniellia oliveri wood

Costly mistakes in the use of the timber may confidently be expected if we try to utilize it in entire ignorance of its properties. Inadequate data on basic working properties of lesser-used species have contributed to the problem of their underutilization (Youngs and Hammet 2001). Tissari (2001) notes that international timber trade is more reliant on technical and aesthetic properties. Some aspects of the available information regarding the species characteristics and properties, reviewed in this work, is rather old. Some sources published between 1950 and 1980s. Moreover, no information is provided about the exact location of wood specimens or of their variation patterns within trees and between trees. Cown (1980) asserts that it is only by recognizing the intrinsic variability of the properties of a raw material that efficient and sustainable utilization can be advanced. Future research is aimed at determining the properties

and possible end uses. Knowledge about the relationships between the growth characteristics, growth conditions such as ecological zone type and climatic conditions on wood quality (anatomical, physical and mechanical properties) can help improve the selection of trees as well as grading considerably.

Opportunities

Eggeling and Dale (1951) described *Daniellia* as fast-growing and light demanding deciduous tree. Odeyeji (Pers. comm.) described that plant as secondary colonizer that outgrows most herbaceous species and other woody species such as *Vitelleria paradoxa* in Nigeria's savanna ecosystem. As a legume, it adapts well to poor soil conditions and found growing luxuriantly even in disturbed sites. In Ghana, it has a wide ecological range. These descriptions together with ease to work wood and stable wood inform *Daniellia* can be a very good species for large scale planting. Wood property information and value-added research on the wood would increase the economic value and its adoption as an important plantation species.

Urban Forest Assessment in Dominican Republic

Mervin E. Pérez[1,2*], Elvia Meléndez-Ackerman[2], Solhanlle Bonilla[2], Jerry Bauer[4,5], Mirel Volcán[5], Ana Pou[5], Claudia Caballero[5], Leonardo Cortés[5], Wayne J. Arendt[4], Tischa Muñoz-Erickson[4], David Nowak[6]

[1]University of Puerto Rico, Río Piedras Campus, Puerto Rico
[2]Universidad de San Carlos de Guatemala, Centro Universitario El Progreso, Guatemala
[3]Instituto Tecnológico de Santo Domingo, República Dominicana
[4]USDA Forest Service, San Juan, Puerto Rico
[5] USDA Forest Service, Santo Domingo, República Dominicana
[6]USDA Forest Service, Northern Research Region, United State of America
[*]ixmulej@gmail.com

The world´s urbanization forecast shows that 60% of the human population will be living in cities by 2050 (United Nations et al. 2017). This growth will negatively impact natural forests surrounding urban areas and will contribute to losses of biodiversity, ecosystem functions, and ecosystem services. Urban green infrastructure is often associated with improvements to city aesthetics and even with improvements in resident (Kabisch and van den Bosch 2017). Yet, the ecosystem services are more extensive as it captures air pollutant, reduce urban runoff by rain interception and water infiltration (Nowak et al. 2006, Nowak and Dwyer 2007), buffer thermal environment of cities (Méndez-Lázaro et al. 2018), and helps to remove atmospheric carbon (Strohbach and Haase 2012). For these reasons, understanding, the quality and quantity of green areas have been a priority of major cities worldwide. In 2015 we started using iTree tools (Nowak et al. 2008) to estimate, qualitative and quantitative, ecosystem services provided by green infrastructure in some cities in the Dominican Republic. To date 104 persons (professors,

technicians, students, and citizens) have been trained in the use of iTree tools, and a total of 18 projects have been developed at the country level. From this total, one was at the National District of Santo Domingo; seven projects in public and private universities (Universidad Autónoma de Santo Domingo, Universidad Iberoamericana, Instituto Tecnológico de Santo Domingo, Pontificia Universidad Católica Madre y Maestra, Universidad Nacional Pedro Henríquez Ureña, Universidad Evangélica, Universidad Pro Educación y Cultura); four in public areas (Parque Las Praderas, Parque Iberoamerica, Plaza de la Cultura, and Centro Olimpico Juan Pablo Duarte); and four projects at the neighborhoods scale (Ciudad Colonial, San Carlos, Ciudad Nueva, and Gascue) in Santo Domingo metropolitan area. Additionally, one project has been developed in San Pedro de Macorís (Universidad Central del Este), and another ongoing project in Santiago de los Caballeros (Parque Central).

Depending of the study area, the project design included a plot sampling method or a complete inventory. Over the study period we have collected data in more than 9,000 ha of urban areas. Tree cover percentage ranged from 2.7 up to 56.7, where neighborhoods scored the lowest value and public areas the highest. Overall, a total of 2,104 trees have been measured represented by more than 140 species. Species richness ranged from one to 15 tree species per plot (0.04 ha), while density ranged from 25 to more than 1,000 trees/ha. The most common species were the non-native palm species *Adonidia merrilli* and *Dypsis lutescens*. Overall, sampled trees have been removing more than 50 metric tons of air pollution per year; storing more than 8.4 thousand metric tons of carbon and sequestering over 7.1 thousand metric tons of carbon per year. They reduced annual runoff in more than 30 thousand cubic meters; and produced more than 18 thousand metric tons of oxygen. The ecosystem services provided by the urban green infrastructure in Dominican Republic have an associated monetary value estimated in more than 244 million of US dollars. This project will provide critical information needed to improve urban planning and to develop urban policies that include green infrastructure solutions. In addition, we have strengthened local capacities thru a series of workshops and field data collection training, so future monitoring can be done by local authorities and stakeholder after the project ends.

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Returning Earth to Mankind and Mankind to Earth: An Ecosystemic Approach to Communication, Advocacy, Public Policies, Research and Teaching Programs

André Francisco Pilon
University of São Paulo / Int. Academy of Science, Health & Ecology
gaiarine@usp.br

In view of the overwhelming pressures on the global environment and the need to disrupt the systems that drive them, an ecosystemic theoretical and practical framework is posited for the evaluation and planning of communication, advocacy, public policies, research and teaching programmes; Priority is given to a set of values, norms and policies in view of human well-being, quality of life and natural and built environments, supporting new socio-cultural learning niches, within and outside the academic area, to change perspectives, develop boundary-crossing skills, and cope with complexity and expertise in a critical and creative way.

Trying to solve isolated and localized problems, without addressing the general phenomenon, is a conceptual error: “sustainable” development, as an ideology, is easily absorbed by predominant interests (including enterprises for plunder); policy makers and researchers, disregarding epistemological and ontological issues at stake, adopt structuralist approaches, with their stress on institutions and institution building, ignoring the general patterns of institutional failure or corruption, and failing to account for the design, formation and maintenance of institutions by leaders, elites and established coalitions of interests.

Nowadays, quality of life, environmental conditions, biocultural landscapes, are hampered by bureaucratic governance regimes, historical injustices, vested interests, biased policies, internal incoherence, corruption, lack of pluralism in decision-making, asymmetries of knowledge and power, a long-standing reproduction of subalternity, aggravated by environmental catastrophes and criminality, unequal sharing of benefits and the consistent destruction of peoples’ cultural, land and territorial basic relationships (adverse effects of real estate interests in urban areas, of large plantations and mining inland, of commercial demands for exported commodities).

In a world where investors have as much or more power than nation-states, the commodification of public goods, services and spaces will continue unabated; while buildings tower to the sky, problems get worse: the role of law, the work of attorneys and judicial courts is held back by the very system in which they have their insertion, "legal" and "illegal" strategies are mixed together in the assemblage of political and economic interests; powerful lobbies, deeply ingrained in the public administration, favor mega-projects with intensive use of resources, rather than appropriate and less expensive technologies.

The paradigms of growth, power, wealth, work and freedom, embedded into the dominant political, technological, economic, social, cultural and educational systems, intermingled in the boundaries between fragmented public policies and reduced academic formats, contribute to the chaotic system of production and consumption, the increased urban violence, energy squander, deforestation, mining expansion, hazardous wastes, pesticides, pollutants, global climate change, diminishing biological diversity and overall degradation of quality of life (fig. 1).

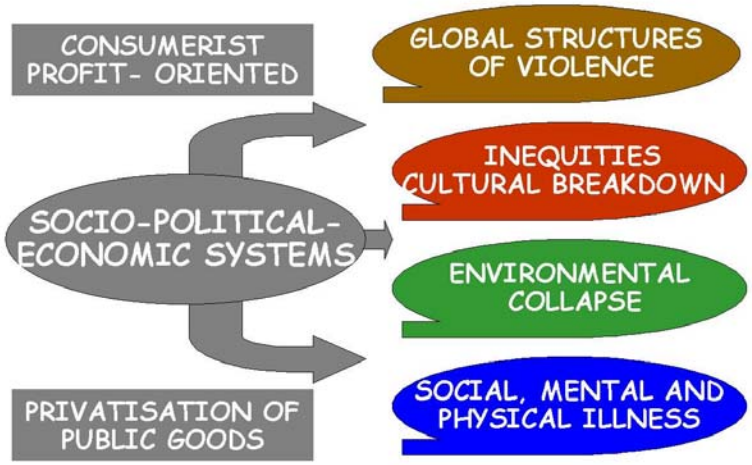

Fig.1: Consequences of current socio-political-economical systems for the state of the world

Consumerism is immune to ethical formulations and cannot be understood outside of contemporary socio-technical systems; traditional economic groups, wealthy elites, powerful multinational corporations (banks, agribusiness, contractors, mining companies), which apparently would be concerned with “development” strategies and “sustainable” development goals, are actually being used not as a roadmap for social, economic and environmental transformation, but as a vehicle to justify the status quo, to entrench inequitable power relations, translating their economic power into political access to influence government decisions.

Current educational and mass communication policies, nowadays aligned to “entrepreneurship” and “development”, are not adequate to prepare people as agents of change; policies of “social inclusion” only accommodate people to the prevailing order: once “included", a new wave of

egocentric producers and consumers reproduce the system responsible for their former exclusion; in this sense, beyond the limits of academic formats and biased public policies, it is proposed the generation of new socio-cultural learning niches, in which people could explore new pathways, within new scenarios relevant to new forms of being in the world.

To reach the roots of, and deal with, the problems of difficult settlement or solution in our times, a theoretical and practical framework is posited to identify and reconceptualize roles and drives, encompassing the co-design of all dimensions of being-in-the-world (intimate, interactive, social and biophysical), in view of their dynamic equilibrium, complementarity and mutual support, as they combine, as donors and recipients, to induce the events (deficits/assets), cope with the consequences (desired/undesired) and organize for change (potential outputs).

For diagnosis and prognosis, deficits and assets in all dimensions of being in the world should be assessed, connections strengthened and ruptures sealed. In this sense, it is expected that advocacy, public policies, research and teaching programs would:

a) define the problems in the core of the "boiling pot" (fig. 2), instead of reducing them to the 'bubbles' of the surface (effects, fragmented and taken for granted issues);

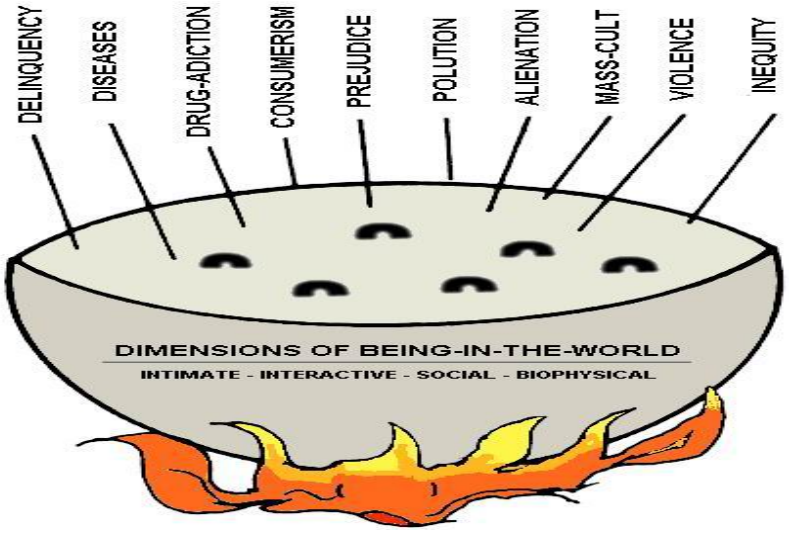

Fig.2: The real problems lie deep inside the boiling pot, not in the bubbles of the surface (effects)

b) combine all dimensions of being in the world in the diagnosis and prognosis of events, assessing their deficits and assets, as donors and recipients (fig. 3);

	INTIMATE	INTERACTIVE	SOCIAL	BIOPHYSICAL
DIAGNOSIS OF THE EVENTS	SUBJECTS' COGNITIVE AND AFFECTIVE ACTUAL STATUS	GROUPS ' AND COMMUNITIES' DYNAMICS AND COHESION	PUBLIC POLICIES LAW ENACTMENT CITIZENSHIP PARTICIPATION	NATURAL AND MAN-MADE ENVIRONMENTS BEINGS, THINGS
ELICITING NEW EVENTS	DEVELOPMENT OF SUBJECTS' EXISTENTIAL SELF-CONTROL	DEVELOPMENT OF GROUPS AND PRO-ACTIVE COMMUNITIES	DEVELOPMENT OF PUBLIC POLICIES AND CITIZENSHIP	PROMOTION OF NATURAL AND MAN-MADE ENVIRONMENTS
IMPACT ON EACH DIMENSION	ENHANCEMENT OF SUBJECTS' WELL-BEING	ENHANCEMENT OF GROUPS AND COMMUNITIES	ENHANCEMENT OF POLICIES AND CITIZENSHIP	ENHANCEMENT OF OVERALL ENVIRONMENT

Fig.3: The process of change implies a synchronized work with the four dimensions of being in the world

c) promote the singularity (identity, proper characteristics) of and the reciprocity (mutual support) between all dimensions in view of their complementarity and dynamic equilibrium;

d) contribute towards the transition to an ecosystemic model of culture, as an essential condition for consistency, effectiveness and endurance.

Human well-being is linked to a set of values, norms and policies that prioritizes and intermingle socio-ecological objectives, the quality of natural and built environments, aesthetic and ethical values, a moral and cultural meaning of existence; science–policy interfaces, public policies, communication, advocacy, research and teaching programs, instead of taking current prospects for granted and projecting them into the future (exploratory forecast), should emphasize the definition of desirable goals (normative forecast), and the exploration of new paths to reach them ("backcasting", as a planning method).

To understand how people create and experience their lives, it is necessary to unveil the epistemic cultures which structure how they know what they know and why they act as they act. As "path breaking" ways do develop awareness, interpretation and understanding beyond established stereotypes and taken from granted views, the development of socio-cultural learning niches could provide new structures of thought and action, from a thematic ("what"), an epistemic ("how") and a strategic (when, who) point of view. Niches are protective spaces to develop new ways for being-in-the-world, "shielding, nurturing and empowering".

The ecosystemic model favors the development of healthy societies that invest in each other rather than in mega-projects with intensive use of resources. It extends to environmental problems, the quality of life and the state of the world a conceptual framework that includes ontological and epistemological issues, the isomorphy and transfers of concepts, laws and models; it highlights how taken-for-granted worldviews, values and perceptions affect the

definition and treatment of the problems by communication, advocacy, public policies, research and teaching programs in the contemporary world.

[Note: For a description of the methodology, please see: PILON, A. F., Education Towards a Responsible Society, An Ecosystemic Approach **for** Advocacy, Public Policies, Research and Teaching Programmes**,** *2nd HEIRRI Conference*, Vienna: 2018 [on line]: https://www.researchgate.net/publication/324840371_Education_Towards_a_Responsible_Society_An_Ecosystemic_Approach_for_Advocacy_Public_Policies_Research_and_Teaching_Programmes]

Niger Delta Mangroves in Nigeria Are under Threats

John O. Shittu

An overview: Nigeria's Niger Delta is the 3rd largest mangrove ecosystem in the world; it faces staggering environmental threats. Comprising over 90% of Nigeria's total exports, the oil-rich Niger Delta produces up to two million barrels of crude oil a day. Such extensive oil extraction has come at great environmental and social cost, and has been the largest threat to Nigeria's mangrove forests.

The Niger Delta mangrove forests play critical roles for 60% of local peoples who rely on the land and sea for survival. The forests contribute local therapeutic, amenity, heritage, and existence values. The world's Mangrove Forests are unique, special and vulnerable; its protection is essential. The earth and humanity simply cannot afford to lose these vital ecosystems.

EFECTO DE REGULADORES DE CRECIMIENTO EN 10 ESPECIES ARBOREAS UBICADAS EN FRANJAS DE SEGURIDAD DE REDES ELÉCTRICAS DE LA EMPRESA DE ENERGÍA DEL PACIFICO – EPSA EN EL VALLE DEL CAUCA - COLOMBIA.

EFFECT OF GROWTH REGULATORS ON 10 TREE SPECIES LOCATED IN SAFETY BANDS OF ELECTRICAL NETWORKS OF THE PACIFIC ENERGY COMPANY – EPSA - IN THE CAUCA VALLEY - COLOMBIA.

Carlos J. Llanos – Rojas, Román Ospina - Montealegre,
Alma Constanza Hurtado – Sarasti, Jonny Arias – Rentería, Lady Lorena Velazco.
GESILVI, Universidad del Cauca, Correo electrónico: gerencia.gesilvi@gmail.com; rospina@unicauca.edu.co

RESUMEN

Se quiso evaluar el efecto del regulador de crecimiento Paclobutrazol, sobre diez especies de árboles sometidos a poda en interferencia con redes eléctricas. Para ello se estableció un diseño de bloques al azar con arreglo factorial 3x2, con seis tratamientos constituidos por la combinación de los factores método de aplicación y concentración del producto. Los métodos evaluados fueron la aspersión radicular, la inyección en el tronco con Arborjet y la aspersión foliar utilizando bomba de espalda, las concentraciones evaluadas fueron 14.000 ppm y 20.000 ppm. Las variables consideradas fueron el incremento en altura de los árboles medida en metros y el peso de la biomasa seca al final de las mediciones. Se hicieron registros mensuales de las variables mencionadas hasta los 9 meses. Para validar las hipótesis planteadas se hicieron análisis de varianza y comparaciones por el método de diferencias de Bonferroni, para las variables que no cumplieron con los supuestos del Anava, se hicieron pruebas no paramétricas de Kruskal Wallis. Se encontró que, para todas las especies, los efectos de los tratamientos se vuelven más significativos, a medida que pasa un mayor tiempo después de la aplicación de los mismos; que las especies Matarratón (*Gliricidia sepium*), Samán (*Pithecellobium. saman*), Guácimo (*Guazuma ulmifolia*), Swinglea (*Swinglea glutinosa*), Mango (*Manguifera indica*) y Chiminango (*Phitecellobium dulce*), mostraron de manera evidente una disminución en la longitud de los entrenudos. Para el Matarratón (*G. sepium*), el efecto de los tratamientos se manifestó de manera significativa a la semana 9, mientras que el Ficus (*Ficus benjamina*), para este mismo tiempo no mostró efectos significativos, para el Hobo (*Spondias purpurea*), si ocurrió en la semana 12; por su parte el Samán (*P. saman*), empezó a mostrar efectos significativos en el crecimiento y la biomasa seca, solo hasta la semana 26, mientras que para el Guácimo (*G. ulmifolia*), esto ocurrió hasta la semana 37; en el chiminango los efectos se empezaron a volver significativos en la semana 17 y se intensificaron hasta la semana 37. Para las especies Swinglea (*Swinglea glutinosa*) y Totocal (*Achatocarpus nigricans*), no se reportaron efectos significativos de los tratamientos ni en el incremento en altura, como tampoco para el peso de la biomasa seca. La Palma Botella (*Roystonea. regia*) no mostró diferencias significativas entre los tratamientos y el testigo, sin embargo, a la semana 37 se pudo ver que los tratamientos de inyección en el tronco y la aspersión foliar, con concentraciones de 20.000 ppm, tienden a generar un efecto inhibidor sobre el incremento en altura.

Palabras claves. Paclobutrazol, Regulación de crecimiento, especies forestales, arboles bajo líneas eléctricas.

ABSTRACT.

The effect of the Paclobutrazol growth inhibitor on ten species of pruned trees was evaluated. For this purpose, a randomized block design with 3x2 factorial arrangement was established, with six treatments consisting of the combination of factors application method and product concentration. The methods evaluated were radiation spray, injection into the trunk with air jet and foliar spray using the back pump, concentrations evaluated were 14,000 ppm and 20,000 ppm. The variables considered were the increase in the height of the trees in meters and the weight of the biomass at the end of the measurements. Monthly records of the mentioned variables were made up to 9 months. In order to validate the hypotheses, variance analysis and comparisons were made by the Bonferroni method, for non-parametric Kruskal Wallis non-parametric variables. It was found that for all species, the effects of the treatments become more significant, a measure that passes a longer time after the application of the same; (Guazuma ulmifolia), Swinglea (Swinglea glutinosa), Mango (Manguifera indica) and Chiminango (Phitecellobium dulce), the result of a decrease in

the length of the internodes for the Matarratón (G. sepium), the effect of treatments (Ficus benjamina), for this same time showed no significant effects, for the hobo (Spondias purpurea) did occur at week 12; (P. saman), began to show significant effects on growth and dry biomass until week 26, whereas for Guácimo (G. ulmifolia), this happened until week 37; 37. For the Swinglea (Swinglea glutinosa) and Totocal (Achatocarpus nigricans) species, no significant effects of treatments have been reported on either height increase or dry biomass weight. However, at week 37, it was possible to see that injection treatments in the trunk and foliar leaf, with concentrations of 20,000 ppm, tended to generate an inhibitory effect on the increase in height

Keywords: Evaluation, Paclobutrazol, Austar, Growth regulation, forest species, trees under electric lines.

INTRODUCIÓN

El árbol urbano es un importante componente en la ciudad, brinda diversos servicios ecosistémicos como estéticos, recreativos sociales y paisajísticos. Contribuyendo también con la regulación de la temperatura, purificación del aire, entre otras. Sin embargo, la relación entre desarrollo y medio ambiente permanecen en diferentes conflictos en todos los escenarios, en este sentido el desarrollo en infraestructura siempre genera impactos sobre el medio natural.

Uno de los riesgos que más preocupa es el relacionado con el conflicto entre árbol y redes de conducción eléctrica debido a que las redes generalmente son aéreas y están en áreas tanto rurales como urbanas, donde hay presencia de árboles, los cuales presentan un rápido crecimiento y se interceptan con el cableado aéreo; para lo cual se genera un mantenimiento al arbolado mediante podas y una vez son sometidos a dicho proceso, estos árboles aceleran su crecimiento, razón por la cual se hace necesaria la búsqueda de alternativas para el control de rebrotes después de la poda.

Sin embargo, el continuo crecimiento por especie supera las posibilidades presupuestales de las empresas administradoras de redes, para mantener las mismas libres de obstáculos, como es el caso de la empresa de Energía del Pacífico (EPSA) en el departamento del Valle del Cauca; quien se encarga del mantenimiento continuo del arbolado que se ubica bajo las redes. Cada especie tiene una velocidad de desarrollo diferente, para lo cual se requiere unos costos y unos requerimientos como la suspensión del sistema eléctrico en dados casos para el mantenimiento de estos.

Debido a que dicho mantenimiento debe realizarse anualmente y con frecuencia se estableció evaluar el efecto de las especies forestales bajo la aplicación del fitoregulador "Paclobutrazol", con lo que se espera lograr una reducción significativa en el desarrollo de los rebrotes de los árboles después de la poda y por consiguiente disminuir la frecuencia de las mismas.

Con esta reducción en la frecuencia de las podas se obtiene una disminución en la producción de residuos vegetales, ahorros importantes en términos económicos, una menor afectación al paisaje, menos intervenciones en el árbol y la posibilidad de optar por alternativas para el control del crecimiento de los árboles que se encuentran bajo las lineas de electricidad. De esta forma, se pretende con esta investigación proponer un nuevo método de manejo para reducir la velocidad de crecimiento de los árboles en mantenimiento gracias a la acción de los fitoreguladores en las plantas.

METODOS

Área de estudio.

La investigación se realizó en 5 corredores de redes de conducción eléctrica de la Empresa de Energía del Pacífico S.A.S (EPSA), en los circuitos Juanchito - Agua Blanca; Santa Bárbara - Palma Seca – La Dolores; ubicados entre los municipios de Buga, Palmira y Santiago de Cali en el Departamento del Valle del Cauca (Figura 1). Con las coordenadas de Latitud: 3.42158, Longitud: -76.5205 3° 25′ 18″ Norte, 76° 31′ 14″ Oeste, con una temperatura media anual de 24°C, y una precipitación promedio anual de 995 - 1.483 mm.

Figura 9. Área de estudio, evaluación de Paclobutrazol sobre especies forestales.

Se evaluó el efecto del regulador de crecimiento Paclobutrazol, sobre diez especies de árboles sometidos a podas. Para ello se estableció un diseño de bloques al

azar con arreglo factorial 3x2, con seis tratamientos constituidos por la combinación de los factores método de aplicación y concentración del producto. Los métodos evaluados fueron la aspersión radicular, la inyección en el tronco con árbol jet y la aspersión foliar utilizando bomba de espalda, las concentraciones evaluadas fueron 14.000 ppm y 20.000 ppm. Las variables consideradas fueron el incremento en altura de los árboles medida en metros y el peso de la biomasa seca al final de las mediciones. Se hicieron registros mensuales de las variables mencionadas hasta los 9 meses. Para validar las hipótesis planteadas se hicieron análisis de varianza y comparaciones por el método de diferencias de Bonferroni, para las variables que no cumplieron con los supuestos del Anava, se hicieron pruebas no paramétricas de Kruskal Wallis.

Desarrollo del Trabajo. Se escogieron árboles con alturas entre los seis y diez metros, los individuos de las especies evaluadas presentaron características fenotípicas semejantes; los mismos se sometieron a una poda con un porcentaje equivalente entre todos los individuos, posteriormente fueron sometidos a diferentes tratamientos. igualmente se emplearon placas propias de la empresa EPSA, para la marcación. Se tomaron mediciones semanales durante 6 meses.

Localización de las especies objeto de estudio. Para la localización de las especies objeto de estudio, se ubicaron los individuos en los circuitos mencionados, posteriormente se seleccionaron las especies e individuos en estos trayectos, teniendo en cuenta un buen estado fitosanitario en el momento de selección de estos.

La investigación se realizó con árboles maduros de 10 especies, las cuales se seleccionaron teniendo en cuenta aquellas reportadas como de mayor frecuencia y mayor interferencia con redes eléctricas (cuadro 2).

Marcación de los individuos. Se marcaron los individuos con plaquetas para garantizar el seguimiento al mismo individuo, con lo que se facilitó la ubicación y la medición mensual de cada uno de ellos. Para este diseñó se indicó en la plaqueta (figura 10), la numeración por individuo, las iniciales de la especie con su respectiva indicación de concentración y método.

Registro de variables antes de la poda. Se tomó nota de las variables altura y DAP antes iniciar con la poda, ya que es necesario tener en cuenta estos datos para el posterior análisis.

Poda de los árboles. La poda se realizó a continuación del proceso de plaqueteado, con ayuda de la cuadrilla forestal del Consorcio GESILVI, teniendo en cuenta que no se debe cortar más del 30% de la copa del árbol a podar. En la figura se puede observar algunos individuos después de las podas.

Aplicación del producto.

Métodos de aplicación. Se aplicó paclobutrazol, en dos concentraciones (14000 y 20000 ppm); además de los tres métodos:

Aspersión foliar. Para este método de aplicación se usó una bomba de 20 litros, el operador realizó la aplicación ascendiendo al árbol en estudio para garantizar que la aspersión abarcara mayor cantidad de área de la copa.

Aspersión radicular. Para la aplicación del producto mediante la aspersión radicular, se limpió y removió el suelo alrededor del tronco del árbol a evaluar, con el fin de garantizar que la solución quedara suspendida alrededor de las raíces de cada árbol y con la mezcla previamente preparada, se procedió a rociar el suelo con el Paclobutrazol.

Inyectología. Para esta aplicación se utilizó un taladro para perforar en varios lados del tronco dependiendo de la cantidad de tallos presentes en la planta, una perforación en cada uno de ellos de tal forma que Arborplug, lo que facilita la aplicación del producto con el Arborjet (Figura 15), con lo que se garantiza la translocación del producto desde el área tratada hasta distantes partes dentro del árbol, por ejemplo el tronco, las raíces y el follaje, a lo que se le conoce como inyección sistémica (UACH, 1996).

Registro de variables después de la poda. Al efectuar la poda es importante registrar diferentes variables, referentes a la cantidad de ramas podadas, peso de los residuos vegetales.

Recolección de muestras de biomasa fresca. Se recolecto la muestra de biomasa la cual incluye una muestra de hojas frescas y 3 troncos de 10cms de largo. Se tiene en cuenta la rotulación de cada una de las muestras, marcándolas con cinta.

Seguimiento al control de altura. Se realizó el seguimiento de crecimiento de los rebrotes y se anexo la altura del primer mes después de la 26 poda de acuerdo al tratamiento aplicado.

Peso de muestras de biomasa seca. Este procedimiento se realizó después de tener las muestras pesadas en fresco, es prioritario para completar el procedimiento para el cálculo de carbono.

Seguimiento mensual de las especies en estudio. Se realizó un seguimiento mensual durante seis meses a las especies.

Diseño experimental. El diseño del estudio fue al azar con arreglo factorial. Mediante la combinación de dos factores, tres niveles del factor método (aspersión radicular), (inyección árbol-jet) y (aspersión foliar) y dos del método concentración (14000 ppm) y (20000 ppm). En donde cada especie se manejó como un diseño independiente, debido a que no se realizaron las mismas mediciones para todas las especies
objeto de estudio, esto quiere decir que se realizaron solo dos mediciones para las especies *Ficus Benjamina, Roystonea regia, Achatocarpus nigricans, Manguifera indica, Pithecellobium saman, Swinglea glutinosa y Spondias purpurea;* las especies *Guazuma ulmifolia y Gliricidia sepium* fueron medidas cuatro veces a través de seis meses de seguimiento a las especies.

La variable de respuesta para determinar el efecto de los tratamientos, fue la altura y la diferencia de pesos después de la primera poda y la poda final, con lo que se compara el efecto de acuerdo a la cantidad de biomasa seca producida por el árbol.

Análisis estadístico. Se implementó un diseño en bloques al azar generalizado, en el cual las diez especies constituyeron los bloques, los tratamientos se generaron mediante un arreglo factorial en el que los factores fueron la concentración de Paclobutrazol con dos niveles (14.000 ppm y 20.000 ppm) y método de aplicación (1: Inyección en el tronco; 2: Aspersión foliar; y 3: Aspersión radicular). Por consiguiente, se generaron seis (6) tratamientos, los que se asignaron a tres (3) repeticiones dentro de cada bloque; además, se incluyeron tres individuos que fueron evaluados como testigos absolutos.
Los registros se organizaron en el programa SPSS, con el cual se realizaron los respectivos análisis descriptivos, prueba de normalidad y homogeneidad de las varianzas para las variables de estudio. Además, la prueba de hipótesis, mediante análisis de varianza y covarianza, con una confiabilidad del 95%.

RESULTADOS Y DISCUSION

Se encontró que para todas las especies, los efectos de los tratamientos se vuelven más significativos, a medida que pasa un mayor tiempo después de la aplicación de los mismos; que las especies Matarratón (*Gliricidia sepium*), samán (*Pithecellobium. saman*), Guácimo (*Guazuma ulmifolia*), Swinglea (*Swinglea glutinosa*), Mango (*Manguifera indica*) y Chiminango (*Phitecellobium dulce*), mostraron de manera evidente una disminución en la longitud de los entrenudos.

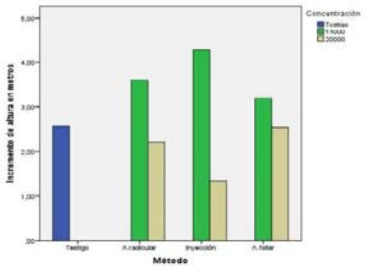

Fig. 4. Incremento en altura de la especie *G. sepium*

Para el Matarratón (*G. sepium*), el efecto de los tratamientos se manifestó de manera significativa a la semana 9, mientras que el ficus (*Ficus benjamina*), para este mismo tiempo no mostró efectos significativos, para el Hobo (*Spondias purpurea*), sí ocurrió en la semana 12; por su parte el Samán (*P. saman*), empezó a mostrar efectos significativos en el crecimiento y la biomasa seca, solo hasta la semana 26,

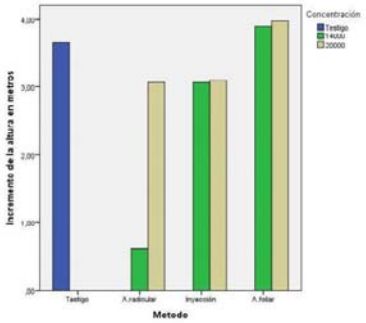

Fig. 5. Incremento en altura de la especie *G. ulmifolia*

mientras que para el guácimo (*G. ulmifolia*), esto ocurrió hasta la semana 37; en el chiminango los efectos se empezaron a volver significativos en la semana 17 y se intensificaron hasta la semana 37. Para las especies Swinglea (*Swinglea glutinosa*) y Totocal (*Achatocarpus nigricans*), no se reportaron efectos significativos de los tratamientos ni en el incremento en altura, como tampoco para el peso de la biomasa seca. La Palma Botella (*Roistonia. regia*) no mostró diferencias significativas entre los tratamientos y el testigo, sin embargo a la semana 37 se pudo ver que los tratamientos de inyección en el tronco y la aspersión foliar, con concentraciones de 20.000 ppm, tienden a generar un efecto inhibidor sobre el incremento en altura.

Algunas de las especies evaluadas con la aplicación foliar no tuvieron un efecto significativo, esto pudo ser debido a que algunas de las especies arbóreas intervenidas mediante la poda, no quedaron con una cantidad de follaje considerable para la absorción del producto mediante las hojas, ya que se realizó una poda que abarcó gran parte del área foliar con las especies Caucho, Matarratón, Guácimo y Guácimo. Resultados similares se encontraron por Barret, *et al* (1983). Con la evaluación de Paclobutrazol en la especie *Ficus Benjamina*, en donde se aplicó con una concentración de alta de Paclobutrazol justo antes de la poda, logrando una menor elongación que en las plantas testigo.

En este sentido la aplicación mediante este método en especies como el Samán, Chiminango y Mango se vuelve tediosa, porque generalmente los árboles bajo las redes se encuentran con alturas mayores a los 7 metros dificultando así, la aspersión en toda el área foliar. Además de esto el trabajo técnico es poco práctico debido a que el operario debe trepar al árbol con el equipo de bomba de espalda, dificultando así su movilidad, y para garantizar efectividad de la absorción mediante el follaje de la planta con el método de aspersión foliar se debe lograr el alcance y contacto con toda la parte aérea de la planta, de no ser así no tendrá un efecto significativo la aplicación de Paclobutrazol (Greene, 1987), muchas sustancias foliares son lentamente absorbidas y pobremente traslocadas dentro de las hojas.

En las especies Swinglea y Totocal, se tuvo un efecto significativo con la aplicación foliar con la aplicación de la fitohormona, se explica debido a que estas especies al ser podadas mantienen una cantidad considerable de follaje en su copa, lo cual facilita que haya una absorción por medio del área foliar existente, además a pesar de poseer una cutícula gruesa, se facilita el transporte por medio de la aplicación que se tornó más efectiva debido a que la altura de los individuos permitió aspersar el producto en todo el área foliar. Una de las ventajas de utilizar la aplicación foliar, ya que al utilizar aplicaciones foliares de materiales tales como pesticidas, fertilizantes y fungicidas, es la omisión de herir al árbol (Rivas, 1996).

Una dificultad para la aplicación foliar radica en que se debe asegurar que el árbol no esté en periodo de floración, debido a que las abejas y otro tipo de polinizadores frecuentan las plantas y esto puede resultar toxico para ellas (ANLA, 2015).

Paclobutrazol, es un regulador para plantas móvil xilema que retarda el crecimiento vegetativo mediante la inhibición de la biosintesis de giberelina. Paclobutrazol reduce el crecimiento vegetativo, es más eficaz al ser aplicado al suelo o cerca de la base del árbol por inyección. Se puede utilizar en árboles de la lista que se encuentran en áreas tales como entornos urbanos, servidumbres de uso público, áreas residenciales y otras áreas no cultivadas (Arias, 2010).

Para el presente estudio, uno de los métodos más efectivos y prácticos, resultó ser el método de inyección-arborjet, debido a que el procedimiento se realiza de forma más ágil y resultó ser eficaz en las especies Matarratón, Samán, Palma Botella, Guácimo, Chiminango y Mango. Resultados similares encontró Sterret (1985), al evaluar Paclobutrazol en la especie *Ficus elástica* con aplicación mediante inyección, afirmando que es efectiva en plantas leñosas, además la porosidad difusa, facilitó el transporte del producto en el interior de la planta. Situación que se presenta en la mayoría de las plantas en mención, presentan tipo de porosidad difusa en su estructuración.

La respuesta positiva ante la aplicación mediante inyección en el tronco, también tiene otra explicación que depende de las características fisiológicas de cada planta, es decir que también influyen otros factores como el tamaño de los vasos conductores, la cual es otra característica relacionada con la entrada del material. En este sentido Los árboles con vasos de grandes diámetros, aceptarían rápidamente los productos químicos mediante la inyección, mientras que los de vasos de diámetros pequeños son menos apropiados para la conducción, como las coníferas, y la translocación se hará lentamente (Rivas, 1996).

El Paclobutrazol se transloca solamente por el xilema de los arboles hasta los puntos de crecimiento, donde se reduce la división celular en la parte subapical al impedir la acción de la giberelina (Wattson, 1987). Para mejorar la aplicación del producto mediante esta técnica se debe tener en cuenta que cuando se realizan aplicaciones de productos químicos, pequeñas cantidades de sustancias pueden ser succionadas hacia arriba dentro de la corriente xilemática del árbol, debido a que existe un gradiente de presión negativo. Si el punto deseado de acción es la copa del árbol, se tiene que hacer durante la transpiración activa, ya que existe ahí una alta concentración de solutos y por consiguiente el potencial de líquido xilemático es bajo (Rivas, 1996).

Es así como los tratamientos sistémicos en el tronco de los árboles son especialmente útiles cuando los métodos convencionales como la aspersión foliar o radicular resultan inefectivos, principalmente por cuestiones ambientales en donde no se debe utiliza aspersiones. Ya que las cantidades de químicos son sistemáticamente liberados dentro del árbol indicado, sin exponer el ambiente circundante, además se ha demostrado que no hay evidencia de cualquier organismo perjudicial que haya entrado a los sitios de tratamiento con inyecciones (Rivas, 1996), evitando contaminación a las corrientes de agua subterráneas y a la fauna existente alrededor del árbol a intervenir.

En las palmeras el tronco es de material similar al centro del mismo pero más endurecido y no lleva la savia que va por la zona central. Al final del tronco, está la yema apical o palmito (que en realidad pertenece a la copa). Esta estructura es el único punto por donde crece la palmera y si se estropeara sería su muerte; en este punto se facilitaría el transporte de Paclobutrazol mediante la inyección (Sánchez, 2017).

En un estudio realizado por Geoffrey (1986), se encontró que al inyectar el producto en el árbol conocido "Arce", notó que los brotes tornaron a ser más cortos que en los dos grupos de control. Situación similar se pudo observar en la especie Matarratón, como se puede observar en la figura 37. Además, se adelantó el proceso de floración y el follaje se tornó más verde.

Por otro lado, la agencia de protección ambiental de los EEUU (1984), agrega que la acción del Paclobutrazol puede ocurrir en pocas semanas, aunque la regulación de crecimiento puede no ser totalmente visible hasta 18 meses después de la aplicación. Efectos iniciales de Paclobutrazol puede observarse como un intenso reverdecimiento del follaje, los árboles tratados con Paclobutrazol exhibirán entrenudos más cortos, reducción en el crecimiento del diámetro de la madera del tallo principal y floración mejorada.

Los suelos de los valles donde se encuentra localizado los municipios de Palmira, Buga y Cali donde están situados los circuitos comparten la característica de ser suelos francos arcillosos con un pH neutro (Alcala, 2008). Por ende presentan buenas condiciones fisicoquímicas y retención de aguas, nutrientes o compuestos químicos, además en suelos francos tienen mayor capacidad de intercambio catiónico de los coloides reduciendo la lixiviación de ellos (Barletto, 1995).

Existen diferentes ventajas y desventajas para la aplicación del producto mediante la aspersión radicular, generalmente se requiere la incorporación del material en el suelo, por lo que resulta menos efectiva y normalmente toman mucho tiempo y lo más grave puede ser la contaminación de aguas subterráneas y de la fauna que allí alberga (Rivas, 1996).

Para la aplicación del Paclobutrazol mediante la aspersión radicular se puede hacer la aplicación durante todo el año, si el tiempo lo permite, excepto cuando el suelo se congela o se satura con agua. Ya que el Paclobutrazol es absorbido por las raíces de las plantas y trasladado a los tejidos en crecimiento en respuesta a la pérdida de agua por evaporación (transpiración). Si las solicitudes se hacen después de la caída de la hoja de la caída, la captación de Paclobutrazol no ocurrirá hasta el desarrollo de nuevas hojas en la primavera y la pérdida de agua por evaporación. (Protection agency, EEUU, 1984).

Sin embargo, la efectividad depende de ciertas variables como la especie, la profundidad de las raíces y la presencia de tricomas en las raíces, con lo que se facilitaría el transporte de las sustancias importantes para las plantas como el agua, y otros compuestos químicos. Aun teniendo efecto en las plantas se desconoce la cantidad de producto que la planta asimila, ya que una parte de este puede perderse por lixiviación, por eso la importancia de aplicar uniformemente el producto de tal forma que se garantice la mayor concentración en el área radicular del árbol, teniendo en cuenta la profundidad de las raíces.

La precipitación del lugar en donde se aplica el producto y la evapotranspiración determinan el déficit hídrico, ya que el agua es fundamental para el proceso de absorción de dichos compuestos, el intercambio de agua y solutos entre la célula y el medio requiere de la consideración de una estructura: la membrana que debido a sus características fisicoquímicas limita y controla el movimiento de iónes y otras sustancias (incluso el agua) hacia y desde el citoplasma, la barrera de mayor importancia para el movimiento de agua en la raíz se halla en las membranas de la endodermis (Torres, 2012).

La respuesta de la especie Ficus a la aplicación de Paclobutrazol corresponde a que este ha demostrado reducir la elongación de brotes y la expansión de las hojas en las especies arbóreas, mediante la disminución de niveles de giberelina y la elongación celular en el estudio por Street, 1986, además presenta raíces superficiales, lo cual contribuye a que el producto al ser aspersado en la superficie logre tener un contacto con este.

Con las podas se obtienen diferentes beneficios, uno de ellos es la reducción de la copa, implicando menor evapotranspiración, mediante la herida se activan células vivas que almacenan aceites, almidón y otras sustancias; éstas convierten sus reservas en compuestos que se distribuyen alrededor de la zona dañada, formando una barrera que restringe el paso de patógenos e insectos (Anaya, 2013).

CONCLUSIONES

Cada una de las especies responde de forma diferente a la aplicación del producto Paclobutrazol, dependiendo de sus estructuras de asimilación de los compuestos como sus hojas, su porosidad de la madera y la superficialidad de las raíces.

Para la mayoría de especies el efecto se empezó a notar después de las 20 semanas de aplicado el producto, sin embargo, para algunas especies como Matarratón (*G.*

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Open Forests

Open Forests (https://openforests.com/) provides a range of information on forest information technologies for sustainable forest management. A sample of that information can be found at the following links:

- **Remote Sensing for Forest Landscapes:** https://medium.com/openforests/remote-sensing-for-forest-landscapes-83e246261c21
- **OpenForests launches the forest project platform explorer.land**: https://medium.com/openforests/openforests-launches-the-forest-project-platform-explorer-land-e195da08a554
- **Forest Information Technology to Protect and Manage Forests Sustainably:** https://medium.com/openforests/forest-information-technology-to-protect-and-manage-forests-sustainably-d2a6278beb37
- **Information-based solutions for forest conservation projects:** https://news.mongabay.com/2018/11/information-based-solutions-for-forest-conservation-projects/

New England Biolabs Foundation

New England Biolabs Foundation offers funding for community-based projects by non-profit organizations in Central America, South America and West Africa. Deadline for submission of letter of interest is March 25, 2019. Get more information and apply via the link: http://www.nebf.org/how-to-apply/application-deadlines/

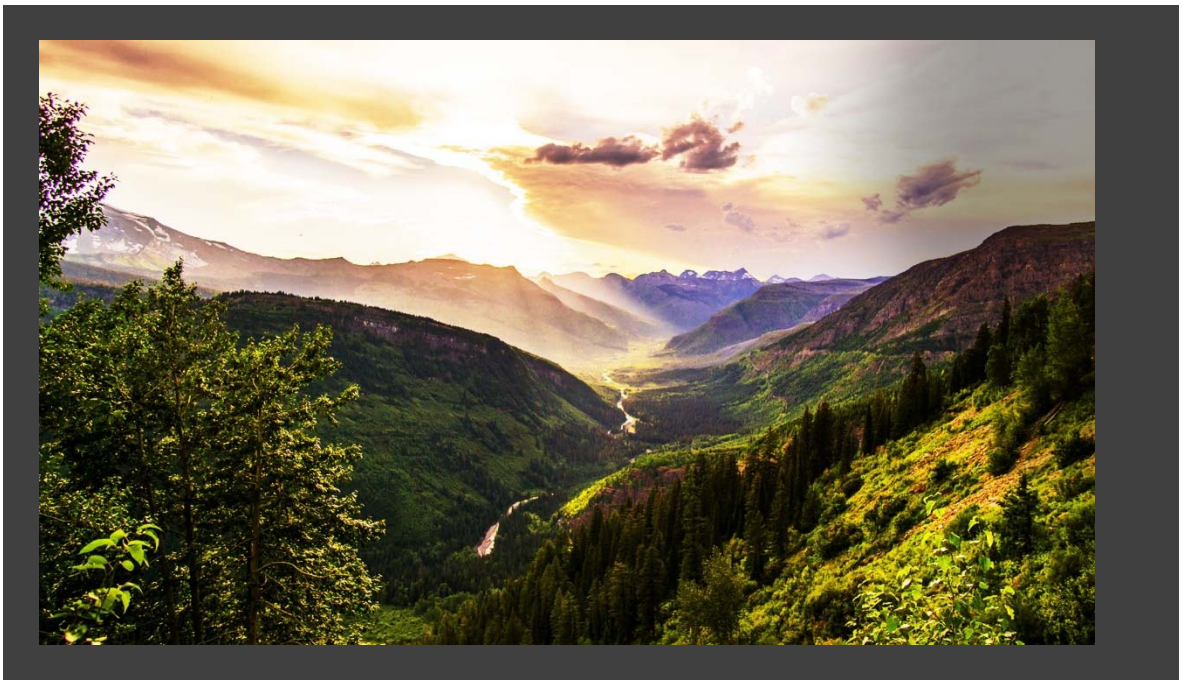
Asia-Pacific Forestry Week 2019

Forests for Peace and Well-being

17-21 June 2019 I Incheon, Republic of Korea

The Food and Agriculture Organization of the United Nations (FAO), the Korea Forest Service (KFS), the Incheon Metropolitan City and partners invite people interested in and committed to sustainable forest management in Asia and the Pacific to come together for the Asia-Pacific Forestry Week (APFW) 2019 in Incheon, the Republic of Korea from 17 to 21 June 2019.

APFW 2019 is expected to be one of the largest and most important forestry gatherings in the region in 2019. *APFW 2019: Forests for Peace and Well-being* seeks to encourage participants to chart new pathways that guide the development of forestry into the future.



APFW 2019 will be organized along five streams:

1 *Restoring our forests and landscapes*

2 *People and forests living in harmony*

3 *Building a resilient environment*

4 *Promoting responsible trade and markets*

5 *Innovating governance and institutions*

Streams will comprise a range of workshops, seminars, panels, business meetings, and other innovative events that will contribute to a broad and inclusive dialogue and outcomes that will help to shape the future of forestry in the Asia-Pacific region.

Call for Events

APFW 2019 is designed to encourage broad participation of various stakeholders. Organizations with an interest in Asia-Pacific forestry are invited to run their own partner events as part of APFW 2019. Don't miss this important opportunity. Register to organize a partner event at APFW 2019. Send in your applications by **31 March 2019**.

Information: http://www.apfw2019korea.kr/

Our mailing address is:

AP-Forestry-Week@fao.org

Forest Education and Science at 2019 World Wood Day Symposium

The theme of the 2019 International Day of Forests is "Forest and Education". This theme will be one of the five key topics to be discussed at a scientific symposium on 21-23 March as part of the 2019 World Wood Day celebrations in Stübing, Austria. The symposium “CHANGE – from tradition to innovation” is jointly organized by IAWA, IAWS and IUFRO. Sandra Rodríguez-Pineros from the Universidad Autónoma de Chihuahua, Mexico, and Coordinator of the Joint IUFRO-IFSA Task Force on Forest Education, will deliver a keynote speech on “Education – an essential tool for forest sustainability and wood utilization”. Other symposium topics are proper tree species identification and illegal timber use, wooden buildings, wood-based musical instruments, and non-wood products.

World Wood Day is an annual event to celebrate the importance of wood, demonstrate the beauty of wood, and share the knowledge about wood. This year’s celebrations will take place

under the motto “CHANGE”. A variety of programs such as woodcraft activities, folk art workshops and events for children will be organized for the public with free admission.

The 2019 WWD event in Austria is jointly organized by the World Wood Day Foundation (WWDF) and the International Wood Culture Society (IWCS). The event will bring more than 500 participants from over 90 countries and regions from around the world to the Austrian Open Air Stübing and Graz.

Links:
IUFRO Forest Products Culture: https://www.iufro.org/science/divisions/division-5/50000/51500/
WWD Symposium: http://www.worldwoodday.org/2019/regions_event/39
WWD: http://www.worldwoodday.org/2019/home
Joint IUFRO-IFSA TF: https://www.iufro.org/science/task-forces/forest-education/

U.S. FOREST SERVICE
INTERNATIONAL PROGRAMS

CENTER FOR PROTECTED AREA MANAGEMENT
COLORADO STATE UNIVERSITY

INTERNATIONAL SEMINAR ON PLANNING & MANAGING TOURISM IN PROTECTED AREAS

2019

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

U.S. FOREST SERVICE
INTERNATIONAL PROGRAMS

COLORADO STATE
UNIVERSITY

SEMINAR THEMES

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

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

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

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

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

HOW TO APPLY

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

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

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

SEMINAR EXPENSES

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

Louisville National SAF

The deadline for presentations and workshops at the Louisville National SAF Convention is March 31st. We are always looking for International focused talks and are especially interested in presentations that feature how our student members, professional members, and retired members can get involved in overseas programs and projects.

Abstracts can be submitted through the SAF website. Although "International Forestry" isn't listed as one of the areas accepting abstracts, we really do want presentations about projects outside of our borders. Last year we had three sessions, of three talks each, listed under "International Forestry – Making an Impact Beyond our Borders." It would be great to have an equal or better showing this coming fall.

If you have ideas on projects that the International Forestry Working Group should get involved in, please let me know!

Bob Sturtevant (Robert.Sturtevant@ColoState.EDU)
Working Group Chair

Join an SAF Working Group

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

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

Join a working group here:

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

ISTF Update March, 2019

1. ISTF Election. The results of the election for the Central Board of the International Society of Tropical Foresters are in. The new officers are: President-elect: Warren K. ("Keith") Moser (pending US Forest Service [employer] approval); Vice-President: Ruth Metzel; Secretary: Maria Paula Sarigumba; Treasurer: Mike Sterner; Tropical Africa Representative: Daniel Kofi Abu; Tropical America Representative: Rene Zamora-Cristales; Tropical Asia-Pacific-Australia Representative: Patrick Durst. Congratulations to the new Board, which held its first meeting on January 22.

2. The ISTF Board invites members to participate in the ISTF Standing Committees. These committees are critical for moving ISTF forward. If you would like to participate in a committee, please fill out this survey by March 20, 2019. These committees are critical to ISTF function. The Board will review prospective committee members by April 1, 2019. The committees and their responsibilities, and current action items to be undertaken first are given here.
Governance Committee: will oversee membership recruitment, nominations, chapter affairs, and other governance issues. ISTF Board members on Governance Committee: Treasurer Michael Sterner; Asia-Pacific-Australia Representative Patrick Durst. PRIORITY ACTION ITEMS: Application for non-profit status. Chapter success metrics, application, and review process.
Finance Committee: will develop the annual budget for the organization, oversee its implementation, perform an internal audit, and assist in obtaining funding for ISTF. ISTF Board members on Finance Committee: Africa Representative Daniel Kofi Abu; Tropical America Representative Rene Zamora-Cristales. PRIORITY ACTION ITEMS: Resource mobilization strategy and Dues structure. Hunt for funding. Branding strategy
Mission Committee: will oversee ISTF communications, including the newsletter; oversee trainings and educational materials in tropical forestry for members; and select topics concerning tropical forests and forestry, for advocacy or for developing informational resources. Board members on Mission Committee: Vice President Ruth Metzel; Secretary Maria Paula Sarigumba PRIORITY ACTION ITEMS: Develop a three-year communication strategy for ISTF, website

Board members other than the president each serve on one of these committees. Therefore, each committee will have two board members. Other committee members shall be interested members of ISTF as appointed by the ISTF president. Each committee shall elect its own chair from among participating members, who are not participating board members. These Committees may delegate particular responsibilities to subcommittees incorporating additional ISTF members.

2. New Yale F&ES online certificate program: Tropical Forest Landscapes. The Environmental Leadership & Training Initiative (ELTI) at Yale University in collaboration with the Yale School of Forestry & Environmental Studies is proud to announce an exciting new online certificate program: Tropical Forest Landscapes: Conservation, Restoration and Sustainable Use. This yearlong program consists of four eight-week online courses, a capstone project and an optional field course in Latin America or Asia. This program is designed for

professionals working to address the complex social, ecological and funding aspects of managing tropical forest landscapes. Participants learn from a diverse team of Yale faculty members, ELTI team members and a network of international partners:

- : Ecological and social concepts
- : Community and institutional engagement
- : Implementing and monitoring techniques
- : Financial concepts and tools
- : Designing a conservation or restoration project

The program will run from June 2019 - May 2020. Applications are open now. The priority deadline for applications and scholarship eligibility is March 7, 2019. The final deadline is April 15, 2019.We invite you to apply and share this program with friends, partners and colleagues. Interested in learning more? Visit the website at: https://tropicalrestorationcertificate.yale.edu/

4. MSc Tropical Forestry (distance learning): 10 scholarships available for September 2019 entry at the University of Bangor, Wale. Please find below a link to information about scholarships to the MSc Tropical Forestry (distance learning) programme, for September 2019 entry.
https://www.bangor.ac.uk/natural-sciences/subject-areas/forestry/news/prestigious-scholarships-awarded-for-msc-tropical-forestry-at-bangor-university-apply-now-39769
Awarded by the Commonwealth Scholarship Commission (CSC), these scholarships are exclusively for scholars from developing Commonwealth countries: Ghana, Guyana, Kenya, Lesotho, Malawi, Papua New Guinea, Tanzania, Uganda and Zambia. The scholarship includes international tuition fees, a study grant to help scholars with the costs of distance-learning study (such as internet data) plus a travel scholarship for a Tropical Forestry Study Tour in July 2021. Deadline: 12:00 BST, 22nd March 2019

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

6. Invitation to submit articles to the STEiSCOPE magazine. The STEi (pronounced as style) Foundation, is a young and promising Pan African Nonprofit Organization. STEi Foundation is an acronym for Sustainable TransEnvironment International Foundation, which was officially certified by the Corporate Affairs Commission (CAC) of Nigeriain 2017. Already, STEi Foundation has representations in Seventeen (17) African countries This magazine promotes sustainable development in Africa, for both people and the environment, and promises to have reach throughout Africa, and beyond. The first edition will be on “greening the environment and

empowering the people of rural communities". ISTF members are invited to submit articles for future editions. For more information and to subscribe to the magazine, contact John Ogbodo jaogbodo@gmail.com

7. The XXV World Congress of the International Union of Forest Research Organizations (IUFRO2019) will be held 29 Sept – 5 oct 2019 at Curitiba, Brazil. See the website http://iufro2019.com/ for more information. ISTF is organizing or co-organizing seven sessions for the Congress (see below, and thanks everyone for the effort!). Please consider attending IUFRO2019.

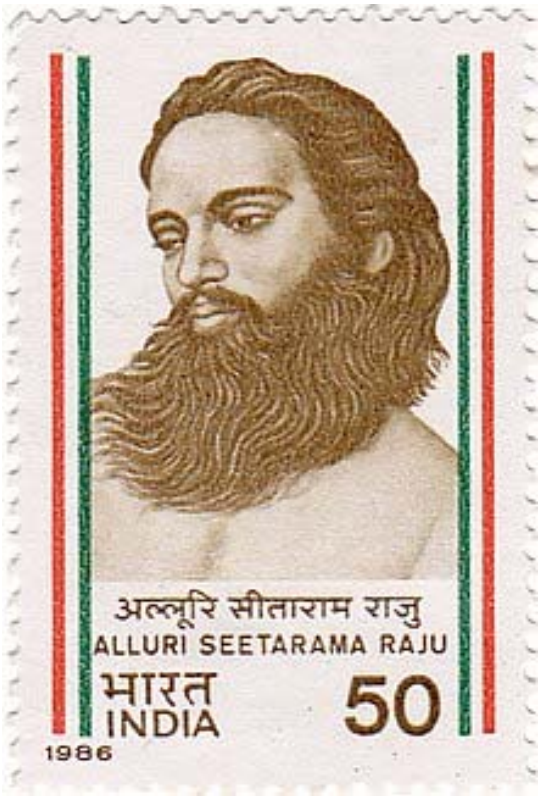
8. ISTF online resources. A new ISTF website is under development, thanks to the team of Paul Dargusch at the University of Queensland. Ciro Moura and Adriane Tobias will help. The current online resources for ISTF include:
1) Blair Orr's continuation of the former ISTF newsletter as a newsletter for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

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

10. ISTF membership. ISTF now stands at ~1200 members. Help us keep growing! If you have any contacts that you would like to invite to join ISTF, you can use the following message:

Dear friends:
We hope you will be interested in joining the International Society of Tropical Foresters (ISTF). With its focus on being a communication network, ISTF can help you connect with others interested in tropical forests and forestry. ISTF was founded in the 1950s and "in response to a worldwide concern for the fate of tropical and subtropical forests, ISTF is committed to the protection, wise management and rational use of the world's tropical forests". So far, over 700 people from around the world have joined. For now, the organization will be dues-free (although this is under discussion). If you would like to join, please fill out the membership form at GoogleForms .Questions? Email tropicalforesters@gmail.com

From the archives:



1986 India Postal Department stamp honoring Alluri Seetarama Raju.
https://www.geni.com/people/Alluri-Seetharama-Raju/6000000035076894547

Recent Publications and Research Notes

"Forestry in Brazil: A Brief History"

Sebastião Kengen, skengen@terra.com.br, 99 pages. Available at no charge online at:

http://www.orrforest.net/saf/LIVROForestryInBrazil.pdf

This paper it is an attempt to bring another vision of forestry development in Brazilian history. The generalized vision is that the Portuguese colonizer had a disregard to the Brazilian forest resources. This argument does not take into account that a similar process of exploration of forest resources took place along the colonization all over of the New World. Along the worldwide history, forest resources have been seen as a valuable resource to be used as well as endless. Therefore, it was not different in the Brazilian colonization. Within this context, it is fair to point out that the forest exploration has not been good or bad, but it follows a common pattern.

Therefore, it is important to take into account the context of each time and that the factors that have contributed to a more or less forest exploration. This approach is valid to all process of forest management since the early stages of the Brazilian colonization up to the present.

It is not the aim of this paper to exhaust the theme, but, on the contrary the aim is to contribute to stimulate other researches go further and bring new information and facts on the Brazilian forest history. To take lessons and experiences from past they contribute to advance with positive experiences, understand the present and avoid to incur in the same mistakes that took place in the past. Along the Brazilian history its forests have been managed from a utilitarian perspective to a preservationist point of view that is taking place at present. It is fair to assume that both extremes are not good. Therefore, the great challenge to the Brazilian Government it is to find an equilibrium point between conservation and development what it is not an easy task.

Biodiversity Recovery in Secondary Forests

Rosendaal, D. et al. (2019). Biodiversity recovery of Neotropical secondary forests. *Science Advances*. 5: eaau3114. Available (open access) from:
http://advances.sciencemag.org/content/5/3/eaau3114
DOI: 10.1126/sciadv.aau3134

An international team of ecologists from Latin America, the USA and Europe, led by researchers from Wageningen University, published a study in Science Advances elucidating the role of regrowth on diversity conservation of tropical trees. They inventoried trees in 1,800 tropical forest plots located in 56 sites across 10 countries in Latin America. They used plot data from secondary forests of different ages and compared it to neighbouring, well-conserved, old-growth forests. They show that species richness of these small forest patches recovers in a few decades, but that it may take centuries before their species composition becomes similar to that of old-growth forests.

Comparison of Sentinel-2 and Landsat-8 OLI Data

Arekhi, M., Goksel, C., Sanli, F.B., and Senel, G. (2019). Comparative evaluation of the spectral and spatial consistency of Sentinel-2 and Landsat-8 OLI Data for Igneada Longos forest. *International Journal of Geo-Information*. 8(2):56.

https://www.mdpi.com/2220-9964/8/2/56

Abstract: This study aims to test the spectral and spatial consistency of Sentinel-2 and Landsat-8 OLI data for the potential of monitoring longos forests for four seasons in Igneada, Turkey. Vegetation indices, including Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI) and Normalized Difference Water Index (NDWI), were generated for the study area in addition to the five corresponding bands of Sentinel-2 and Landsat-8 OLI

Images. Although the spectral consistency of the data was interpreted by cross-calibration analysis using the Pearson correlation coefficient, spatial consistency was evaluated by descriptive statistical analysis of investigated variables. In general, the highest correlation values were achieved for the images that were acquired in the spring season for almost all investigated variables. In the spring season, among the investigated variables, the Red band (B4), NDVI and EVI have the largest correlation coefficients of 0.94, 0.92 and 0.91, respectively. Regarding the spatial consistency, the mean and standard deviation values of all variables were consistent for all seasons except for the mean value of the NDVI for the fall season. As a result, if there is no atmospheric effect or data retrieval/acquisition error, either Landsat-8 or Sentinel-2 can be used as a combination or to provide the continuity data in longos monitoring applications. This study contributes to longos forest monitoring science in terms of remote sensing data analysis.

Logging Contractors' Growth in the Southern Cone

Patricio Mac Donagh, Santiago José Elías Velazco , Guido F. Botta, Tomas Schlichter and Frederick Cubbage. () Logging Contractors' Growth in the Southern Cone: An Analysis of Contractor Business Strategies, Innovation, and Mechanization. *Forests* **2019**, *10*, 69; doi:10.3390/f10010069

https://www.mdpi.com/1999-4907/10/1/69

Abstract: Forest plantations have increased in South America for several decades. Harvesting is performed mainly through contractor companies. Our hypothesis is that logging contractors that innovate, grow more than others. We analyzed logging contractors through production and innovation, working in Argentina (22), Brazil (35) and Uruguay (10), through surveys between 2008 and 2012. Factors that affected firm growth were analyzed with linear mixed effect models. In all three countries there was a preponderance of logging contractors with cellulose companies. Our results show that logging firms that had mutualistic supply chain relations with the contracting organizations had better production indicators and lower cost per ton than other independent harvesting contractors. In the last 10 years, mechanization increased significantly, reducing the number of employees. Innovation was the most significant variable in enhanced logging production. For the period from 10 to 5 years before the survey period, the number of employees and type of contracting company were most significant on loggers' growth. During the last 5-year period before the survey period, the number of employees and innovation were significant. Thus, during the last 10 years, logging companies shifted from growth based on type of the firm to the amount of innovation by firms, and contracting companies.

Private Forests in India

Sushant, K. (2019) Unlocking the potential of private forests in Madhya Pradesh, India.

Area Development and Policy

https://doi.org/10.1080/23792949.2018.1549955

Abstract: Trees outside state-owned forests have the potential to meet local and national needs for timber, pulp and allied industries, reduce imports, and increase carbon sequestration. An analysis of the operation of private forestry in the state of Madhya Pradesh, India, indicates that the realization of this potential involves a liberalization of existing legislation and specified changes in regulatory procedures that at present result in delays in seeking permission to fell timber, transport it and receive payments, which cause private forest owners to lose interest in tree planting and to shift towards alternative uses of their land.

Interested readers may also request copy of the full paper by an email to katariasushant@hotmail.com.

Drought and Stem Growth in an Aseasonal, Everwet Forest

Hogan, J. Aaron, Sean M. McMahon, Vanessa Buzzard, Sean T. Michaletz, Brian J. Enquist, Jill Thompson, Nathan G. Swenson, and Jess K. Zimmerman. Drought and the interannual variability of stem growth in an aseasonal, everwet forest. *Biotropica*. DOI: 10.1111/btp.12624

link: https://onlinelibrary.wiley.com/doi/full/10.1111/btp.12624
(or available by emailrequest to jamesaaronhogan@gmail.com)

Abstract: Linking drought to the timing of physiological processes governing tree growth remains one limitation in forecasting climate change effects on tropical trees. Using dendrometers, we measured fine-scale growth for 96 trees of 25 species from 2013 to 2016 in an everwet forest in Puerto Rico. Rainfall over this time span varied, including an unusual, severe El Niño drought in 2015. We assessed how growing season onset, median day, conclusion, and length varied with absolute growth rate and tree size over time. Stem growth was seasonal, beginning in February, peaking in July, and ending in November. Species growth rates varied between 0 and 8 mm/year and correlated weakly with specific leaf area, leaf phosphorus, and leaf nitrogen, and to a lesser degree with wood specific gravity and plant height. Drought and tree growth were decoupled, and drought lengthened and increased variation in growing season length. During the 2015 drought, many trees terminated growth early but did not necessarily grow less. In the year following drought, trees grew more over a shorter growing season, with many smaller trees showing a post-drought increase in growth. We attribute the increased growth of smaller trees to release from light limitation as the canopy thinned because of the drought, and less inferred hydraulic stress than larger trees during drought. Soil type accounted for interannual and interspecific differences, with the finest Zarzal clays reducing tree growth. We conclude that drought affects the phenological timing of tree growth and favors the post-drought growth of smaller, sub-canopy trees in this everwet forest.

Agroforestry Seed Systems

Lillesø, J.P.B., Harwood, C., Derero, A., Graudal, L., Roshetko, J.M., Kindt, R., Moestrup, S., Omondi, W. O., Holtne, N., Mbora, A., van Breugel, P., Dawson, I. K., Jamnadass, R. and Egelyng, H. 2018. Why Institutional Environments for Agroforestry Seed Systems Matter. *Development Policy Review* 36: O89–O112

Abstract: Rethinking the logic of institutional environments aiming to facilitate agroforestry smallholders in economic development, this article compares smallholder input supply systems for crop and tree seeds in sub- Saharan Africa and reflects on two basic challenges: (1) how to develop a large number of relevant tree crops for different agroecologies, (2) how to reach smallholders in rural areas. Policy options for improving agroforestry input supply systems are discussed, whereby our article concludes with suggestions how sectoral approaches for crop seed systems can be modified to agroforestry seed-seedling systems. Biophysical differences have practical implications for how the logic of the 'African green revolution' would be translated into a corresponding revolution for agroforestry

The paper is open access and can be downloaded from
https://onlinelibrary.wiley.com/doi/epdf/10.1111/dpr.12233

Soil Microarthropods in Kerala, India

Lakshmi, G. & Joseph, A. Soil microarthropods as indicators of soil quality of tropical home gardens in a village in Kerala, India. *Agroforest Syst* (2017) 91: 439.
https://doi.org/10.1007/s10457-016-9941-z
e mail: melakshmigop@gmail.com

Abstract
The cosmopolitan distribution of soil microarthropods and their various degrees of adaptation make them suitable tools for assessing soil ecosystem health. In this study, the microarthropod abundance of 25 home gardens in Kerala state located in South West coast of India was studied during summer and north east monsoon season of 2014. The soil microarthropods were categorized into six groups: collembola, coleoptera, hymenoptera, araeneae, acari and diplopoda. Their numbers varied from 0 to 28 per 1000 cm^3 and were more abundant in the rainy season than in summer. The occurrence of these microarthropods was positively correlated to soil moisture and organic carbon and had negative correlation to soil temperature and soil pH. The presence of eu-edaphic and epi-edaphic microarthropod fauna was used to derive the soil quality index of each home garden and soil quality classes were defined. Out of the 25 home gardens, two were of good quality, 21 were of medium quality and two were of poor quality. The study supports the scope of applying the indicator value of soil microarthropods in future studies related to soil quality, management and conservation of tropical home garden ecosystems, which are facing threats of removal of canopy and unscientific land management practices.

https://doi.org/10.1007/s10457-016-9941-z

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

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

Nutrients from bamboo forest

Nutrients were collected in plots of Bambusa vulgaris in an area of Ife-Ife, Nigeria where nutrient availability was lacking. Leaves and twigs oven dried to a constant weight. Ground and analysed for nutrients. Leaf litter had a higher concentration of Ca, P, Na, Mn, Zn, and Cu. Twig litter had C, Mg, Fe, and N. In the soil dominated by bamboo shoots, exchangeable cations, pH, sand content, and organic C were lower, while total N, available P silt and clay contents were higher in the soil dominated by bamboo stands. *Bambusa vulgaris* is a better conserver of C, N, and P than the secondary forest.

T. V. Bonsade and others. Nutrient input in litter and soil of *Bambusa vulgaris* stands in a secondary rainforest, Ife_Ife, Nigeria.[Journal of Tropical Forest Science 30 (2) 195-205 2018].

Eucalyptus charcoal species

In Rio Grande do Sul, Brazil the seven-year-old commercial plantation *Eucalyptus benthami, E. dunnii, E. grandis, E. saligna, and E. urophylla X E. grandis* woods were evaluated for charcoal production. The species *E. benthami* was superior compared to the others, and so is the most useful for charcoal production. The wood properties determined included basic density, structural chemical composition, and high heating value. The wood was carbonized in a furnace with a known heating rate. The yield of charcoal pirolenous liquor and non-condensable gases were collected. Charcoal properties evaluated were fixed carbon and ash contents.

R. Simetti and others. Wood quality of Eucalyptus species planted in Rio Grande doSul, Brazil, for charcoal production. [Journal of Tropical Forest Science 30 (*2) 175-181 2018].

Gap size and location for regeneration

Castanopsi kawakamii is endangered due to its low population in the middle stage of development due to low percentage of seedlings in natural conditions. The number of *C. Kawakamii* tree, sapling, shrub, and seedlings within a gap 9 center, south, east, north, and west, during a growing season were measured. A significant positive relationship was found between the number and gap area with higher numbers in large gap size and the center of these gaps.

S. Buajan and others. Effects of gap size and locations on the regeneration of *Castanopsis kawakamii* in a subtropical natural forest, China. [Journal of Tropical Forest Science 30 (1) 39-48 2018].

Timber management impact in Malaysia

The eeconomic impact of the sawn timber market under sustainable forest management was examined from 1980 to 2015. Scenarios included reduction in harvested area, increase in the domestic price of sawn timber, increase in input cost, and the increase of contribution of forestry and harvesting activities to total gross domestic product. The supply and export of sawn timber had a positive impact on sustainable forest management. It was found possible to boost the sawn timber industry without compromising efforts to sustain and conserve forest resources.

W. Noraida and others. Sawn timber market and the impact of sustainable forest management practices in Peninsular Malaysia [Journal of Tropical forest Science 30 (1) 9-24 2018].

Peatland regeneration in Kalamantan

Reforestation in degraded peatlands is a major challenge. Careful selection of species and management techniques are needed. A regeneration study area had weeding mounding, and fertilizing for five native tree species. The seedlings of *Shorea balangeran* can be recommended. *Alstonia* and *Dacryodes* performed relatively well. Wildfires engulfed the study area two years after planting.

M. Lampela and others. To treat or not to treat? The seeding performance of native tree species for reforestation on degraded tropical peatlands of SE Asia. [Forest Ecology and Management 429 217=225 2018].

Litterfall for regeneration

A hypothesis assumes that leaf litter, quantity and quality, could differ in line with forest disturbances and that these changes would translate into dissimilar decomposition rates. Litterfall and litter decomposition n position are slowed by disturbances. Both processes became stabilized in secondary forest.

Silva and others. Are litterfall and litter decomposition indicators of forest regeneration in the Neo tropics? Highlights from a case study in the Brazilian Amazon. [Forest Ecology and Management 429 189-197 2018].

Nutrient leakage from green leaves

Nutrients (NH4, PO4, and K) leaching from oven-dried green leaves of *Emblica*, *Sesbania*, and *Moringa* were soaked 8 days in demineralized, distilled water. Electrical conductivity, (EC) dissolved solids (TDS) and nutrients (were measured up to 192 hours. The concentrations of nutrients in the leachate of the three species were not significantly different. *Sesbania* and *Moringa* leaves are potential sources of agricultural nutrients.

S. H. Limon and 0thers. Nutrients leaching from green leaves of three potential agroforestry systems. [Agroforestry Systems 92 (2) 389-395 2018].

Soil carbon sequestration in agroforestry

Review of 53 published studies showed increases. In soil organic carbon with the participation of trees and forests, compared to agriculture, pasture, and uncultivated crops. Differentials ranged from 10 to 34%.

E Stafano and others. Soil carbon sequestration in agroforestry a metanalysis. Agroforestry Systems 92 (2) 285-299 2018)

Cocoa future in Ghana

To meet the growing global demand for cocoa intensification in West Africa is crucial. A total of 731 farmers from four districts and all six cocoa growing regions were questioned. Results from a questionnaire indicate low income. Profits average $150/ha. Farm management requires control of black pod disease and capsids, regular pruning and efficient application of fertilizers rather than focusing on excessive land expansion at a cost to both productivity and biodiversity.

J. E. Kingor and others Constraints for future cocoa production in Ghana. [Agroforestry systems 92 (5) 1373-1385 2018].

Biofuel impact on agroforestry in India

A study analyzed biofuel production as tree-borne non-edible oilseed production benefits generated by planting multipurpose trees on bunds and boundaries of agricultural fields. The strategy depends on the investment required, the operational practices required, and the benefit potential at the farm level. State requirements on biofuel agroforestry include socio-economic impact on small- and large-holder farmers. With these assurances, biofuel production is accepted by the farming community.

Bohra and others. Socio-economic impact of biofuel agroforestry systems on small holder and large -holder farmers in Karnataka, India [Agroforestry Systems 92 (3) 759-774 2018].

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 Winter 2018 issue, Vol. 72, No. 3

Survival and Growth of Interior Spruce in Britain (SF pp. 22-29)

By Gary Kerr, Jack Forster and Rob Coventry, contact gary.kerr@forestry.gsi.gov.uk

Summary: Interior spruce is the name given to white spruce (Picea glauca (Mornch) (Voss), Englemann spruce (Picea englemannii (Parry) Englem.) and the hybrids of the two species growing in the Pacific Northwest. A series of experiments was planted in 1985 to examine the potential of Interior spruce as a possible alternative to Sitka spruce (Picea sitchensis (Bong.) Carr.) Recent interest in species options in British forestry, motivated by the policy of building resilience in planted forests, has led Forest Research to examine some of its long-term experiments. Twelve seed origins if Interior spruce were planted in randomized block experiments at four sites in Scotland and one in England. At each one of the Scottish sites, growth was compared with Sitka spruce. in England the control species was Norway spruce (Picea abies)L.) Karst). Analysis of early results for survival and growth after 30 years shows that Interior spruce can survive well but growth is modest in terms of volume production The control species were at

least five times more productive. This probably rules out Interior spruce as an option in situations where timber production is an important objective.

A commentary: Alternatives to Sitka: A Private Sector View (pp. 32-37)

By David Williams, contact djwforestry@yandex.com

Scotland has half a million hectares of Sitka spruce. (Scotland is about the size of West Virginia. -- RR) Should it diversify towards alternative species? Most in the private sector are sceptical. Sweden has ten million hectares of spruce and no plans for change. Several reasons to plant Sitka are that it is Scotland's most widely accepted commercial timber species, it is tolerant of wind exposure, salt spray and wet soil; It flourishes from the seashore to high elevations. It grows fast and is one of Scotland's tallest trees, and its origin was mostly from the Queen Charlotte Islands where the climate is a good match for Scotland. There are counter arguments. Sawmills like smaller 40 cm dbh Sitka but pay less for large trees of around 70 cm dbh; it does not do well on poor soils, and spruce aphid can be a problem. Several alternative species from North America and Europe are discussed. In conclusion, Sitka spruce is very well adapted to Scottish conditions and to timber production. It occupies 6% of Scotland's land area; so why cut back? There are several species that should be used more widely but not necessarily with Sitka-style silviculture.

Small Local Forestry Businesses in Scotland. (pp. 38-44)

By Rick Worrell, Anna Lawrence, Buy Watt, Simon Pepper and Willie McGhee, contact anna@randomforest.ink

Small businesses are a significant feature of forestry in Scotland. They have expanded in numbers and scope in recent decades, to such an extent that we can identify them as a distinct sector. Some are doing things in new ways, reinventing crafts and making them work in the modern economy. Others are more radical, community-based or with distinct social aims, occupying new exciting roles. Many are servicing the expanding needs of the forestry and timber industries using new tools. Mobile sawmills are even starting to look part pf the establishment. Exciting things are happening: people are trying out new things, finding out what succeeds and what fails and pushing into new business territory.

This paper makes the case for paying more attention to this sector. These businesses generate jobs and money in ways which make forests more important to more people. Many generate jobs in remote rural locations, or less well-off peri-urban areas where other opportunities are limited. Their wider social impacts include the potential for generating "sticky money", which circulates several times in local economies, and for providing new training opportunities.

Small local forestry businesses are micro scale businesses, typically owned and managed by the employees and operating locally.

Travel Opportunities

If anyone is traveling to Scotland this spring or summer, the Royal Scottish Forestry Society has several field trips scheduled. Go and meet your professional counterparts and forest owners. For details visit the web site www.rsfs.org.

Notes from the editor

The ever-expanding subscription list: This newsletter will be sent to over 2,000 subscribers.

Feel free to send this newsletter on to others.

Many thanks to the many contributors to this issue. The next issue is scheduled for June 2019.

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

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

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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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