



Excerpts from
TROPICAL FORESTRY ABSTRACTS I

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FOREWORD

Frank Wadsworth: During 1942-1949 Frank learned from tropical forestry research based in Puerto Rico. During 1950-2000 Frank traveled much in the tropics, learning from forests and foresters in the Americas, Africa, Asia, and Australia. Based on these experiences, during 1976-2019, Frank selected key abstracts for the Tropical Forestry Notes for International Society of Tropical Foresters and the Society of American Foresters. Through the Notes, Frank hopes to help tropical foresters increase their understanding, including of tropical forest ecology and wildlife conservation.

Frank respects the scientists and science behind the selected abstracts. For the busy forester, at times he has strived to express more concisely the information they contain.

Isabel (Beba) M. Fernández: Isabel is an attorney in Puerto Rico, married to Attorney Ivan Fernández, and a resourceful mother of two. She facilitated the production of this volume of Tropical Forestry Notes with loving, hands-on labor, providing Frank with key information from each selected abstract in large print, and assisting with the editing.

NOTES

This volume is a compendium of excerpts of selected abstracts from recently published tropical forestry research, followed by citations of that research. Many of these abstracts were obtained through the library of the USDA Forest Service International Institute of Tropical Forestry in Puerto Rico.

D = We thought this was of special interest.

Note: It is suggested to use the search function in your PDF reader to find articles on topics of interest.

2019-

TROPICAL FORESTRY NOTES (1)

WHITHER THE LOWLAND EVERGREEN FORESTS OF SOUTHEAST ASIA?

The global value of tropical forests is increasing for atmospheric carbon sequestration and biodiversity conservation, as well as local and regional services. But little now remains of the lowland dipterocarp forest, logged over the last fifty years as home markets were neglected in favor of exportation, increasingly exacerbated by conversion to oil palm on soils for which techniques for sustainable silvicultural management had become known. What remains will be amenable only to selective silvicultural management methods based on deep knowledge of tree flora, growth rates, and methods developed by continuing research and trials, with oversight by highly trained researchers and technicians. These will be costly. Successful management must depend on international investment and support. P. Ashton. What future for Asia's lowland tropical evergreen forests? [Journal of Tropical Forest Science 30 (5) 418-423 2018] D

HOME GARDEN BENEFITS

Soils under home gardens in Central Amazonia were compared with those of adjacent primary and secondary forest soils to a depth of 30 cm. Gardens raised the pH of the average soil from 4.3 to 4.4. Management raised phosphorus from 5 to 14 mg/kg, decreased calcium 0.1 cmol/kg, increased aluminum from 3.0 to 3.2 cmol/kg, organic carbon from 11 to 13 g/kg, and calcium from 0.24 to 0.38 cmol/kg. Magnesium and potassium were not significantly different from those of primary and secondary forest soils. The management of home gardens contributes to maintain or increase soil fertility. M. Vieira da Cunha Salim and others. Soil fertility management in indigenous home gardens of Central Amazonia, Brazil. [Agroforestry Systems 92 (2) 463-472 2018] D

WILD MEAT VALUE FOR LOCAL FOOD SECURITY

The food security value of wild meat extracted from natural ecosystems remains poorly quantified. Here we provide an economic valuation of the nutritional and monetary benefits of year-around wild-meat hunting across a large international region of southwestern Amazonia, using data from indigenous and non-indigenous settlements from 30 sites. We then build scenarios to explore whether three ubiquitous sources of regional-scale household income (wage labor, horticultural revenues from manioc flour production, and the harvest of Brazil-nuts) could match the purchase costs of alternative meat demand to meet domestic consumption of animal protein should game stocks collapse. We also considered a fourth valuation scenario in terms of game meat substitution with bovine beef. We conservatively estimate a total annual consumption of 1,431 tons of dressed animal carcasses, equivalent to a mean per capita meat consumption of 55 kg per person per year, or 10.9 kg of animal protein per person, per year. This overall consumption of terrestrial wildlife meat provides US\$7.875 million per year across the study region. However, household income levels were too low to enable transitions into domestic livestock consumption, indicating low adaptation capacity to alternative animal protein. Replacement purchases of domestic meat would amount to 90% of aggregate annual wages, 194% of overall income from manioc flour, and 67% of the Brazil nuts collected. Complete beef replacement by the population in this region would require further inputs of US\$2.658 million per year, and the conversion of 4,31 hectares of Amazonian forests into pasture. Our results emphasize the environmentally valuable and irreplaceable role of wild meat in the food security of tropical forest dwellers. Proposing consumption of alternative sources of animal protein for monetary deprived forest dwellers is clearly an unrealistic, if not environmentally damaging. Conservation scientists, wildlife biologists, and policymakers should therefore prioritize adding value of standing forests by managing sustainably wild-meat offtake from natural ecosystems. V. Nunes and others.

Value of wild meat extraction compared to local food security in the Amazon. [Biological Conservation 236 171-179 2019] D

MANGROVE EXPANSION IN TAIWAN

Major changes in the land surface occurred between 1978 and 2012 in the Kuantu Nature Reserve, caused by over pumping of groundwater and sand intrusion induced by expansion of tidal creek and typhoon-induced erosion. Mangrove encroached on salt marsh most rapidly during 1984-1996, at a rate of 2.27 ha/year. L-C. Hsu and other. The current extent and historical expansion of mangroves in the Kuantu Nature Reserve, North Taiwan. [Journal of Coastal Research 34 (2) 360-372 2018] D

BAMBOO HARVEST ROTATION LENGTHS IN NIGERIA

Bambusa vulgaris bamboo is commonly used for fiber, fuel, and construction. Bamboo culms at different ages were assessed for density, porosity, shrinkage, swelling, fiber values, and strength in accordance with pulp and paper standards in Nigeria. The optimum technical rotation age for *B. vulgaris* cellulose is 2 years, for construction, 3 years, and for fuelwood harvesting may be at any age. NA. Sadiku and other. Technical rotation age for naturally grown *Bambusa vulgaris* for fiber, fuel, and structural application. [Journal of Tropical Forest Science 29 (4) 541-548 2017] D

HANDICRAFT PROSPECTS IN PUERTO RICO

Foreseen for this are small-scale harvesting of 125 local forest products and handicraft production for an excellent potential market. Competition from imported crafts is seen as an initial constraint. To increase competitiveness and product quality, small-scale producers must obtain institutional support for artisan development from government, non-government sources, and associations of artisans to provide technical assistance, marketing, and financial services. J. Ferrero-Montana and others. Analysis of the potential of small-scale enterprises of artisans and sawyers as instruments for sustainable forest management in Puerto Rico. [Journal of Sustainable Forestry 37 (3) 257-269 2017] D

HOW LONG DO BENEFITS FROM THINNING CONTINUE IN PLANTATIONS?

Despite the critical role of pulsed resources in the dynamics and conservation of several forest-dwelling species, the period when the effects of a thinning-induced resource pulse are maximal and the period when only residual effects remain has yet to be documented. We investigated the effect of a transition period on flying coleopterans after a woody necromass resource pulse produced by commercial thinning operations. In a large-scale manipulative study, spruce plantations were subjected to commercial thinning treatments, and beetles were collected using flight intercept traps during the four years that followed thinning operations. 82,062 beetles from 50 families and 242 species were recovered. For two years after thinning treatments, beetle communities differed in composition between thinned and unthinned plantations. Species richness and abundance was higher in thinned areas. By the third and fourth year after thinning these differences began to fade, indication that the transition period was recurring. This was associated with a decline in the quality of woody debris found close to or on thinning trails. Despite a decline in abundance and species richness in thinned areas during the last two years of the study, thinned plantations still harbored richer and more abundant beetle communities than unthinned plantations. F. G. G. Moreau and others. How long are thinning reduced resource pulses maintained in plantation forests? [Forest Ecology and Management 440 113-121 2019] D

BANGLADESH EXTENSIVE MANGROVE PLANTATIONS

In alignment with UN Sustainable Development Goals, the Government of Bangladesh has established mangrove plantations to stabilize 120,000 ha of coastland. Local data indicate that mangroves facilitate accretion and prevent erosion. Mangroves have an important role to play in the sustainable development of coastal regions. J. Chow and others. Mangrove management for climate change adaptation and sustainable development in coastal zones. [Journal of Sustainable Forestry 37 (2) 139-156 2017] D

SUSTAINABLE TOURISM AND CONSERVATION IN MALAYSIA

Whether turning forests into tourist sites can generate incomes comparable to the lucrative traditional activities is not clear. We estimated the recreational values of the Belum-Temengor Rainforest Complex in Perak, Malaysia, and compared it with the alternative of one-time consumptive revenues from logging. Based on data from an onsite survey of 367 visitors to the Rainforest, as direct, one-time, were computed using the individual travel cost approach. Our main conclusion is that the direct non-consumptive use values from recreation demand exceed the one-time consumptive revenues from logging. A. K. G. Tan and others [Journal of Sustainable Forestry 38 (4) 327-342 2019] D

TROPICAL FORESTRY NOTES (2)

WOMEN AND FUEL IN TANZANIA

Women of Lupeta, Tanzania, use wood and charcoal as fuel. They would prefer to use charcoal but are limited by costs and access to trees. Land constraints also limit them. K. Preston and others. Women and fuelwood in Lupeta, Tanzania: Constraints to alternative fuels and fuelwood management strategies. [Journal of Sustainable Forestry 36 (6) 555-567 2017] D

LEGUME TREE USES

A study was made of legume trees' capacity to fix nitrogen, control erosion, and protect other tree species. New global uses as bioenergy sources open new possibilities for management. Legumes continue to provide multiple benefits from economic, social, and environmental standpoints. D. Castro and others. Woody leguminous trees: New uses for sustainable development of dry lands. [Journal of Sustainable Forestry 36 (8) 764-786 2017] D

GENETIC GROWTH AND WOOD OF *CASUARINA EQUISITIFOLIA*

Forty-six clones of *Casuarina* were evaluated for growth and wood parameters to study their genetic divergence. The highest values for heritability, genetic advance and genetic gain were obtained for specific gravity, fiber length and volume, respectively. Both phenotypic coefficients and environmental coefficients of variation were highest for vessel frequency, while genotypic coefficients were highest for volume. The environmental coefficient was observed to be higher than genetic coefficients for all the traits, showing the influence of environmental factors on these traits. The results on genetic divergence had potential for immediate application in the establishment of clonal seed orchards. Information on genetic divergence presents an opportunity for hybridization among the genotypes and obtaining quality seeds with high vigor. R. Vishnu and others. Genetic divergence for growth and wood parameters in different clones of *Casuarina equisetifolia*. [Journal of Tropical Forest Science 30 (4) 615-621 2018] D

FRUIT TREES AS SHADE FOR COFFEE AGROECOSYSTEMS IN JAMAICA

Studies in coffee agroecosystems rarely examine the socioeconomic benefits of the shade tree products themselves to coffee farmers. An examination of Blue Mountain coffee farmers along an elevational gradient within the Yallahs River watershed saw several tree species emerge as important within the agroecosystems, accounting for approximately 10% of gross farm incomes. Of the 24 tropical, subtropical, and temperate fruit trees reported by farmers, eight species (*Mangifera indica*, *Blighia sapida*, two *Musa* species (bananas and plantains), *Syzygium samarangense*, *Persea americana*, and two citrus species) accounted for more than 90% of reported fruit incomes. Our results reveal that farmers, on average, could make an additional US\$443.23 and US\$1485.28 per haper year from fruit trees used as shade on high and low elevation coffee farms, respectively. With better marketing of fruit tree products and improved roads to provide access to markets, shade coffee farms could significantly improve coffee farmer livelihoods and forest-like cover within the severely degraded agricultural areas within the Yallahs River watershed. H. Davis and others. The economic potential of fruit trees as shade in Blue Mountain coffee agroecosystem of the Yallahs River watershed, Jamaica. [Agroforestry Systems 93 (2) 581-589 2019] D

LOW-COST ECOSYSTEM PROTECTION

The first rule of low-cost conservation is to avoid areas of high opportunity costs. These are subject to intense use for other activities and may be costly for any purpose. Low-cost can be found in lands with few people. Two considerations are applied to the selection of protection areas: the possibility of sustainability and the possibility of strict protection. Selecting areas with low population density and low opportunity costs would improve the cost efficiency of biodiversity conservation. A. Pellegrini and others. Low-cost strategies for protecting ecosystem services and biodiversity. [Biological Conservation 217 187-194 2018] D

EUCALYPTUS MIXED WITH OTHER TREE SPECIES IIN BRAZIL

A study in the Brazilian Atlantic forest combined *Eucalyptus* wood production with 23 to 30 native tree species. In a mixture with 50% *Eucalyptus* seedlings, the *Eucalyptus* yield was 75% of that produced by *Eucalyptus* monoculture. It was concluded that *Eucalyptus* and a high degree of native tree species are an alternative for multi-purpose plantations. N. T. Amazonas and others. High diversity mixed plantations of *Eucalyptus* and native trees: An interface between production and restoration for the tropics. [Forest Ecology and Management 417 247-256 2018] D

RETENTION OF SOIL AND WATER BY PLANTATIONS

A six-year study in South China showed that young plantations reduced runoff and soil erosion by 65%, and under mature plantations, by 73%. *Eucalyptus* was found, either young or mature, to reduce runoff and soil erosion more than other tree species. In young plantations herb density is critical to surface runoff and sediment and in mature plantations it is the litter that controls runoff. D. Sun and others. Soil erosion and water retention varies with plantation type and age. [Forest Ecology and Management 422 1-10 2018] D

BALSA'S RAPID SEEDLING GROWTH WITH PHOSPHORUS

Effects of phosphorus fertilization on the growth and physiology of balsa (*Ochroma pyramidale*) seedlings in soil-free medium were examined. Rate of phosphorus application significantly affected most biometric and physiologic variables, and the greatest response occurred with the increase from 5.6 to 56 mg/L. All growth response parameters were greatest at 56 mg/L. A minimum sufficiency level was between 5.6 and 56 mg/L applied P. All foliar macro and micronutrient concentrations were influenced by P supply, except Mn. Foliar P, Ca, and Mg concentration increased with increasing P and the concentration of most other nutrient decreased. Phosphorus, N, and C content in each tissue increased with increasing P application rate due to dry mass increase. The highest concentrations of malic, succinic, and lactic acids in xylem fluid occurred at the highest P rate. C. Seabra and others. Influence of phosphorus limitations on the growth, nutrient partitioning and physiology of balsa (*Ochroma pyramidale*) seedlings. [Journal of Tropical Forest Science 29 (4) 530-540 2017] D

PROSPECTS FOR THE TIGER OF SUMATRA

The Sumatran tiger (*Panthera tigris sumatrae*) is one of the large mammals endangered in Sumatra because of poaching and habitat degradation. The population of the insular subspecies retains genetic variation (heterozygosity) comparable with mainland tigers. The levels of heterozygosity could protect the tiger from extinction if habitat improvement is provided within 30-100 years. Improvement of population management, such as hunting control, and slowing habitat deterioration due to palm cultivation and other organized agriculture in the vicinity, could favor this and several

other large mammals. O. Smith and others. Evaluating the effect of forest loss and agricultural expansion on Sumatran tigers from scat surveys. [Biological Conservation 221 270-278 2018] D

REGENERATION AFTER LOGGING IN BORNEO

Stand dynamics were monitored for 10 years after conventional logging (CL), reduced impact logging (RIL), and RIL followed by enrichment planting and annual slashing (RIL+LP/S) in three 1-ha plots in central Kalimantan. All trees with DBH of >10cm and planted *Shorea johorensis* were monitored for survival and growth. Natural recruitment poles of commercial *Shorea* spp. (DBH >10 cm) were very low in CL, intermediate in RIL, and 46/ha in RIL+LP/S. Ten years after treatment 78% of the planted seedlings were still alive. The slashing significantly promoted natural regeneration of more commercial species between the lines. For sustainable production LP/S is an appropriate treatment, and light conditions were improved over RIL. LP with desirable species is recommended, particularly with slashing, if relatively inexpensive, and depending on the condition of the forest. T. Inada and others. Dynamics of forest regeneration following logging management in a Bornean lowland dipterocarp forest. [Journal of Tropical Forest Science 29 (2) 185-197 2017] D

TROPICAL FORESTRY NOTES (3)

THE PANTANAL OF BRAZIL

The study was conducted in Brazil at a 140,000 ha where large areas of improved pasture are bounded by blocks of intact montane forests and seasonally flooded lowland habitat., a habitat for wild predators and prey, in the Pantanal. Large predators include jaguar, puma, and wolf. Prey include wild and domestic animals. Depredations accounted for almost one percent of the domestic herd during a past year, mostly near forests and distant from cattle husbandry operations. Management opportunities exist to reduce the loss of calves and facilitate movement of mammals between forests. C. Souza Rosana and others. Habitat use, ranching, and human-wildlife conflict within a fragmented landscape in the Pantanal, Brazil. [Biological Conservation 217 349-357 2018] D.

ELEPHANT CONTROL BY BEES

African elephants (*Loxodonta africana*) are a serious source of bark stripping and broken branches in large trees and are seen to avoid contact with African honeybees (*Apis mellifera* subsp. *scutelata*), staying clear of beehive fence lines. To determine the capability of using the bees to control the elephants, a study used 150 trees. Fifty were untreated, as a control. Fifty had their bark tied with wire to prevent stripping. The third group had the bees. In the control trees some 50% were attacked. In the wired group about 25% were attacked. Of the bee trees only 2% were attacked. R. M. Cook and others. African honeybees as a mitigation method for elephant impact on trees. [Biological Conservation 217 329-336 2018] D

RAIN-FED AGROFORESTRY CROPS IN SUDAN

Land use and land rights policies discourage farmers from having trees on their properties. A study was designed to compare agroforestry with trees and conventional monocropping with three crops, sorghum, pearl millet, and sesame. The 10-year crop records with and without agroforestry were compared. Net present value to the farmers followed the same pattern. Farmers should rely more on agroforestry for food security and cash income. M. K. M. Fahmi and others. Impact of agroforestry parklands on crop yield and income generation: Case study of rainfed farming in the semi-arid zone of Sudan. [Agroforestry Systems 92 (3) 785-800 2018]

TROPICAL RAINFOREST: WHAT IS IT?

Tropical rainforest consists of forest within the tropical zone covering 7% of the planet, with average temperatures 26.7C (80F), relative humidity between 77 and 88%, subject to at least 60 mm of rainfall every month (no droughts), on deep soils with N and P, and composed of up to 4 plant layers. It is the most complex and richest biome on earth, dense and diverse as to both forest structure and composition. In the absence of seasonality, species flower and fruit in response to their individual requirements. [Wikipedia, Biomes of the World, Plant Biomes, Animal Facts] D

CONSERVATION VALUE OF SACRED NATURAL SITES

Sacred Natural Sites are found throughout the world, ranging in size from a few square meters to millions of hectares, based on ethnic, historical, and ecological purposes. Eight small (5 to 116 ha) sacred groves in Greece were compared with control conservation areas. The sacred groves included fungi, lichens, herbaceous plants, woody plants, nematodes, insects, bats, and passerine birds. The sacred groves had a small conservation advantage due to more distinct sets of organisms among

sacred groves than among control conservation sites. Their importance would be greater if they became incorporated in networks. D. N. Avizis and others. Quantifying the conservation value of Sacred Natural Sites. [Biological Conservation 222 95-103 2018] D

THE POTENTIAL OF MAINTAINED URBAN BIRD FEEDERS

Farmland bird abundances in cities have been declining due to changes in human habits, food availability, and land use. In the temperate zone the bird food problem is most severe during the winter. However, in the tropics, if the objective is to acquaint urban people with native birds, a greater number of species should be attracted by nuts and fruits in well-constructed and maintained feeders, such as in a much-visited central urban location. P. Pierret and others. The potential virtue of garden bird feeders: More birds in citizen backyards close to intensive agricultural landscapes. [Biological Conservation 222 14-20 2018] D

WHAT EARTHWORMS DO

Some 20 compounds that support living organisms in the soil are vulnerable to being leached from terrestrial ecosystems. Stable systems require mechanisms that sequester and retain nutrients. Earthworms appear to perform such a function. S. Johnson and others. The role of earthworms in nitrogen and solute retention in a tropical forest in Sabah, Malaysia. [Journal of Tropical Ecology 25 611-614 2012] D

SUCCESSFUL AGROFORESTRY IN ARID REGIONS OF LATIN AMERICA

The characteristics of agroforestry systems in arid and semi-arid areas have not been extensively determined in Latin America. We document the characteristics of replicable, widely practiced agroforestry systems in five climatic regimes across the arid and semi-arid regions of Latin America. The research was conducted on 4 to 6 farms per region, using the design and diagnosis method, highlighting that the combination of multi-purpose trees with subsistence crops and livestock is highly context specific. The analysis was corroborated by semi-structured interviews and focus group discussions on farmers' perceptions of the challenges and benefits of implementing agroforestry. In general, farmers perceive the significant contributions to economic and ecological sustainability including the improvement of soil fertility and resilience to climate change. L. Krishnanurthy and others. Can agroforestry systems thrive in drylands? [Agroforestry Systems 93 (2) 503-513 2019] D

RECOVERY AFTER CULTIVATION IN KALIMANTAN

A study was conducted in Kalimantan in plots that formerly were primary forest that had been abandoned after shifting cultivation 1, 5, and 10 years earlier. The total number of trees, the Shannon index of biodiversity, the number of large trees (>20cm dbh) and the number of late-successional species (*Shorea* spp.) all increased over this time period. Soil carbon and nitrogen appeared on the surface (0-2cm depth) after only 1 year. They were both needed for the late-successional tree species. W. Budladi and others. Recovery by vegetation structure, soil nutrients and late-succession species after shifting cultivation in Central Kalimantan, Indonesia. [Journal of Tropical Forest Science 29 (2) 151-162 2017] D

TROPICAL FORESTRY NOTES (4)

LOGGING EFFECTS ON FOREST COMPOSITION IN AMAZONIA

The extent to which selective logging affects tree floristic composition and the recovery process is little known. Understanding how floristic composition is affected by logging activities is essential for determining subsequent cutting cycles, for the maintenance of carbon stocks and for diversity conservation. The effect of logging on long-term trends in the recovery of species composition was investigated in a tropical forest using a unique logging experiment, where measurements have been taken annually over a period of 25 years. Changes were monitored in 12 long-term, 1-ha permanent plots where different selective logging intensities occurred. In the first years after logging floristic composition differed widely between intact and selectively logged forests, with exploited areas deviating from pre-logged composition. Over time, exploited areas shifted toward the original composition with more pronounced changes in this trend after 13 years. Shifts in floristic composition were caused mainly by a significant increase in light-demanding, fast-growing pioneer species and their subsequent continuous high mortality rates after 13 years of recovery. However, the control plots showed similar shifts in composition over time, suggesting external factors such as long-term climate changes may be driving these shifts. The results suggest that 25 years after an experimental selective logging has taken place, floristic composition tends to move closer to the pre-logged status. Thus, in the absence of further human disturbances experimentally logged forests in low to moderate intensities are compatible with biodiversity conservation, at least during the first cycle of exploitation. Reconnecting conservation strategies with the recovery of stocks of commercial timber species would be greatly improved by using these results and lead to more sustainable forest management. F. Regina and others. Long-term effect of selective logging on floristic composition: A 25-year experiment in the Brazilian Amazon. [Forest Ecology and Management 440 258-266 2019] D

LITTER DECOMPOSITION ALONG ROADS OR IN FORESTS IN SABAH

Forest roads constructed by bulldozers change the physical environment within the forest. In a study this was simulated with wood blocks, compared with leaf litter of *Shorea* and *Macaranga* from the forest. The wood blocks decomposed more slowly on the road than in the forest. The *Shorea* leaf litter decomposed more quickly on the road than in the forest. The lower moisture content of both *Shorea* and *Macaranga* leaf litter indicated a more pronounced drought condition on the path. The decomposition of the two leaves also differed. Findings suggested that *Macaranga* leaf litter mainly decomposed by fragmentation, whereas *Shorea* leaf litter mainly decomposed by microbial degradation and leaching, in addition to fragmentation. The results indicated that road disturbance changed the balance between fragmentation and other degradation processes. T. Yoshida and others. Litter decomposition on forest roads versus inside tropical rain forests in Sabah, Malaysia. [Journal of Tropical Forest Science 31 (1) 108-113 2019] D

OLEORESIN AND TURPENTINE FROM PINUS MERKUSII IN JAVA

Oleoresin production and turpentine yield of three subpopulations of *Pinus merkusii* in the Aceh provenance (Jantho, Takengon, and Blankejeren), Indonesia, and the Java land race were examined. Oleoresin yield declined with increasing altitude of subpopulation origin. Turpentine yield increased with increasing altitude of subpopulation origin. The oleoresin yields were 12.2, 14.5, 18.0, and 21.1 g/hole/tree/day for Takengon, Java land race, Blankejeren, and Jantho, respectively. Turpentine yields were 13.6, 15.3, 16.0 and 19.6% for Java land race, Jantho, Blankejeren and Takengon subpopulations respectively. Sukramo and others. Oleoresin production, turpentine yield and

components of *Pinus merkusii* from various Indonesian provenances. [Journal of Tropical Forest Science 27 (1) 2015] D

TREE GIRDLING EFFECTS ON ACACIA MANGIUM IN INDONESIA

Nine-year-old *Acacia mangium* trees in plantations in Bogor, Indonesia were selected for a study of the effects of girdling tree trunks at 4 and 8 months before felling. Girdling, in severing the bark, cuts off tree access to soil moisture but leaves active tree crowns to remove tree moisture. The green moisture content of the wood was 122% and 8 months after girdling the moisture content of the wood had dropped to 60%, having lost essentially half of its moisture. After drying there was no end splitting of logs. In general, wood quality of girdled trees is better than that of non-girdled trees. The longer girdling period also decreased the percentage of honeycombing and degree of deformation during drying. E. Basin and others. Effects of girdling on wood properties and drying characteristics of *Acacia mangium*. [Journal of Tropical Forest Science 27 (4) 498-505 2015] D

CEDRELA ODORATA GENETIC RANGE IN MEXICO

Because of the importance of *Cedrela odorata*, a progeny trial with 168 families was undertaken in Veracruz. Tree height, stem diameter at breast height, volume, and stem straightness, were statistically different at 3, 5, 7, and 11 years of age. A 56% gain in volume was obtained by using this selection criterion and leaving 20% of the best trees standing. Early selection at three years old, based on dbh was efficient to improve volume at 11 years with 37.3% gain, whereas at seven years the volume gain was 54%. E. Hernández-Maximo and others. Early performance and genetic gain of *Cedrela odorata* families from wide-ranging sites in Mexico. [Journal of Tropical Forest Science 28 (4) 446-456 2016] D.

PLANTATION SPACING EFFECTS ON EUCALYPTUS WOOD IN BRAZIL

Eucalyptus grandis x *E. camaldulensis* clones were grown at plant spacings of 1.5, 3.0, 4.5, 6.0, and 9 m² (representing 3.0 m x 0.5 m, 3.0 m x 1.0 m, 3.0 m x 1.5 m, 3.0 m x 2.0 m, and 3.0 m x 3.0 m, respectively, in Minas Gerais, Brazil in 2003. Wood of trees planted at the two widest spacings was 8% denser than typical wood. Lignin content from wood 6 m² and 9 m² was approximately 12% higher than in wood at 3 m² spacing. M. F. V. Rocha and others. Effects of plant spacing on the physical, chemical, and energy properties of eucalyptus wood and bark. [Journal of Tropical Forest Science 28 (3) 243-248 2016] D

HABITAT SELECTION MAY PROMOTE LION SURVIVAL

Human-dominated landscapes are increasingly critical to carnivore conservation as human land use continues to encroach on wildlife habitat. Flexibility in large carnivore behavior may be a primary factor mediating coexistence with people, allowing carnivores to calibrate their activity and habitat use to the perceived level of risk. However, our understanding of how large carnivores adjust the timing and location of behaviors in response to variations in human activity across the landscape remains limited, impacting our ability to identify important habitat for populations outside of protected areas. Here we examine whether African lions (*Panthera leo*) modify their behavior and habitat use in response to risk of a human encounter, and whether behavior-specific habitat selection allows lion to access feeding opportunities in a human dominated landscape in Kenya. We determined fine-scale behavioral states for lions using high-resolution GPS and accelerometer data and then investigated behavior-specific habitat selection on multiple temporal and spatial scales, ranging from 15 minutes to 12 hours and from approximately 200 meters to several kilometers. We found that lions exhibit substantial differences in habitat selection. With respect to behavior and time

of the day when risk of human encounter is highest, lions avoided areas of high human use when resting, meandering, and feeding. However, lions specially selected for habitat near people when feeding at night. Flexible habitat use by lions permits access to prey which appear to concentrate in areas near humans. The importance of habitat near people for feeding was only apparent when analysis explicitly accounted for lion behavioral state and spatiotemporal state, highlighting the necessity of incorporating such information when investigating human impacts on large carnivore habitat use. Our results support the contention that behavior-specific habitat selection promotes carnivore persistence in human dominated landscapes, demonstrating the importance of considering not just whether, but how, large carnivores use habitat near humans when managing vulnerable populations. L. G. Frank and others. Behavior-specific habitat selection by African lions may promote their persistence in human dominated landscape. [Ecology 100 (4) e02644 2019] D

REGENERATION IN LOGGING GAPS IN THE BRAZILIAN AMAZON

Treatments included reduced impact logging, tending of natural regeneration, needed enrichment planting in gaps, and enrichment planting in gaps with removal of logging residuals. Growth rates of treated individuals were projected in 30 and 60 years to simulate sawnwood production. Assuming increases of 25% to 50% in growth rates, 500% in timber prices after a 60-year rotation, and interest rates of 4 and 6% annually, tending and enrichment planting could profit at year 60. A prospect is seen for an even greater financially profitable forest treatment. G. Schwartz and others. Profitability of silvicultural treatments in logging gaps in the Brazilian Amazon. [Journal of Tropical Forest Science 28 (1) 68-78 2016] D

TREE PLANTING ON A RIPARIAN SOIL UNDER OIL PALMS IN MALAYSIA

Testing of tree planting along a river in an oil palm plantation was undertaken with 351 tree seedlings in Peninsular Malaysia in 2003. The seedlings, less than a meter tall, survived >90% after the first year. There was no evidence of any cost to the oil yield. T. Yamada and others. Growth and survival of trees planted in an oil palm plantation: implications for restoration of biodiversity. [Journal of Tropical Forest Science 28 (1) 97-105 2016] D

LOGGING INTENSITY AND BUTTERFLIES IN THE AMAZON

Two levels of logging impacts on butterflies were assessed: the impacts of logging intensity on overall diversity and community composition; and how logging intensity affects individual species' abundance-logging yield relationships. Butterfly abundance was highest at intermediate logging intensities. Species richness benefitted from low-intensity logging. It was predicted that some butterfly benefits were from retention of primary forest. G. Montejo and others. Impacts of selective logging management on butterflies in the Amazon. [Biological Conservation 225 1-9 2018] D

TROPICAL FORESTRY NOTES (5)

MIXING AND DENSITY CONTROL EFFECT ON DROUGHT GROWTH

Forest managers can increase the resistance of forest stands to summer drought by reducing stand density and favoring tree species mixtures. These strategies have been studied separately, but their combined effect on increasing forest stand resistance to summer drought is unknown. The main objective of our study was to quantify tree species interaction effects on stand growth during a summer stress period and to determine whether these effects changed with different levels of competition reflected by stand density. The study was based in central France at a long-term study site with pure and mixed stands of mature *Quercus petraea* and *Pinus sylvestris*. The experimental design compared three replications of two densities (low and medium) in each comparison (pure oak, mixed stands, pure pine). We monitored tree radial growth with 216 annual dendrometers placed throughout 18 plots on small medium, and large trees. We analyzed three consecutive years with contrasted water stress: no water stress, a summer stress period, and a late summer stress period. We found that mixture did not improve tree growth of either species during a water stress period. On the other hand, there was a mixture effect during the late summer water stress period but only in medium density stands. J. Bello and others. How do mixing tree species and stand density affect annual radial growth during drought events. [Forest Ecology and Management 442 436-445 2019] D.

NIGHT TREE TRANSPIRATION

A test of 18 tropical timber tree species (9 deciduous) was done in southwest China in 2012-2013. During the wet season the nocturnal ratio of sap flux density for average evergreen and deciduous species ranged from 12 to 19% and 15 to 20%, respectively. In the dry season the range was 18 to 32%. Nocturnal transpiration is constrained by wood density. High nocturnal air temperature will result in water loss. Z. Siddio and others. Nocturnal transpiration in 18 broadleaf timber species under a tropical seasonal climate. [Forest Ecology and Management 418 47-54 2018] D

FOLIAGE FROM SIX SPECIES IN VERACRUZ, MEXCO

Six tree species: including *Dyphirya*, *Gliricidia*, *Eryithina*, *Bursera*, and *Zanthoxylum* were investigated *in situ* for annual dry matter, degradation and effective degradability at three passage rates in Veracruz, Mexico. Leaves, stems, and petioles were randomly collected from trees during dry and rainy periods to estimate dry matter, crude protein, neutral detergent fiber, acid detergent fiber, and *in situ* dry matter degradation using the nylon-bag technique. Rumenal degradation of organic matter, crude protein, and effective dry matter digestibility were also calculated. The experiment was a completely randomized design with a split plot arrangement of factors with the main plot factor being the species, and the sub-plot factor the season. Legume trees had the highest crude protein values for both dry and rainy seasons. Organic matter showed less variability and ranged in all species from 87.6% to 93.1%. For natural detergent fiber during both seasons, *Bursera* held the highest value. Based on the moderate to high crude protein values and the degradation characteristics, the assessed species constitute an alternative supply for different annual production systems, especially during the dry season. L. Ascencio-Rojas and others. *In situ* ruminal degradation and effective degradation in foliage from six tree species during dry and rainy seasons in Veracruz, Mexico. [Agroforestry Systems 93 123-133 2019] D

MANGROVE PRODUCTIVITY AND CARBON IN LOWER CALIFORNIA

Mangroves provide multiple ecosystem services, including fish and wildlife habitat, protection from coastal erosion and flooding impacts, food resources, water quality, and carbon sequestration and storage. Most of the information on mangrove wetlands structure and function useful to evaluate the quality, quantity, and financial value of ecosystem services has been obtained from studies at tropical latitudes usually dominated by large deltas and extensive coastal lagoons and estuaries. Thus, there is a major gap for mangrove wetlands located in arid and semiarid regions, due to their limited land cover and location at the boundary of transitional climatic gradients. Here, we analyze the spatial distribution of mangrove wetlands carbon stocks and net primary productivity (i.e., litterfall and root productivity) in La Paz Bay, an arid coastal region in the Gulf of California, Mexico. There, mangrove wetlands are spatially distributed in conspicuously extensive patches. We used this information to quantitatively rank ecosystem support services. Three peri-urban mangrove wetland sites (Balandria, Enfermeria, and Zacatecas) were characterized by different degrees of anthropogenic impact. Aboveground biomass was in the lower range when compared globally. The average carbon storage in mangrove soils (at 45 cm depth in La Paz Bay) is 175 MgC/ha, which is higher than the values reported for other arid zones (≥ 1 m soil depth: 43-156 MgC/ha). We found distinct differences in aboveground carbon storage values among sites where mangrove species formed monospecific stands across the landscape within each site. Areas dominated by *Rhizophora* had the highest soil carbon density values (208.9 MgC/ha), followed by *Laguncularia* (181.4) and *Avicennia* (155.5). We identified services provided by each of the sites, including ecotourism and fishery services. Our quantitative assessment of ecosystem services of arid mangrove wetlands in La Paz Bay could be translated into robust economic estimates for this arid coastal region. G. Ochoa-Gómez and others. Mangrove wetland productivity and carbon stocks in an arid zone of the Gulf of California, Mexico. [Forest Ecology and Management 442 135-147 2019] D

BIOLOGICAL OUTCOMES FROM PLANTATION THINNING IN AUSTRALIA

In New South Wales *Callitris glaucophytia* was thinned by 16-22% to determine the short-term and long-term effects on bats, birds, invertebrates, reptiles, non-volent mammals and plants. Bat activity and diversity were comparable to levels of long-undisturbed forest but influenced by time since thinning. Reptile diversity and abundance were positively associated at an immediate time since thinning (8-20 years). Bird diversity was greater in recent and older thinning treatments, although species composition was not affected. Thinning did not affect invertebrate biomass, but it was associated with a more even distribution among invertebrate size classes after 8 years and a greater representation of beetles. Non-volent mammals and understory plants did not differ among treatments. Overall, thinning has neutral to positive effects on biodiversity, but this depends on forest type. L. G. Bradley and others. Biological outcomes for multiple taxa from silvicultural thinning of regrowth forest. [Forest Ecology and Management 425 177-188 2018] D

COMPETITION WITH SOUTHERN BRAZIL'S ARAUCARIA

There is a theory that gymnosperms recruit after a disturbance, followed by angiosperms, the separation guided by competition, bringing first gymnosperm species that use light, and followed by shade-tolerant angiosperms. *Araucaria angustifolia* is a typical gymnosperm to be followed first by light-demanding angiosperms, such as *Populus* spp., and later by shade-tolerant species, such as *Manilkara*. E. Orellana and others. Competition and dominance between angiosperms and *Araucaria angustifolia* (Bert.) O. Kuntze in the Atlantic Forest in southern Brazil. [Forest Ecology and Management 425 119-125 2018] D

CERTIFIED RAINFOREST LOGGING AND EFFECTS ON WILDLIFE IN KALAMANTAN

In two certified forest management units ground dwelling fauna were observed in 23 circular plots 1km in diameter, with camera points installed from 2012 to 2016. A total of 41 species of medium to large ground dwelling fauna was found in the two units. Surrogates for three levels of pressure were measured against the species: (1) forest intactness = tree species composition, (2) above-ground carbon = forest structure), and (3) village distance = hunting pressure. Of the 32 fauna species under observation, 8 responded to forest intactness. Consistent responses of several species to forest intactness suggest that changes in tree species composition determine the animal assemblage in logged-over Bornean rainforests. These forests are habitat for diverse species and therefore are in need of biodiversity conservation. A. S. Jati and others. Effects of logging on wildlife communities in certified tropical rainforests in Kalimantan, Indonesia. [Forest Ecology and Management 427 124-134 2018] D

GIANT BAMBOO PROPERTIES CHANGED BY SITE ON MINDAAO

A study on Mindanao island compared selected properties of giant bamboo (*Dendrocalamus asper*) growing on a moist riparian site and an upland site (far from water). Eighteen culms 3-4 years old were harvested from three clumps from each of the two sites. Results showed that on the upland site the bamboo had higher specific gravity, thinner culm walls, lower moisture content, and was better in bending than poles from riparian sites. Volumetric shrinking and swelling were also different between the two sites. R. G. Aguinatan and others. Site influences of the morphological, physical, and mechanical properties of giant bamboo (*Dendrocalamus asper*) in Bukidnon Province, Mindanao, Philippines. [Journal of Tropical Forest Science 31 (1) 99-107 2019] D

THREATS TO WOODLAND BIRDS ON FARMLANDS IN AUSTRALIA

We must understand the relative contributions of old growth, second growth and planted forests to biodiversity and species persistence of threatened woodland birds in agricultural landscapes. An eight-year study of woodland birds threatened with extinction in Australia showed, by regression, that remaining species were more likely to occur in regrowth and old growth forest patches instead of in plantings. We found that species persistence could be achieved only through sets of patches containing all patch types (old growth, regrowth, plantings). Biodiversity can be conserved through maintaining a patchwork of different types of woodland. K. Ayesha and others. Old growth, regrowth, and planted woodlands provide complementary habitat for threatened woodland birds on farms. [Biological Conservation 223 120-128 2018]

THREATENED FOREST HORNBILL OF GHANA

Hornbills (Bucerotidae) of the (Paleotropics) are extinction-prone, with restricted habitat and a slow reproductive rate in the Upper Guinea forest biodiversity hot-spot in Ghana, West Africa. Seven surveys between 1990 and 2014 reported declines in six species. Remnant populations of large hornbills persist mainly in two large and well protected reserves: Ankasa Resource Reserve and Kakum National Park. Five hornbill species formerly in Bia Biosphere Reserve vanished since the 1990's. Uncontrolled hunting is a major cause. H. H. Nathaniel and others. Uncontrolled hunting and habitat degradation decimate and extirpate forest hornbills in Ghana. [Biological Conservation 223 104-111 2018] D

TROPICAL FORESTRY NOTES (6)

MIOMBO WOODLAND AND ITS GROWTH IN ZAMBIA

The miombo woodlands of eastern and southern Africa date from some 14,500 years ago. There is dry miombo (<1,000 mm precipitation annually) and wet miombo (>1,000 mm annually). Key tree species are *Brachystegia* and *Juibemardia*. Since the migration of the Bantu people 5,000 years ago the woodlands have experienced widespread degradation and deforestation. There are few data on miombo tree growth and forest production. A current study used data from 35 temporary plots in regrowth of 5-49 years old, and six permanent plots in old-growth forest, monitored over a 28-year period. These data were used to investigate tree diameter growth and forest dynamics in wet and dry miombo woodlands. Variations in increments in tree diameter and basal area are strongly driven by stand age, tree size, and density, and growth rates are higher in wet than dry miombo. Overall, miombo woodland trees grew slowly at a rate of 0.34-0.50 cm/year in re-growth areas. Most of the species in uneven-aged old-growth stands grew by 0.15 cm/yr with no significant annual differences, although variances among conspecifics were large. Models predicted tree diameter increments of 0.10-0.24 cm/yr for stands 100 years old. Transitions from one 5 cm diameter class to the next was estimated to take over 20 years, and significant shifts in tree diameter distribution require over 25 years because of the low increment. Stand responses to degradation varied from site to site and were driven by the number of saplings transiting into small diameter size classes.

On the temporary regrowth plots, basal areas averaged 7.1 m²/ha and 9.9 m²/ha in dry and wet regrowth miombo, respectively, with positive increments estimated at 0.40 m²/ha in dry miombo and 0.53 m²/ha in wet miombo. By contrast, average basal area increment in old growth was negative, at -0.26 m²/ha/yr over the 1990-2018 period, due to cutting and fire damage. Such drivers of forest degradation need to be controlled, especially in old growth miombo, to maintain forest health and prevent decline in biomass. N. Chidumaya and others. Management implications of tree growth patterns in miombo woodlands of Zambia. [Forest Ecology and Management 436 105-116 2019] D

PRICKLY-PEAR CACTUS: POTENTIAL ANIMAL FEED IN MEXICO

In production systems of prickly pear fruit and prickly pear cactus, significant amounts of pruned material are produced that might be used as an ingredient in animal feeding. A study was made to measure the nutrient content, fermentation kinetics, and digestibility of eleven cultivars of cladodes of prickly pear cactus. It can be concluded that the cladodes of prickly pear cactus from different cultivars can be used in animal feed for its good rumen fermentation characteristics. P. Vázquez-Mendoza and others. Evaluation of eleven Mexican cultivars of prickly pear cactus trees for possible utilization as animal feed in vitro gas production. [Agroforestry Systems 91 (4) 749-756 2017] D

RESIDUAL PROTECTED AREAS IN BRAZIL

Protected areas now cover 10% of the earth. However, protected areas have been consistently established on marginal lands that minimize costs and conflicts with extractive uses instead of focusing on places important to biodiversity. We present a panorama of current networks of protected areas in Brazil to display the biases in relation to slope and land use. We measured protection bias by accounting for differences between protection areas and municipalities in which they were established, including the direction and strength of the bias. Brazil has 18% of its land under protection, but 70% of this is in the Amazon. Brazil's other biomes hardly reach 10% of their territories under protection and have strong protection bias. Generally, protection areas are strongly biased towards lands with low intensity of use before they were established compared to their background landscapes. Most protection areas had the same slope profile as their background

landscapes. Trusting percentages of area under protection as a measure of conservation success risks misdirecting conservation actions to areas of lower biological importance. To promote effective conservation actions more evidence-informed strategies should be used. R. R. S. Vieir and others. The residual nature of protected areas in Brazil. [Biological Conservation 233 152-161 2019] D

NATURAL REGENERATION FOR AGROFORESTRY IN CENTRAL AMERICA

The management of trees that occur within pastures as natural regeneration promotes ecosystem services. Timber is one of the products from these services with potential to increase family revenues. Two tree species from Central America managed for timber, *Pinus oocarpa* and *Tabebuia rosea*, are produced with native grasses that don't require fire for weed control. For both tree species, sustainable timber harvest is viable on pasture lands using natural regeneration and long-term planning that simplifies timber production on farmlands. G. Detlefsen and others. Population dominance and management of *Pinus oocarpa* and *Tabebuia rosea* are possible within silvipastoral systems in Central America. [Agroforestry Systems 92 (6) 1119-1127 2017]

HORTICULTURAL TREE CROPS IN INDIA

In western India there are riparian lands in ravines near streams that are subject to erosion. They can be used to grow a variety of horticultural crop trees. Examples are drumstick (*Moringa oleifera*) and (*Emblica officinalis*). Both are horticultural trees contributing to the local diet. *M. oleifera* and *Phaseolus radiatus* followed by *Foeniculum vulgare* were assessed in 2013 at \$386/ha over a production cycle of 15 years. The expected land value of the *E. officinalis*-based agri-horticulture production system was \$1,564/ha, higher land value than tobacco monocropping, suggesting alternatives to tobacco. R. S. Kurothe and others. Economic assessment of an agri-horticulture production system on reclaimed ravine lands in western India. [Agroforestry Systems 92 (1) 195-211 2018] D

BIOFUEL AGROFORESTRY SYSTEM IMPACTS ON FARMERS IN INDIA

Biofuel production impacts are related to tree species, and the following were considered: pongamia (*Millenia pinnata*), simarouba (*Simarouba glauca*), rubber (*Hevea braziliensis*), and neem (*Azadirachta indica*). Field interviews and economic modelling show that the government program has potential to deliver a small income to smallholders during years without timber harvest. The analysis of end-product prices shows that biofuel prices have a potential to boost income levels of smallholder farmers up to 60% over starting income in 25 years. B. Bohra and others. Socio-economic impact of biofuel agroforestry systems on smallholder and large-holder farmers in Karnataka, India. [Agroforestry Systems 92 (3) 759-774 2018] D

TREE FRUITS WITH EXPORT POTENTIAL FROM UGANDA

Both ethnobotanical studies and score-card assessments have been used to identify and prioritize indigenous fruit trees with potential for international markets. The study included household and market surveys, group discussions, and interviews. Pre-determined scoring criteria were applied to species identified. Those with export potentials included *Canarium schweinfur*, *Vangueria apiculata*, *Garcinia buchananii*, and *Tamarindus indica*. Scorecard assessment identified *V. apiculata*, and *G. buchananii* and added *Myrianthus arboreus*, *Pseudospondias microcarpa*, *Phoenix reclinata*, and *Rhus vulgaris* as having export potential. K. R. Nieminen and others. Identification of indigenous fruits with export potential from Mucono District, Uganda: An assessment of two methods. [Agroforestry Systems 91 (5) 967-878 2017] D

CANOPY RECOVERY AFTER LOGGING OF LOWLAND FOREST

The effects of selective logging on forest canopy height was studied in Pasoh Forest Reserve, Peninsular Malaysia. Canopy height was measured in 2003 and 2011 by using an airborne light detection and ranging system and mapping on a 2.5 m grid over logged and primary forest plots. The logged forest plot was in an area where a selective logging operation had been conducted in 1958, whereas the primary forest plot has no trace of major human induced disturbances. The average canopy height in the logged forest plot increased from 23.6 m in 2003 to 25.8 in 2011, but both of these heights were still significantly lower than those in the primary forest plot (28.7 in 2003 and 30.4 in 2011). The coefficient of variation and canopy height diversity were also lower in the logged forest plot, suggesting that the highly heterogeneous canopy height commonly seen in the primary forest in this region had not been fully recovered even 53 years after the logging operation. Simulation analysis indicated that it will take at least another 16 years from the last canopy sampling in 2011 for full recovery. T. Okudo and others. Canopy height recovery after selective logging. [Forest Ecology and Management 442 117-123 2019] D

FODDER HARVESTING COSTS FRUITS OF AFZELIA IN BURKINA FASO

In Sub-Saharan, harvesting of tree bark and foliage for medical needs or fodder may sacrifice otherwise important fruits. In Burkina Faso, Africa this harvesting performance affects the production of the fruits of *Afzelia africana*. Data on fruit yields were collected by sampling of no, low, severe, and very severe tree harvesting intensities. Trees under very severe harvesting intensity bore no fruits. Under low harvesting intensity large trees had twice as many fruits as the unharvested controls. High harvesting intensity should be completely prohibited, and low intensity should be limited to large trees. A. M. Lykke and others. Impact of bark and foliage harvesting on fruit production of the multipurpose tree *Afzelia africana* in Burkina, Faso, West Africa. [Agroforestry Systems 91 (3) 565-576 2017] D

TREE TRANSPIRATION VARIES WITH RAINFALL IN SUDAN

Rainfall water is partly transpired through the leaves of trees. For centuries rural populations have been practicing agroforestry dominated by *Vitellaria paradoxa*. In Benin, with 1200 mm annual rainfall, the water transpired by *Vitellaria*, the dominant fallow of agroforestry, was compared with that from *Isobertina doka*, the dominant dry forest tree. Transpiration of each was derived from sap flow density, measured by transient thermal dissipation. Over a three-year study period the average transpiration of the 5-tree sample of *V. paradoxa* (diameters 8-38cm) ranged between 4.4 and 26.8 liters per day. In contrast, *Isobertina doka*, the tree of the agroforestry region forests (diameters 20-38cm) ranged in transpiration from 9.8 to 92.5 liters per day. During the dry season transpiration by *V. paradoxa* is significantly lower (15%) than in the rainy season. On the contrary, transpiration of *I. doka* during the dry season was significantly higher (13%) than in the rainy season. C. Peugeot and others. Differences in transpiration between forest and an agroforestry tree species in the Sudanian belt. [Agroforestry Systems 91 (3) 403-413 2017] D

TROPICAL FORESTRY NOTES (7)

LIMESTONE FOREST FLORA, IN MALAYSIA

The species richness recorded within the FELDA Chiku limestone hills and the adjacent one in Relei Forest Reserve was 266 species of vascular plants in 166 genera, including 27 species endemic to Peninsular Malaysia. A network of hills is needed to conserve adequately limestone biodiversity. Diversity of habitats was the most important source of species richness. R. Kiew and others. Distribution and conservation implications of limestone plant species in FELDA Chiku limestone flora, Kelantan, Malaysia. [Journal of Tropical Forest Science 31 (1) 19-36 2019] D

AFFORESTING GRASSLANDS OF INDIA

Early efforts in India were to convert grasslands into more productive timber forests. In colonial times, montane forest-grassland mosaics of the higher reaches of the Ghats of southwestern India Grasslands were thought to be the results of tree felling, fire, and buffalo grazing, by indigenous communities. This led to large-scale efforts to plant exotic trees in grasslands. These efforts persisted despite repeated failures and ecological evidence that even native tree seedlings started in the grassland failed to establish. In spite of this, today the grasslands bear large-scale commercial plantations of exotic species. Some of these species have become invasive and pose threats to remnant natural grasslands. These ancient forest-grassland mosaics are threatened by the misconception that they are degraded ecosystems that can be forested, portending the fate of many tropical grasslands and savannas. A. A. Joshi and others. Foresting the grassland: Historical management legacies in forest-grassland mosaics in southern India, and lessons for the conservation of tropical grassy biomes. [Biological Conservation 224 144-152 2018] D

FOREST SPECIES RESPONSE TO WARMING CLIMATE CHANGE

From a forest management standpoint, it is crucial to know the ecological processes most likely to drive changes in species distributions and abundances under warming climate conditions. In this study we simulated forest dynamics in a 703,580 km² territory that straddles broadleaved forest biomes. The objective was to evaluate the capacity of tree species to persist under warmer climate conditions. The results indicate that forest composition species show continuing persistence when conditions became warmer or dryer. More research is needed to investigate further underlying ecological and physiological processes that influence tree species persistence. M. B. N Auiliue and others. Tree species persistence under warming climatic conditions. A key driver of forest response to climate change. [Forest Ecology and Management 442 96-104 2019] D

NATURE RESERVE EFFECTS ON FOREST PROTECTION

We compared the effects on forest protection of nature reserves with different management levels and establishment ages by means of nonparametric tests and statistical inference. We found that approximately 63% of the nature reserves suffered less deforestation within their boundaries than common areas. National nature reserves were more effective than provincial reserves. Reserve age had little bearing on the effectiveness of nature reserves. Our results revealed that nature reserves could play a prominent role in the greening trends of southwest China. The study offers the first individual level assessment of nature reserve effectiveness for forest protection which helps provide solid support for promoting nature reserve management. H. Zhao and others. Individual-level performance of nature reserves in forest protection and the effects of management level and establishment age. [Biological Conservation 233 23-30 2019] D

HUMAN EXPERIENCES WITH JAGUARS

Human perception of jaguars impacts on livestock and human safety varies with experience (including reported animal loss). Attitudes and knowledge were influenced by age, gender, and whether respondents lived in urban or rural areas. Responses reveal low familiarity with the animal. The owners of small holdings believe that depredations are worse on larger holdings, based on what is heard from other people rather than personal experience. S. Marchini and others. Mind over matter: Perceptions behind the impact of jaguars on human livelihoods. [Biological Conservation 224 230-237 2018] D

OIL PALM EXPANSION THREATENS COLOMBIA'S BIODIVERSITY

The outlook for oil palm production expansion is almost destruction, from the standpoint of conservation as experienced in Malaysia and Indonesia. This leads to conservation planning for accommodation to inevitable oil palm expansion into regions with high biodiversity. Using Colombia as an example, current and projected impacts of oil palm expansion on threatened vertebrates (birds, mammals, and amphibians) should be avoided in habitats where threatened fauna are found (in Colombia such as La Serrania de la Macarena, the Darien, and the Tumaco forests) by minimizing overlap between areas suited for oil palm expansion and threatened vertebrates. N. Ocampo and others. Quantifying impacts of oil palm expansion on Colombia's threatened biodiversity. [Biological Conservation 224 117-121 2018] D

DRY FOREST HURRICANE RESPONSE IN MEXICO

Tropical dry forests on the Pacific Coast of Mexico experience very infrequent hurricanes. Landfall of two occurred in 2011 (category 2) and 2015 (category 4), in the Chamela-Cuixmala Reserve. Within it, 120 litter traps have functioned across five small watersheds since 1982. A direct instantaneous effect of both hurricanes was massive deposition of green and senescent leaves and fine woody debris on the forest floor, a volume in excess of that of any previous month. Recovery from the category 2 hurricane was fast, partly due to higher than seasonal precipitation, and the P-enriched litter. Litterfall decreased to half during the first year after the category 4 hurricane and the rainfall was 20% below average. Drought after a hurricane is likely to slow recovery. Martínez and others. Resilience of tropical dry forest productivity to two hurricanes of different intensity in western Mexico. [Forest Ecology and Management 426 53-60 2018] D

HURRICANE RESISTENCE BY TREES IN MEXICO

Tree response to hurricanes in the tropical dry forest of Mexico varies by species and depends on architecture and resource use strategy. A study was made of 993 trees of DBH >10 cm and 36 species, looking at five functional traits for tree resistance and resilience. Characteristics of tree shape, size, and function influence the type and severity of damage by hurricane winds and the degree of recovery by resprouting tree trunks or branches. Resprouting recovery was positively related to total height, but negatively related to wood density. The fast-slow growth traits do not mandate a capacity to recover from damage. The results challenge the notion that dense-wooded forests should resist better than light-wooded, wide-stemmed species. H. Paz and others. Understanding hurricane resistance and resilience in tropical dry forest trees. [Forest Ecology and Management 426 115-122 2018] D

***EUCALYPTUS* WOOD FOR CHARCOAL IN BRAZIL**

The source of the wood was 7-year-old plantations of 5 species of *Eucalyptus* in Rio Grande do Sul, Brazil. Species were rated on basic density, structural chemical composition, and heating value. The woods were carbonized in a furnace at 450 degrees C. All species had similar charcoal quality. Differences existed in the structural chemical composition of the wood, resulting in differences in yields. Of the five species compared *Eucalyptus benthami* was superior to the others, as the most useful for charcoal production. R. Simetti and others. Wood quality of five *Eucalyptus* species planted in Rio Grande do Sul Brazil, for charcoal production. [Journal of Tropical Forest Science 30 (2) 175-181 2018] D

TROPICAL FORESTRY NOTES (8)

OVERLAP FLOWERING PROMOTES HYBRIDS WITH VIGOR IN SINGAPORE

Overlapping flowering promotes hybridization in a tropical rain forest. We recently found hybrids in a rain forest fragment in Singapore, the fertility and growth of which are unknown. We studied the flowering of four species of *Shorea*, a dipterocarp, and the seedlings reproduced from them. We found that one species bloomed first, followed by other *Shorea* species and two hybrids. Fruits collected from the hybrids were viable and showed greater survival and a higher growth rate under greenhouse conditions than those from pure species. These results may imply that successive hybrids and introgression spontaneously occur among *Shorea* species. It may be important to consider the risk of hybridization for the management of tropical forests, particularly in degraded tropical rainforests where mechanisms of ecological isolation between closely related species might be altered. T. Kenzo and others. Overlapping flowering periods among *Shorea* species promote hybridization and introgression, with seedlings of high performance for management of a tropical rain forest. [Forest Ecology and Management 435 38-44 2]

COLLABORATIVE FOREST RESEARCH IN NEW GUINEA

Australia and Papua New Guinea have a close relationship in agriculture and forestry and related research. The present study concerns ten collaborative forestry research projects implemented in the PNG by the Australian Center for International Research. Such projects in the PNG are challenging due to weak government service delivery, poor infrastructure, and a clan-based society. The relative success of the projects depended on 37 identified factors. Factors promoting success included initial collaborative scoping, research design, funding and equipment, leadership and management, selection and commitment of partner institutions, and effective communication. (FHW) The factors listed belong in all forest research, whatever the subject. A G. Bartlett and others. Factors affecting the success of collaborative forestry research in Papua New Guinea. [Australian Forestry 81 (2) 116-128 2018] D

AUSTRALIAN FOREST RESEARCH: ITS RISE AND DECLINE

A modern Australian forest industry was built on the foundations of science and technology provided by decades of research and development undertaken and funded by government and the universities. It has enabled socio-innovation for business growth and sustainability. In recent years investments in R&D declined sharply. R&D funding declined from the national economy. Government involvement with the industry declined. Recognition of the importance of R&D by the industry declined. R&D talent and capability is declining. For a better future, requirements include industry investment, partnerships between R&D and other priority sources, and general funding from public and private sources. G. A. Kile and others. The rise and fall of research and development for the forest industry in Australia. [Australian Forester 77 (3/4) 142-152 2014] D

THE AUSTRALIAN BUSHFIRE CLASSIFICATION

Bushfire managers need explicit fuel data to support fire management. Fuel characteristics, including the distribution of fuel elements by size class, live and dead components, compactness, and horizontal and vertical continuity, are important determinants of fire behavior and key to understanding suppression difficulty and assessing the risk of damage from bushfires. The Bushfire Fuel Classification scheme is based on a top-down approach with three hierarchical tiers suitable for a variety of fire management applications. The level of detail with which a fuel complex is described varies from a coarse description for the top tier to precise information in the third (bottom) tier. J. J.

Hollis and others. Framework for an Australian fuel classification to support bushfire management. [Australian Forestry 78 (1) 1-17 2015] D

HEAD-FIRE RATE OF SPREAD FOR AUSTRALIAN FUELS

The knowledge of a free-burning fire's potential rate of spread is critical for safe and effective brushfire control and use. Head-fire rates of spread in various types of Australian vegetation have been developed over the past 60 years, including grassland, shrubland, and both dry and wet Eucalypt forests and pine plantations. Recommended are models that should underpin best practices in the operational prediction of fire behavior. M. G. Cruz and others. Empirical-based models for predicting head-fire rate of spread in Australian fuel types. [Australian Forestry 78 (3) 118-158 2015] D

FOREST THINNING EFFECTS ON FIRE HAZARD IN AUSTRALIA

The effects of thinning on the hazard of fire depend on how and when thinning is done. Thinning operations have been perceived to potentially heighten fire risk in East Gippsland, Australia. But slash remains largely disappeared in 4 years, reducing hazardous fuels. Thinning, by reducing the overall fuel hazard, may also reduce the likely suppression difficulty by substantially reducing potential vertical development of fire at the flaming front. E. Proctor & G. McCarthy. Changes in fuel hazard following thinning operations in mixed-species forests in East Gippsland, Victoria. [Australian Forestry 78 (4) 195-206 2015] D

FORTY YEARS OF CITES WILDLIFE TRADE

Trade is reported for CITES (Convention on International Trade in Endangered Species of Fauna and Flora). The reporting period is from 1975 to 2014, a period with > 16 million shipments of 28,282 species. During that period the volume in reported legal trade in CITES-listed wildlife rose from 25 million organism equivalents per year to 100 million. M. H. Satu and others. Unveiling the patterns and trends in 40 years of global trade in CITES listed wildlife. [Biological Conservation 223 47-57 2018] D

THE THREATS FACING FAUNA IN AUSTRALIA

In Australia wildlife is faced by six threats, invasive species, habitat loss, biological resources use, natural systems modification, and climate change. The number of threats associated with each species was correlated with the research effort for that species and research effort was correlated with body mass, exposing a bias towards larger-bodied species. Body mass was also correlated with the number of threats. A. Ariadna and others. The threats endangering Australia's at-risk fauna. [Biological Conservation 222 172-179 2018] D

CUBA CONSERVATION STATUS

A major report of nature in the Caribbean discusses high biodiversity and endemism in Cuba. Forest and biodiversity protection policies result in the second largest rate of forest recovery worldwide, and doubling of both marine and terrestrial protected areas. Nevertheless, a significant part of the Cuban biota suffers from deforestation and degradation. Threats include tourism, hurricanes, and introduced species. F. Goulart and others. Conservation lessons from Cuba. [Biological Conservation 217 280-288 2018] D

TROPICAL FORESTRY NOTES (9)

IDENTIFICATION BY BARK OF AMAZONIANS TREES

The ability to confirm tree identification in the field is needed for Amazonian forest management. Spectral reflectance of outer tree bark (rhytidome) offers a method. Spectral data were collected from 254 trees of 11 species in the Central Amazon. A field spectrometer gave reflectance values from 350 to 2500 nm wave lengths. The rate of correct species assignment using the technique on outer bark spectra was 94%. The application of this technique can improve the quality of species identification directly during field inventories, fostering better management. L. Hadlich and others. Recognizing Amazonian tree species in the field using bark tissues spectra. [Forest Ecology and Management 427 296-304 2018] D

SILVICULTURAL FOREST RECOVERY IN AUSTRALIA

To compare the effects of silvicultural treatment intensity, forest plots with initially 70 to 75 species each received different types of management. In 1967, plots were treated (1) with selective logging only, and (2, 3, and 4) in 1969 in addition received low, medium, and high-intensity silvicultural treatments. After the additional treatments, the number of species with trees dbh>10 cm was reduced to 48 (2), 42 (3), and 18 (4) species. Changes in the number of species were followed until 2015. Over 46 years, species composition largely returned to pre-logging conditions in the logged only, and low and medium intensity treatments, but not in the high intensity treatment.. High intensity silvicultural treatments should be avoided if rapid recovery of species diversity and composition is wanted. J. Herbohn and others. Recovery of species composition, over 46 years in a logged Australian tropical forest following different intensity silvicultural treatments. [Forest Ecology and Management 409 660-666 2018] D

OIL PALM PLANTATION EFFECTS ON AMAZON BIRDS

A study tested the hypothesis that converting forests to oil palm decreases functional diversity of bird communities, selecting species more tolerant of environmental disturbances. Bird point counts were conducted in 16 plots in the eastern Amazon, 32 points in riparian forest, 128 in oil palm, and 160 in forested habitats. We calculated indexes for functional diversity and functional richness. Functional diversity of birds was significantly higher in the forest plots in comparison with riparian forests and oil palm, and lower in oil palm when compared with riparian forests. Functional richness values were greater forest than in oil palm and riparian forest. These results show that the conversion of forested areas to oil palm represents a great loss of functional strategies. The functional traits most affected by oil palm are associated with diet and foraging stratum. Oil palm plantations reduced functional diversity of the birds, but riparian forests within plantations and adjacent fragments of forest are extremely important for the maintenance of ecosystem services. S. M. Almeida and others. The effects of oil palm plantations on the functional diversity of Amazonian birds. [Journal of Tropical Ecology 32 (6) 510-525 2016] D

DARK SOIL OF PRECOLUMBIANS IN AMAZONIAN HOME GARDENS

Amazonian dark earths (ADE) are anthropogenic soils mostly created between 500 and 2500 years ago by pre-Columbian populations. They are currently used by local people for different agricultural and agroforestry systems. Because of their high fertility they may play an important role in the conservation of non-native agrobiodiversity. This study is aimed to investigate the variation in richness and abundance of exotic and native species using home gardens along the ADE soil continuum. We conducted floristic inventories in 70 home gardens located in seven riverside

communities along the lower and middle Madeira River in Central Amazonia. Each species sampled was classified according to its origin: native Amazonian, American from outside Amazonia, and non-American, and each sample was classified according to its form of establishment: cultivated or spontaneous. The floristic diversity was significantly related to soil fertility, texture, and home garden size. We found a positive relationship between soil fertility and richness of species and land uses. Home gardens on more fertile soils tended to have a higher richness and abundance of cultivated non-American species, as well as higher richness and abundance of spontaneously established American species. More fertile home gardens provided conditions for the establishment and growth of many species, especially exotic species that are often more nutrient-demanding than Amazon species. Our results show that home gardens on ADEI favor experimentation with the introduction of a wide range of species from various regions of the globe. N. B. de Souza and others. The role of fertile anthropogenic soils in the conservation of native and exotic agrobiodiversity in Amazonian home gardens. [Agroforestry Systems 93 (2) 471-482 2019] D

TEAK: PRUNED AND THINNED IN JAVA

Thinning and pruning treatments were applied to four-year-old teak trees on degraded limestone soil in Java. Diameter growth increased with thinning intensity, especially in the first year, whereas the effect of pruning was undetectable after three years. Initial high growth rate after thinning could not be maintained due to poor soil condition. The effect of pruning was undetectable after three years. Cumulative production (standing stock plus harvested timber) was highest for the heaviest thinning treatment. On degraded soils, short rotation commercial teak thinning could maintain growth rates and provide income for tree growers. W. Budiadi and others. Response of a clonal teak plantation to thinning and pruning in Java, Indonesia. [Journal of Tropical Forest Science 29 (1) 44-53 2017] D

RADIAL WOOD OF *NEOLAMARCKIA*

The effect of radial growth on anatomical characteristics was tested on 4-year-old trees of *Neolamarckia cadamba*. No significant differences between slow, medium, and fast-growing trees were found in almost all anatomical characteristics and wood properties, such as stress-wave velocity, dynamic modulus of logs, fiber length, diameter, and wall thickness, vessel element length, diameter and frequency, basic density, and compressive strength, suggesting that these characteristics are independent of radial tree growth rate. Y. A. B. Pertiwi and other. Radial wood variance in *Neolamarckia cadamba*. [Journal of Tropical Forest Science 29 (1) 30-36 2017] D

NUTRITION INPUT OF BAMBOO IN NIGERIA

Bambusa vulgaris stands are a better conservers of C, N, and P compared to secondary forests in Nigeria. Collected litter there, sorted by leaves and twigs, is dried and analyzed for nutrients. Leaf litter yielded Ca, K, Na, P, Mn, Zn and Cu, whereas twigs yielded C, Mg, Fe, and N. T. V. Borisade and others. Nutrient input in litter and soil of *Bambusa vulgaris* stands in a secondary rain forest, ILE-IFE, Nigeria. [Journal of Tropical Forest Science 30 (2) 195-206 2018] D

TROPICAL FORESTRY NOTES (10)

HOW MUCH CONSERVATION AREA IS NEEDED?

Conservationists commonly recommend larger protected areas. Yet conservation values are not distributed evenly over the land, making protection more effective in some places than others. Return on investment is called for, including a maximum of special habitats and living endangered animals per protected area. Not only do protection benefits vary but also protection costs. Large protected areas offer a greater ecological return per dollar invested if the goal is to reduce forest fragmentation, whereas smaller areas may offer a greater return on investment offering protection to more species. A portfolio of site sizes may need to be included in protected area networks when multiple objectives motivate conservation. P. R. Armsworth and others. Is conservation right to go big? Protected area size and conservation-return-on-the-investment. [Biological Conservation 225 229-236 2018] D

SPACING OF BRAZILNUT TREES IN THE PERUVIAN AMAZON

The distribution of commercial Brazil nut trees (*Bertholletia excelsa*) was not uniform in a 1,413 ha sample in three selectively logged concessions in Madre de Dios in the Peruvian Amazon Basin. A study asked (1) what are the densities and distribution of juvenile (<40 cm DBH) and adult (>40 cm DBH) trees of Brazil nuts, (2) what is the spatial relationship between juveniles and adults? and (3) what is the spatial relationship between juveniles and stumps? Juveniles were not associated with either adults or cut stumps. Strong peaks of aggregation for juveniles and adult Brazil nut trees occurred at long distances (300-900 m), suggesting multiple tree canopy gaps as drivers of spatial distribution patterns either via natural or human sources in southwestern Amazonia. C. A. Rockell and others. Spatial distribution of *Bertholletia excelsa* in selectively logged. Forests of the Peruvian Amazon. [Journal of Tropical Ecology 33 (2) 114-127 2017] D

NOCTURNAL BIRDS OF ECUADOR

The nocturnal birds of Ecuador include owls, nightjars, and potoos. A survey on 22 forest fragments in northwest Ecuador (3-34 ha) found 11 species (2 to 7 per fragment). Bird community similarity was not correlated with any measured environmental variable. S. T. Walter and others. Nocturnal birds of Ecuador forests. [Journal of Tropical Ecology 33 (6) 357-364 2017] D

LEAF-CUTTING ANTS IN BRAZILIAN DISTURBANCES

A total of 35.4 ha was sampled for leaf-cutting ants in Brazil, some near roads and some distant. Included were 131 active colonies (and 93 inactive) of leaf-cutting ants. Three species of *Atta* were encountered: *A. opaciceps*, *A. sexdens*, and *A. laevigata*. The density of active colonies decreased from 15/ha along roads to only 3/ha at a distance of up to 300 m from roads. Active colonies generally occur with low vegetation. Anthropogenic disturbances promote the proliferation of leaf-cutting ant colonies that affect plant regeneration via herbivory and ecosystem engineering, such as in the rainforests. F. F. S. Siqueira and others. Leaf-cutting ant populations profit from human disturbances in tropical dry forest in Brazil. [Journal of Tropical Ecology 33 (5) 337-344 2017] D

CASUARINA: IMPROVING GROWTH AND NITROGEN FIXATION

Casuarina is one of the commonest trees along tropical beaches. *Casuarina equisetifolia* has root nodules where actinomycetes fix atmospheric nitrogen for plant needs. Seedlings of *C. equisetifolia* were inoculated with Frankia strains and their growth performances, biomass, and tissue N content were improved over control seedlings. Inoculated seedlings survived >95% and had improved

biomass and N fixation. Karthkeyan and others. Frankia strains for improving growth, biomass, and nitrogen fixation in *Casuarina equisetifolia* seedlings. [Journal of Tropical Forest Science 28(3) 235-242 2016] D

GROWTH OF EIGHT TREE SPECIES BASED ON TREE RINGS

Precise delimitation of annual rings in tropical trees is vital for implementing precise management practices. Annual rings were found in *Amburana*, *Cedrela*, *Platymiscium*, *Centrolobium*, *Hymenaea*, *Adenanthera*, and *Ficus*, from the dry tropical cerrado forests of Bolivia. Initial or marginal parenchyma is the most consistent pattern delimiting annual bands in six of the eight selected species.. Given the difficulty of properly dating some tropical woods, a combination of cross-dated and non-cross-dated tree rings could provide reliable information for sustainable forest management. L. López and others. Reliable estimates of radial growth for eight tropical species based on wood anatomical patterns. [Journal of Tropical Forest Science 28 (2) 139-152 2016] D

POST-LOGGING REGENERATION GROWTH IN VIETNAM

Forest regeneration after logging is part of sustainable forest management. After 30 years of selective logging, regeneration of seedlings (height <2m), saplings (height >2m) and small trees (dbh <10 cm) and larger trees (dbh >10cm) were compared in high impact (30-50% extracted), low impact (<30% extracted) and unlogged forest. After 30 years the forest was still recovering from logging. Basal areas in high and low impact forests were significantly lower than that in unlogged forest. Densities of seedlings and saplings after high impact logging were significantly higher than in other forests. T.V. Do NV Cam and others. Post-logging regeneration and growth of commercially valuable tree species in evergreen broadleaf forest of Vietnam. [Journal of Tropical Forest Science 28 (4) 426- 435 2016] D

SEED DISPERSAL BY BIRDS VISITING A TROPICAL TREE IN BRAZIL

Observations covered 22 frugivorous bird species visiting a tree of *Cabralea canjerana* in a fragment of the Brazilian Atlantic Forest during a 9-year period. Quantitative seed dispersal efficiency depended on the frequency of visits to the tree and the number of fruits removed per visit. The qualitative measure considered the probability that seeds were dispersed to a suitable site for recruitment. These measured varied among bird species and among years within bird species. The main disperser was a migratory species (the chivi vireo) which varied in quantitative fruit take from 3.0 to 7.1. Seed dispersal is variable over the course of a plants life, with consequences for its fitness. M. A. Pizo and others. Temporal dynamics in the effectiveness of seed dispersal by birds visiting a tropical tree. [Journal of Tropical Ecology 34 (4) 235-242 2018] D

PARROT THREATS IN AMERICA

Threats to parrots were found in 192 populations, of 96 species in 21 countries. The threat most closely associated with population decline is capture for the pet trade. Other threats include small-holder farming, rural population pressure, and grazing by agroindustry and small-holders. Conservation actions have applied to less than 20% of the species. Threats should concentrate on protection of wild populations to reduce the capture of wild parrots for pets. B. Quillfeldt and others. Current threats faced by Neotropical parrot populations. [Biological Conservation 214 278-287 2017] D

TROPICAL FORESTRY NOTES (11)

TYPHOON EFFECTS ON CLIMBING PLANTS IN TAIWAN

We used all 167 typhoon warnings issued by the Taiwanese Central Weather Bureau from 1958 to 2006 and the frequency of each in 1-km² grid cells was calculated. We used other sources to compile a comprehensive georeferenced vascular epiphyte database that contained 39,084 records of 331 species. Each epiphyte record was assigned to a cell in the same 1-km² grid. Then we used species distribution models to predict the potential presence of each species in the grid cells. We considered cells only east of the central mountain ridge where typhoons hit with full force. We eliminated rare species and those that could not be evaluated. We were left with 156 epiphyte species in 10,725 1-km² cells. The number per cell ranged from 2 to 82 species. Correlation analysis showed that, over time, typhoons led to a decrease in epiphyte richness. Ferns, orchids, hemi-epiphytes, and dicotyledons generally showed the same pattern. We recommend monitoring of epiphytes over a long period to corroborate the suggestion from this indirect study that typhoons have a long-term effect on the epiphytes of Taiwan. R. C-C Hsu and others. The long-term effect of typhoons on vascular epiphytes in Taiwan. [Journal of Tropical Ecology 34 (5) 308-315 2018]

INTERNATIONAL CONSERVATION COMMITMENTS FOR NATIONAL ACTION

Most countries have preserved a portion of their land to preserve biodiversity, in compliance with the Convention on Biological Diversity Aichi targets 11, with a focus on protecting areas of particular importance for biodiversity. National-scale provisions are needed to meet the targets and guide broader conservation and land use policy development. In recent years international threats to biodiversity conservation have increased and consequently, protected areas are evermore critical to achieving the Aichi targets. Guyana is a country with high biodiversity and low economic development. For Guyana, conservation priorities were established with stakeholders based on 17 vegetation types and 329 vertebrate species. Our study provides a scientifically robust, politically acceptable protected area expansion strategy for Guyana, and illustrates the importance of conservation planning at the country-scale to translate international commitments into national action. E. Bicknell and others. Designing protected area networks that translate international conservation commitments into national action. [Biological Conservation 214 168-175 2017] D

CLIMATIC EFFECT ON BRAZILIAN WOOD DENSITY

Provenance trials are a useful tool to disentangle genetic variation from plasticity of adaptive traits among populations within the same species. If wood density is a strongly heritable trait selected by climatic conditions, we hypothesized that its variation in provenance trials should be shaped by the provenance climatic variables. We tested data on 25 species published between 1966 and 2010. Eight species showed significant positive correlations between provenance wood density and drought conditions at provenance origin. Two species of woods showed the opposite trend. For these ten species, their wood densities may reflect drought acting as a selection pressure. The remaining 15 species of woods showed no correlation. Nabais and others. The effect of climate on wood density: What provenance trials tell us. [Forest Ecology and Management 408 148-156 2018] D

WILD FOREST FOODS IN TIMBER CONCESSIONS IN CONGO

Sapelli (*Entandophragma cylindricum*) and tali (*Erythrophleum suaveolens*) are important timber trees harvested in the Congo Basin forests. They also host edible caterpillars (*Imbrasia oyermensis* and *Cirina forda*), which are important for the nutrition and income of rural and urban populations. The density of these two tree species was evaluated around 4 villages and in the 2012 cutting areas of

two timber concessions in the Region of Kisangani. Of the harvestable trees, sapelli has been logged more than 25% and tali only 3%. Harvestable sized trees (>60 cm DBH) occurred at 0.048/ha for sapelli and 0.347/ha for tali. Harvestable trees yielded more caterpillars than smaller trees. Multiple-use management would require more deliberate planning and local committees. P. Aluku and others. Can the production of wild forest foods be sustained in timber concessions? Logging and the availability of edible caterpillars hosted by sapelli (*Entandrophragma cylindricum*) and tali (*Erythrophleum suaveolens*) trees in the Democratic Republic of Congo. [Forest Ecology and Management 410 56-65 2018] D

REDUCED LOGGING EFFECTS IN YUCATAN, MEXICO

On the Yucatan peninsula communities (ejidos) are an important source of timber for national and international markets. Carbon emissions from these harvests can be substantial. To assess variation in logging-induced emissions we estimated carbon from damage to trees >5cm DBH in the annual cutting areas of ten forest-managing ejidos. Baselines were developed for emissions from felling, skidding, and transport of timber. Ejidos were then compared with respect to whether they were FSC-certified, size of annual cutting, area, logging intensity, and implemental of RIL practices, particularly directional felling, skid trail planning, and the use of small agricultural tractors instead of heavy logging skidders. The carbon impacts of enrichment planting in multiple-tree felling gaps were also evaluated. Carbon emissions for selective logging ranged from 1.19 to 2.55 Mg/m³ for the 10 ejidos. Most emissions (73%) were from the remnants of trees felled for their timber, followed by skidding (11%), and transport infrastructure (roads and landings) (8%). Our analyses indicate that employment of RIL practices resulted in fewer damaged trees and lower carbon emissions, even in ejidos with high logging intensities. Greater collateral damage was found in multiple felling gaps, but the increased emissions were offset by reductions in the remnants of harvest trees. Adoption of RIL practices by all ejidos would be a substantial Mexican contribution to mitigation of climate change. E. A. Ellis and others. Reduced impact logging practices reduce forest disturbance and carbon emissions in community managed forests on the Yucatan Peninsula of Mexico. [Forest Ecology and Management 437 (1) 396-410 2019] D

ARAUCARIA IN FRAGMENTS IN SOUTHERN BRAZIL

A study of *Araucaria* forest on nine fragments in southern Brazil related forest development to environmental characteristics. The study concluded that tree mortality and basal area loss rates were less on the larger fragments, with a greater proportion of interior areas. Based on results recommendations the protection of small and large forest fragments and incentives to promote the silviculture of the most relevant timber species, the light demanding *Araucaria angustifolia*, in the deforested lands of the region. A. Gross and others. Fragmentation as a key driver of tree community dynamics in mixed subtropical forests in southern Brazil. [Forest Ecology and Management 411 20-26 2018] D

MANAGEMENT OF MATANG MANGROVE, MALAYSIA

The availability of Unmanned Aerial Vehicles (drones) with sensors presented a promising alternative for inventorying mangrove forests that are homogenous and remote. A comparison of UAV and ground measurements was made in a structurally complex 90-year old protective forest zone in the Matang Mangrove Forest Reserve in Perak Province, Malaysia. In the productive zone median tree stand heights by the UAV was 13.7 m, compared to 14.0 m by the field method. In the protective zone, the median tree stand heights retrieved from the UAV and field data were, respectively, 25.8 and 16.5 m (significant difference, p-value = .0001) taking into account only the upper canopy. The above ground biomass (AGB) in the productive zone was estimated at 217 Mg/ha using UAV data

and 238 Mg/ha using ground inventory data. UAV was considered most useful for canopy heights and biomass from forests that were relatively homogeneous with a single dominant layer. Suggestions are included for combining UAV use with field data that might be appropriate where mangroves are remote or difficult to work in. V. Otro and others. Managing mangrove forests from the sky: Forest inventory using field data and Unmanned Aerial Vehicle (UAV) imagery in the Matang Mangrove Forest Reserve, Peninsular Malaysia. [Forest Ecology and Management 411 35-45 2018] D

BRAZIL NUT FRUIT SUSTAINABILITY

Primary (fruit fall) and secondary dispersal was tracked for 20 Brazilnut trees in a 20ha area over a three month period. The fruit fall of 6,855 fruits was relatively synchronous. Agoutis and other scatter hoarders removed 4% of fruits from beneath the tree crowns and opened 0.5% of fruits beneath the mother trees. About 25% of fruit opening and removal was within 5 days of fruit fall. By mid-January, when human harvest begins at the study site, 94% of the fruits have fallen and 3% have been consumed or dispersed. Humans had weeks of unlimited harvesting access in the study area. Our results and collective understanding of the *Bertholletia-Dasyprocta-Homo sapiens* interactions indicate that harvests in our study site and region boost incomes and likely do not threaten Brazil nut recruitment or maintenance of agouti populations. H. de Oliveira and others. Primary and secondary dispersal of *Bertholletia excelsa*: Implications for sustainable harvests. [Forest Ecology and Management 415-41] D

FATES OF ATMOSPHERIC NITROGEN OVER FORESTS

Stable isotope $^{15}\text{NH}_4^+$ and $^{15}\text{NO}_3^-$ tracers were applied as solutions to a forest floor to examine the fates of different forms of N in a tropical montane primary forest with low background atmospheric N deposition (6 kg N /ha/yr) in China. Between 60 and 66% of added ^{15}N was retained in the ecosystem. Recovery of from ^{15}N $^{15}\text{NH}_4^+$ and $^{15}\text{NO}_3^-$ from plants was 7% and 16% respectively after three months, and 11% and 29% after a year. After three months, 21% and 12% of the ^{15}N from the two sources of N had been accumulated in the organic layer, but over half of this was lost after one year. Mineral soil was the largest sink for deposited N, which is relatively stable, with 39% and 32% of the initial ^{15}N input recovered after one year. Weixing and others. Fates of atmospheric deposited nitrogen in an Asian tropical primary forest. [Forest Ecology and Management 411 213-222 2018] D

TROPICAL FORESTRY NOTES (12)

MANGROVE NUTRIENTS FROM AUSTRALIA TO THE SEA

At Lizard Island in Western Australia two mangrove forests (marine ecosystems) received nutrients from kangaroos and a bat roost. The transfer from terrestrial to marine ecosystem is thought driven by hydrological connectivity. On Lizard Island kangaroos that feed in grasslands and shelter in the mangrove contribute nutrients to the mangrove. The bat roost seemed to enrich foliar nitrogen in nearby mangrove trees by up to 150%. R. Reef and others. Mammalian herbivores in Australia transport nutrients from terrestrial to marine ecosystem via mangroves. [Journal of Tropical Ecology 30 (3) 179-188 2014] D

TREE FRUIT SET NEAR FORESTS IN THAILAND

Pollinators are sensitive to their proximity to orchards and forests. Different pollinator groups respond differently to distance from sources. Rambutan fruit set is significantly influenced by distance to forest. The main visitors to rambutan flowers are bees. To durian and mango, they are nectarivores bees and flies. And fruit set is not influenced by distance from forest. Maintaining forest patches may provide stepping-stones across fragmented landscapes. T. Sritongchuay and others. Effects of forest and cave proximity on fruit set of tree crops in tropical orchards in southern Thailand. [Journal of Tropical Ecology 32 (4) 269-279 2016] D

HABITAT USE BY KENYA LEOPARDS

The activities of seven leopards (*Panthera pardus*) outside a preserve were tracked in rural Kenya. During the day they avoided prospective encounters with people, but the avoided locations were used at night. Human habitats were also visited during far-ranging activities. There is a need to balance leopard conservation and livestock ranching. K. van Cleave and others. Patterns of movement activity and habitat use by leopards (*Panthera pardus*) living in a human dominated landscape in central Kenya. [Biological Conservation 226 224-237 2018] D

PINUS TAEDA BETTER GROWTH IN BRAZIL

Evidence exists that *Pinus taeda* grows faster outside its native range. The cause was hypothesized to be either differences in light use efficiency or volume growth per unit heat sum. *Pinus taeda* seedlings of common genetic composition were planted in at three densities 3 or 4 replications at a native site in North Carolina, USA and at exotic sites in Virginia, USA, and Parana, Brazil. Densities were 618, 1,235, and 1,853 per hectare. After 5 years the trees in the Brazil site were taller, and their stand basal area and volume were greater than on the other sites. There was no evidence of light use efficiency differences or heat sum differences. Other factors of respiration and extreme climate conditions may contribute to growth differences, but their assessment would call for more intensive research. The sites used in this study for further research are ideal because they have the same genotypes. J. Albaugh and others. A common garden experiment examining light use efficiency and heat sum to explain growth differences in native and exotic *Pinus taeda*. [Forest Ecology and Management 425 35-44 2018] D

LITTERFALL AND LITTER DECOMPOSITION IN FOREST RECOVERY IN BRAZIL

Litterfall is important in nutrient cycling and maintenance of soil fertility. It is subject to seasonal and human activity impacts. Litterfall quantity and quality relate to the status of forest habitats. Litterfall is less in disturbed habitats. The dynamics of litterfall and its decomposition reflect the progress of

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

NUTRITIONAL POTENTIAL OF FODDER TREES

The nutritional potential of leaves available for cows was analyzed from trees suited for silvopastoral systems. Tree leaves were collected during the summer months and analyzed for digestibility, crude protein, and major and minor elements. Much depends on the species selected. No effect of soil type was found on leaves. Species and sampling period are key to nutrient concentrations. Depending on the species, trees can provide useful nutrients to the diet of livestock. Luske and others. Nutritional potential of fodder trees on clay and sandy soils. [Agroforestry Systems 92 (4) 975-986 2018] D

ROSEWOOD OIL PRODUCTION IN AMAZONIA

Rosewood essential oil (REO) is an Amazonian crop required by fragrance and cosmetic industries worldwide. It is obtained from a singular resource, the endangered tree species *Aniba rosaeodor*. Management of the trees influences the quality and international price. A study was performed in the plantations of two producers. It showed differences in REO yield and composition between different tree parts and harvest seasons. REO yield was highest in branches from the first harvest and in resprouting leaves from the second harvest. The temporal spacing of harvest rotations and the use of different plant parts in extraction are the main management tools determining the variations in REO. Despite higher EO yield in the stem, the management by crown pruning assures sustainable oil production. Greater understanding of these differences may permit higher yields. M. Kramovic and others. Changes in rosewood (*Aniba roseanodora* Ducke) essential oil in response to management. [Forest Ecology and Management 429 143-157 2018] D

GROWTH OF TIMBER AND IMPLICATIONS FOR MANAGEMENT IN AFRICA

Tree growth depends on ecological conditions, tree genetics, and competition with surrounding vegetation, as well as tree size. We evaluated the variability in growth of *Triplochiton scleroxylon*, an African long-lived pioneer and commercially very important species. We gathered a broad dataset composed of tree-ring data recorded from one site in Cameroon and periodic field inventory data recorded from seven sites across Central Africa. In total we analyzed 13,225 records of tree diameter from Cameroon, Republic of the Congo, and Central African Republic. We evaluated (1) to what extent the average growth of trees that reach harvestable dimensions differs from the population average and (2) to what extent past perturbations influence the growth of remaining trees. We found the diameter growth of *T. scleroxylon* to be remarkably variable and some key growth determinants. Diameter increment was weakly related to tree size but increased twofold from unlogged to logged forests. Logging stimulates growth of *T. scleroxylon* for at least 10-15 years. Harvestable large-sized *T. scleroxylon* were found to be trees that grew on average twice as fast as the population average. G. Ligot and others. Growth determinants of timber species *Triplochiton scleroxylon* and implications for forest management in central Africa. [Forest Ecology and Management 437 211-221 2019] D

TROPICAL FORESTRY NOTES (13)

NUTRIENTS FROM BAMBOO FORETS OF NIGERIA

Nutrient contents were collected in four 0.06-ha plots of *Bambusa vulgaris* in secondary forest in Ife-Ife, Nigeria to provide information on nutrient availability. Leaves and twigs were oven dried to a constant weight, and ground and analyzed for nutrients. Leaf litter had higher concentrations of Ca, P, Na, Mn, Zn, and Cu. Twig litter had more C, Mg, Fe, and N. In soil dominated by bamboo shoots, exchangeable cations, pH, sand content, and organic C were lower, and total N, available P silt and clay contents were higher. *Bambusa vulgaris* is a better conserver of C, N and P compared to areas dominated by trees and shrubs species in 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] D

REPRODUCTIVE EFFECT OF LOGGING GAP SIZE AND LOCATION

Castanopsis kawakamii is endangered due to its low population in the middle stage of development and low percentage of seedlings in natural conditions. In nine gaps, the number of *C. kawakamii* trees at the tree, sapling, shrub, and seedling stages were determined at five locations in each gap (center, south, east, north, and west) during a growing season. A significant positive relationship was found between the number of trees and gap area, with higher numbers in larger gaps and in 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] D

SEEDLING REFORESTATION ON PEATLAND IN SOUTHEAST ASIA

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] D

MOLECULARLY MODIFIED WOOD PRODUCTS

Stable and durable wood products can be produced by chemical modification at the molecular level. These properties can be achieved by reacting both hardwoods and softwoods with acetic anhydride. The reaction takes place with the most accessible hydroxyl groups in the cell wall polymers. Lignin reacts the fastest, followed by the hemicelluloses. Both are highly substituted. As the level of bonded acetyl increases, dimensional stability increases, and attack by fungi decreases. The threshold of fungal resistance is approximately 18% acetyl, at which the moisture in the cell wall may be too low to support fungal growth. This is a summary of several projects on the mechanism for enhancement of wood properties. R. M. Rowell and others. Stable and durable wood products based on molecular modification. [Journal of Tropical Forest Science 30 (5) 488-495 2018] D

NUTRIENTS FROM AGROFORESTRY GREEN LEAVES

Nutrients (NH₄, PO₄, and K) leaching from oven-dried green leaves of *Emblica*, *Sesbania*, and *Moringa* were investigated. Leaves were soaked for 8 days in demineralized, distilled water.

Electrical conductivity, dissolved solids, and nutrients were measured at up to 192 hour intervals. The green leaves of *S. grandiflora* and *M. oleifera* can be potential source of NH₄, PO₄ and K for a quick nutrient supplement to the agricultural crops in agroforestry practices. S. H. Limon and others. Nutrients leaching from green leaves of three potential agroforestry systems. [Agroforestry Systems 92 (2) 389-395 2018] D

SOIL CARBON SEQUESTRATION IN AGROFORESTRY

Review of 53 published studies showed increases in soil organic carbon with the presence 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 systems: A meta-analysis. [Agroforestry Systems 92 (2) 285-299 2018] D

FUTURE PRACTICES FOR CACAO PRODUCTION IN GHANA

To meet the growing global demand for cocoa, intensification of production in West Africa is crucial. A total of 731 farmers from four districts and all six cocoa growing regions were questioned to understand the challenges faced in productivity and profitability. Results indicated that show that cocoa productivity and profitability was very low, with an average of 234 kg/ha and Gh¢568 (ca. US\$150) per ha, respectively. Farm management should focus on 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] D

MIGRATORY BIRD HABITATS IN THE MATANG MANGROVE, MALAYSIA

The migratory birds of this study are in the families of sandpipers and plovers. A search for their habitat focused on the Matang mangrove, a Forest Reserve in Perak, Malaysia. Software (GIS) and ERDAS were used to model the relationship between the study parameters (climate, environment, and elevation) and the population density of the migratory birds. Data obtained from satellite images and fieldwork were also used for habitat modelling. Pulau Kalumpang had the highest density of migratory birds. Pulau Sangga Besar and Kertang have potential to be alternative habitat locations in 20 years. R. Azimah and others. Habitat requirements of migratory birds in the Matang Mangrove Forest Reserve, Perak. [Journal of Tropical Forest Science 30 (3) 304-311 2018] D

DETECTING POACHERS IN MIOMBO WOODLANDS IN TANZANIA

We evaluated the influence of various factors on poacher detection probability: camera (visual spectrum: RGB and thermal infrared: TIR), density of canopy cover, subject distance from the image center line, subject contrast against the background, altitude of the drone, and image analyst. A multi-level model was used to analyze TIR image and a general linear model was used for RGB image data. The TIR camera had a higher detection probability than the RGB camera. Detection probability in TIR images was significantly influenced by canopy density and subject distance from the centerline, and the analyst. Detection probability in RGB images was significantly influenced by canopy density and subject contrast against the background, altitude, and the analyst. Development of automated detection using machine learning might increase the probability of detection. L. Hambrecht and others. Detecting ‘poachers’ with drones: Factors influencing the probability of detection with TIR and RGB imaging in Miombo woodlands, Tanzania. [Biological Conservation 233 109-117 2019] D

TROPICAL FORESTRY NOTES (14)

ECONOMICS OF INTERCROPPING RUBBER IN THAILAND

To alleviate rural poverty in northeastern Thailand, the government promoted new rubber plantations at the expense of annual crops. Rubber, because of a long immature period, is initially produced at a loss. Intercropping of the rubber during this period compensates for the loss of income. Results from a survey of 22 sites showed that interest in intercropping has grown, using cassava and rice as intercrops. Rubber-cassava generated a gross margin of 11,340 B/year for 3 years. Compared to a monospecific rubber plantation, rubber-cassava intercropping systems reduced management costs by 59% over the 6-year period of rubber immaturity. The cash-income from intercropping ranged up to 26.8% of the mean household annual income. D. J. M. Hougni and others. The household economics of rubber intercropping during the immature period in Northeast Thailand. [Journal of Sustainable Forestry 37 (8) 787-803 2018] D

BIRD HABITATS IN AGROFORESTRY IN CAMEROON

Understanding the relationship between forest cover and bird guilds may help assess how much forest is necessary to conserve significant portions of tropical forest bird assemblages. We sampled birds (198 species) from 6,883 encounters along a full gradient of deforestation across 4,000 km² of forest-dominated landscapes in Southwest Cameroon. Multi-variate splines were applied to a, b, and y richness of guilds in relation to forest cover. Overall, b and y richness remained constant above 42% forest cover. However, total α -richness, and all richness measures of biome-restricted, large-bodied, arboreal foliage-gleaning, tree nesting, and frugivorous species declined when forest cover were below 74%. Our study implies that Afrotropical bird diversity decreases non-linearly with forest loss. Our critical habitat thresholds estimates at above 70% are much higher than those previously reported, highlighting the need to integrate substantial proportions of natural vegetation within wildlife friendly farming schemes. D. Kupsch and others. High critical forest habitat thresholds of native bird communities in Afrotropical agroforestry landscapes. [Biological Conservation 230 20-28 2019] D

AGROFORESTRY GRAFTING OF BOABAB

The baobab (*Adansonia digitata* L.) is an African tree that rural communities depend on as a source of food, medicine, and income. Developing vegetative propagation could enhance domestication of the species and the supply of its products. Top cleft grafting had the highest success rate in October at 66.6% and 33.3% success in November. Side veneer grafting in October attained 63.3% success in October and 30.0% success in November. Baobab is easily amenable to grafting when done at the right time and with the correct size of scions. To promote the species in agroforestry grafting, use scions from mother trees with desired attributes. H. Jenya and others. [Journal of Sustainable Forestry 37 (6) 632-644 2018] D

WOOD/CEMENT COMPOSITE PROPERTIES

The rising costs of construction material and global demand for economically sustainable and environmentally friendly building resources have necessitated the use of sawdust/cement composite. The use of sawdust increases the green building resource base and reduces environmental pollution. Sawdust suitability from *Triplochiton scleroxylon* (T), *Entandrophragma cylindricum* (E), and *Klainodoxa gabonensis* (K) for wood/cement composite was determined from their chemical constituents and their composite's physico-mechanical properties. T had the minimum of total extractives, (6.12%) and K the maximum (9.31%). C. Antwi-Boasiako and others. Suitability of

sawdust from three tropical timbers for wood-cement composites. [Journal of Sustainable Forestry 37 (4) 414-428 2018] D

PRIORITIZED PLANTS FOR SPECIES BASED CONSERVATION

There is a growing demand that species-based conservation be strategic and deliver the greatest possible benefits for the money and resources invested. There is no global consensus on what constitutes an important species, but many biodiversity conservation initiatives indicate the most rare, unique, vulnerable and/or useful as deserving attention. It can be difficult for conservation managers to choose the protocol best suited to their conservation purposes, and to combine the protocols that are available. The prioritization process proposed here is integrative, adaptable, straightforward, transparent, and open to refinement. Based on the availability of taxon level data, from an initial list of 337,137 accepted scientific names, we produced a conservation priority list for 25,025 vascular plant taxa. The pteridophytes, gymnosperms, and angiosperms were prioritized based on their geographic rarity, or endemism, taxonomic rarity or uniqueness, vulnerability to extinction, and natural capital value by means of a multicriteria decision-making approach. This list represents about 4.47% of pteridophytes, 36.12% of gymnosperms, and 7.41% of angiosperms global diversity. The list consisted of a high percentage of taxa from South America (30%), and North America (22%) followed by Asia and Europe (each 15%) and Asia tropical (14%) with a low percentage from Australasia (6%), the Pacific (5%) and Antarctica (-2%). The occurrence of some taxa was reported from more than one geographic continent. We found that 573 taxa (2%) had a high priority status, 21,707 taxa (87%) had a medium priority status, and 2,745 taxa (11%) had a low priority status for conservation. The resulting list of plants with priority status, along with their geographic distribution should complement, not replace existing conservation plans. Our method can be used globally across various conservation activities. U. L. S. Kenney and others. A multicriteria decision making approach to prioritize vascular plants for species-based conservation. [Biological Conservation 234 221-240 2019] D.

DELAYED CONSERVATION IN THE BRAZILIAN CERRADO

In a world of increasing demand for natural resources, conservation actions are frequently postponed, even though this may impair biodiversity and the supply of ecosystem services. Here we evaluated the consequences of delaying conservation actions to protect ecosystem services in the Brazilian Cerrado, the most diverse tropical savanna in the world, which is threatened by rapid expansion of agriculture. We generated land use maps for the present and two future periods (2025 and 2050), using a comprehensive land use model. Based on these maps we modeled the provision of six ecosystem services: water yield, sediment retention, carbon storage, nutrient retention, net primary productivity, and wild food provision. We identified priority areas for safeguarding ecosystem services to meet four conservation targets (10, 20, 30, and 40% of each ecosystem service). We found that expected land use changes tended to diminish ecosystem services provision over time and modify their spatial distribution. Priority areas in the region also tended to differ spatially between present and future. Moreover, priority areas identified for the future will encompass more extensive altered environments than those for present day landscapes. Our study highlights the importance of avoiding delays in conservation actions as this may exacerbate conflicts between conservation and development. Arguments based on ecosystem services could create new incentives to simultaneously conserve ecosystem services and the biodiversity associated with them in the region. F. M. Resende and others. Consequences of delaying actions for safeguarding ecosystem services in the Brazilian Cerrado. [Biological Conservation 234 90-99 2019] D

PERSONAL COMPETENCIES DEFINE CONSERVATION LEADERSHIP

Effective leadership is considered essential for conservation success, but there is currently not enough understanding of what conservation leaders are doing or should be doing in order to be effective. Other sectors have a good knowledge of particular styles and suitable instruments for measuring leadership effectiveness. This study uses the perspectives of conservation professionals through interviews, a focus group, and an online survey to help develop a more comprehensive picture of the role of leaders and leadership within the discipline. The study concludes that competencies that relate to interpersonal skills are key for effectiveness, particularly to building trust amongst followers. However, leaders in conservation are not showing these to be the same extent as they are showing more technical skills. Future conservation training schemes should incorporate these competencies to ensure leaders are effective. Greater understanding can help inform conservation professionals who wish to invest in leadership development schemes to improve effectiveness across conservation initiatives. E. Englefield and others. Interpersonal competencies define effective conservation leadership. [Biological Conservation 235 18-26 2019] D

AUSTRALIA'S FOREST BIODIVERSITY

National inventory databases have been developed on native forest-dwelling vertebrate fauna and vascular flora for Australia's State of the Forests Report Series. Although these databases are incomplete, nearly 17,000 species records of vascular plants and over 2,000 vertebrate species records have been assembled. Of the 2,212 records of forest-dwelling vertebrate species, half (1,101 species) require a forest habitat for at least part of their lifecycle. Eucalypt open forest and eucalypt woodland are the most important habitat types for both forest-dwelling and forest dependent vertebrate species. S. M. Davey and others. Reporting Australia's forest biodiversity, forest dwelling and forest dependent native species. [Australian Forestry 81 (2)196-209 2018] D

SECONDARY FOREST RECOVERY IN WEST AFRICA

Of the original rainforest of West Africa, 90% has disappeared and the remainder is heavily fragmented and highly degraded. We studied a chrono sequence of 96 secondary and old growth forest fragments (0.2ha each). Here 32,103 trees with DBH of >2.5 cm have been censused. We modeled the biomass recovery trajectories in a time-explicit Bayesian framework and tested the effect on recovery rates of a large set of covariates related to the physical environment, plot history, and forest connectivity. The trajectory of recovery rate is highly non-linear: recovery rates accelerated from 1 to 37 years, when biomass recovery reached 4.23 Mg/ha/yr. We predict that, on average, 10%, 25%, and 50% of the old growth forest biomass is respectively recovered in 17, 30, and 51 years after abandonment. Recovery rates are strongly shaped by both the number of remnant trees and the previous crop cultivated before abandonment. The latter induced large difference in the time needed to recover 50% of an old growth forest biomass: from 38 years for former yam fields up to 86 years for former rice fields. Our results show (1) the very slow recovery rates of West African forests as compared to neotropical forests, and (2) the long-lasting impacts of past human activities and management choices on ecosystem biomass recovery in West African degraded forests. A. E. N. Guessan and others. Drivers of biomass recovery in a secondary forested landscape in West Africa. [Forest Ecology and Management 433 325-331 2019] D

TROPICAL FORESTRY NOTES (15)

FOREST- EDGE ASSOCIATED BEES IN COLOMBIA

Understanding how bee communities vary with distance from natural areas is key to their conservation. A study of forest-edge bees was made in the Colombian Andes. Bee species richness and abundance increased with an increasing proportion of forest within 1,000 m and flower abundance. Below-ground nesters did not respond to forest. Forest-edge length influenced the abundance of only solitary bees. C. Gutiérrez and others. Forest-edge associated bees benefit from the proportion of tropical forest regardless of its edge length. [Biological Conservation 220 149-160 2018] D.

STEWARDSHIP: WHAT IT IS?

Stewardship broadly refers to a form of collaborative planning and responsible management of the environment using sustainable natural resource management practices that respects ecosystem functions. Types of stewardship include reformist, adaptive, and transformative. These results present future directions for both research and conservation policy. R. Mathevet and others. The concept of stewardship in sustainability science and conservation biology. [Biological Conservation 217 363-370 2018] D

INVASIVE TREE IMPERILS ENDEMIC HOT-SPOT IN JAMAICA

Repeated measurements in permanent plots coincided with invasion by a non-native tree (*Pittosporum undulatum*) of the rain forests over 24 to 40 years of the Blue and John Crow Mountain National Parks in Jamaica. By 2014 *P. undulatum* occupied 12% of the stems >3cm dbh and 10.4% of the basal area of the forest. Across 16 sample plots the more *P. undulatum* increased in basal area over 24 years, the greater the decline in native species richness. Remedial action should identify forest communities with greatest endemism and protect them by control and removal of *P. undulatum*. V. J. Tanner and others. Endemic trees in a tropical diversity hotspot imperiled by an invasive tree. [Biological Conservation 217 47-53 2018] D

INCREASE OF NIGHT LIGHT IN PROTECTED AREAS

The extent to which artificial light at night affects protected areas and biodiversity hotspots was assessed. Artificial light at night was low and stable over time within protected areas, but was highest and increasing in the first outer belt (>25km) around protected areas. Artificial light at night was higher within hotspots, but these are subject to concentric human encroachment. Artificial night light belongs in large-scale conservation policies. A. Guette and others. Worldwide increase in artificial light at night around protected areas and within hotspots. [Biological Conservation 223 97-103 2018] D

PRESCRIBED BURNING AND WILDFIRE SEVERITY REDUCTION IN AUSTRALIA

A study was done of the effect of previous fuel reduction burning (FRB) on the severity of the >1 million ha 2003 Alpine Fire in eastern Victoria, Australia. Sixty-five paired observations (130 total) of fire severity were completed across the broad fire area using GIS (Geographic Information System) analysis. A Fire Severity Index was calculated from the fire, weather, and topographic variables. The greatest effects of previous FRB occurred when the Fire Danger Index stood at 25 or less, and less than 3 years after the burn, when all the components of fuel surface were still substantially reduced. Some fire severity reduction effects were evident, up to 10 years later. K. G.

Tolhurst and others. Effect of prescribed burning on wildfire severity: A landscape case study from the 2003 fires in Victoria. [Australian Forestry 79 (1) 1-14 2016] D

CROP TREE LIBERATION IN BELIZE: COSTS AND BENEFITS

Liana cutting after logging is a seldom-practiced silvicultural treatment designed to foster the growth of future crop trees. We worked in a commercial concession in Belize where future crop trees were liberated from lianas in 500-1000-ha annual timber harvest blocks. We found that field crews assigned this and inventory-related tasks, spent 11.8% of their time cutting lianas from future crop trees at a cost of \$ 0.11 per tree. Workers failed to cut 31.9% of the lianas that infested the 701 future crop trees they were supposed to liberate. Most of the missed lianas grew into crop tree crowns. In a logging block treated 9 years prior to this study, 39% of liberated mahoganies were still liana-free, whereas in an untreated stand 94% of similar sized mahoganies were liana-infested. Based on tree-ring data on the same 9-year period, liberated crop trees grew 38-63% faster than untreated crop trees. If the mean growth is sustained for a 40-year cutting cycle, each liberated crop tree will yield 639 board feet more than from untreated forest. J. M. Stephanie and others. Liberation of future crop trees from lianas in Belize: Completeness, costs, and timber yield benefits. [Forest Ecology and Management 439 97-104 2019] D

THREATS TO ORCHIDS IN AUSTRALIA

In Australia there are 184 orchids identified as threatened by the Australian Government, but what threatens them and where are they threatened? Using data derived from listing documents for these orchids, threats were allocated to 28 categories. Then, the distributions of the orchids and hence likely geographic patterns of threats were mapped using 14,651 location records from the Atlas of Living Australia. The most common threats were changes in the fire regimes (74% of threatened orchids) invasive species (65%), habitat modification (64%), grazing (63%), tourism and recreation (47%), and illegal collection (46%), which often co-occurred as threat syndromes. Most threatened orchids are terrestrial (165 species) and many occur in temperate forests (96) and temperate shrubland (36). In regions with higher protected area cover were more likely to contain orchids threatened by tourism and recreation. Understanding drivers of threats and their distribution is crucial for successful management as they highlight key areas for conservation. J. W. C. Pickering and others. Analysis of threats to orchids. [Biological Conservation 234 7-17 2019] D

INCREMENT CORING EFFECTS ON TREES IN SINGAPORE

Thirty-five trees of 11 species with wood densities ranging from 0.39 to 0.69 g/cm were subjected to increment coring at two sites in Singapore. Of the bored trees only one died within a year. Twenty-five trees had at least one closed borehole and the median time for closing was 10 months. Results indicate that increment coring does not negatively impact the survival and growth of some species of tropical forest trees within the first year after coring. L. Neo and others. Short-term external effects of increment coring on some tropical trees. [Journal of Tropical Forest Science 29 (4) 519-529 2017] D

TROPICAL FORESTRY NOTES (16)

MANAGEMENT PRIORITIES FOR THE ELEPHANTS OF BORNEO

In Sabah, Malaysia less than a quarter of fully protected intact forests are of suitable stature for elephants, since their preference, according to a sample of 29 individuals, is for vegetation only 13 m tall. Such low-lying vegetation is often viewed as suitable for oil palm conversion. Yet disturbed commercial forests were found to be highly suitable for the elephants. The suitability of such degraded lands for the elephants is underestimated as a basis for prioritization of habitats and important relict forests. J. Evans and others. Protected area management priorities are crucial for the future of Bornean elephants. [Biological Conservation 221 365-373 2018] D

RECOVERY OF THE AFRICAN LION IN MOZAMBIQUE

A recovering population of indigenous, free-ranging lions (*Panthera leo*) exists in Gorongosa National Park, Mozambique. The park is undergoing large-scale ecological restoration. Under a government partnership, the park offers a rare example of a population of lions responding to conservation interventions. Within the Park 104 lions were documented and in the 1,100 km² study area there were 6 prides and 7 males under intensive monitoring. The dominant negative factor is traps set by bushmeat hunters. These findings have since resulted in tangible and measurable interventions to reduce these impacts and demonstrate how management interventions can favor large-carnivore recovery. P. Bouley and others. Post-war recovery of the African lion in response to large-scale ecosystem restoration. [Biological Conservation 227 233-242 2018] D

CLIMATE AND FUNGI IN BENIN

Wood-inhabiting fungi contribute substantially to carbon and nutrient cycles by decomposing dead wood. Current knowledge of their occurrence, distribution, and of drivers of their diversity derive almost exclusively from temperate and boreal forest ecosystems. We sampled wood-inhabiting fungi across Benin, a tropical country in West Africa with a strong north-south seasonality gradient consisting of three macroclimatic zones. We aimed at determining whether the macroclimate or the resource base (size or amount of dead wood, number of host tree species, and stage of wood decomposition) is more important for their diversity. Variation partitioning revealed a stronger partial effect of resource on fungal species richness and a strong effect of macroclimate on the community composition. A more detailed linear mixed-effects model revealed a significantly positive effect of host richness, amount of dead wood and macroclimate on fungal species richness and a significantly positive effect of macroclimate and stage of wood decomposition on the community composition. These findings are consistent with the general global pattern of the diversity of wood-inhabiting fungi. Based on these results, existing knowledge should be exploited for the conservation of wood-inhabiting fungi in tropical Benin. A. Olou and others. Effects of Macroclimate and Resource on the diversity of tropical wood-inhabiting fungi. [Forest Ecology and Management 436 79-87 2019] D

CEIBA PENTANDRA CONSERVATION IN THE CARIBBEAN

Understanding the genetic diversity and structure of tree species is crucial not only conservation measures, but also to the sourcing of planting materials to ensure the long-term success of tree planting efforts. The genetic diversity, and stature of *Ceiba pentandra* was assessed from twelve representative locations seasonally dry tropical forest in Colombia. Three different genetic groups were found, representing the Caribbean, the Upper Cauca Valley, and the Patia River Valley. Results indicate priority areas for the *in situ* conservation of *C. pentandra* in seasonal dry forest in Colombia and the Caribbean, and can guide the selection of appropriate planting material for use in restoration.

T. Bocanegra and others. Genetic diversity of *Ceiba pentandra* in Colombian and Caribbean seasonally dry tropical forest: Implications for conservation and management. [Biological Conservation 227 29-37 2018] D

SELECTIVE LOGGING AND LARGE MAMMALS IN MALAYSIA

On West Peninsular Malaysia, unlogged forest had greater wildlife occurrences compared to selectively logged forests. Two endangered mammal species were not found in selectively logged forest. At high altitudes mammal species richness increased with more forest trees with a DBH of >45cm. Leopards and tigers are absent from even unlogged forest, possibly due to disturbances. Reduced impact logging is recommended. J. Jamhun and others. Selective logging causes the decline of large-sized mammals, including those in unlogged patches surrounded by logged and agricultural areas. [Biological Conservation 227 40-47 2018] D

AMERICAN RAINFOREST PRODUCT DIVERSITY IN MEXICO

The New World landscape should yield a diversity of forest products. The abundance and diversity of potential forest products was assessed in a tropical rainforest in southwestern Mexico. In three plots all trees DBH>10 cm were measured, identified, and assigned to eight forest product categories. More than half (94 species) of the total number of species (165) yielded more than one forest product. Decisions concerning sustainable forest management should consider variability in the availability and diversity of forest products across landscapes. Navarrete and others. Availability and species diversity of forest products in a Neotropical rainforest landscape. [Forest Ecology and Management 406 242-250 2017] D

FLOOD EFFECTS ON MANAGED BRAZILNUT STANDS IN BRAZIL

A record-breaking 2014 flood occurred on the Madeira River in Brazil. Factors were assessed that affected the survival of Brazilnut trees (*Bertholletia excelsa*) under root asphyxia caused by flooding. In three Brazilnut groves there were 680 Brazilnut trees, of which 357 had been exposed to flooding and 200 had been flooded for at least 83 days, the threshold for mortality effects. It was possible to determine the time that each tree was flooded. None of the unflooded trees died. Of the trees exposed to flooding 17% died, of those exposed more than 100 days, 35% died. Survival exceeded 50% for all flooding durations. Larger trees are the most susceptible. Extreme floods threaten sustainable management. D. Herraiz and others. Amazonian flood impacts on managed Brazilnut stands along Brazil's Madeira River: A sustainable forest management system. [Forest Ecology and Management 406 6-52 2017] D

FORESTS FOR TIMBER AND CONSERVATION

A search for compatibility between timber production and biodiversity conservation has led to prohibition of timber cutting in certain forest areas in order to conserve old-growth forest for biodiversity values. One strategy is to define at the stand level where final cuttings should not be allowed. To maintain a percentage of mature forest that fulfills conservation goals, these areas can be dispersed throughout the forest. In one study, productive, technical, and environmental criteria have been considered in order to analyze the degree of conflict among them. Conflicting objectives were assessed, and decision-maker interactions have been introduced. These interactions range from criteria selection to the allocation of preferential weights to each criterion until the best solution among a set of possible alternatives is identified. Our results show that the proposed methodology allows deriving solutions that are acceptable for decision-makers while estimating physical and economic opportunity costs of conservation measures in timber volume and Euros, respectively. M.

Ezquerro and others. Integrating variable retention systems into strategic forest management to deal with conservation biodiversity objectives. [Forest Ecology and Management 433 585-593 2019] D

THINNING *EUCALYPTUS* IN AUSTRALIA AND RESULTANT FIRE BEHAVIOR

In *Eucalyptus delegatensis* forest in southeastern Australia thinning reduced tree stocking by more than 50%. Fire simulation under severe to extreme weather conditions, as occurred in the 2006/7 Great Divide Fires, indicated an almost 30% reduction in fireline intensity and about 20% reduction in the rate of spread and spotting distance in thinned forest compared with unthinned forest. The potential of thinning to reduce wildfire severity is seen. L. V. Huiquan and others. Impact of mechanical thinning on forest carbon, fuel hazard, and simulated fire behavior in *Eucalyptus delegatensis* forest of southwestern Australia. [Forest Ecology and Management 405 92-100 2017] D

TREE DIVERSITY IN RIPARIAN FOREST IN SEMI-ARID KENYA

Riparian forests in tropical drylands provide crucial ecosystem services. Fertile soil, water, and timber trees in these areas provide favorable conditions for agroforestry and timber in semi-arid Kenya and provide a basis for developing conservation and management strategies. Plant diversity was assessed along the Nzeen and Kalundu rivers where riparian forest patches were intermingled with agricultural and pasture lands and thickets of *Lantana camara*. Woody species >5cm DBH were recorded in 74 transects (50 x 10 m) laid out perpendicular to the rivers on both sides at 300 m intervals. In each transect, the distance of each plant from the riverbank was noted. Overall, 631 individuals were recorded, representing 85 woody species, of which 12 were exotic timber and fruit trees. Indigenous vegetation covered only 12% of the transect area, but had 188 trees and 49 tree species. Only two species (*Shirokiopsis elliptica* and *Rauvolfia caffra*) were clearly associated with the riverbank. Targeted management interventions could help maintain indigenous tree diversity, with positive effects for overall diversity, soil protection, and livelihood diversification. It is recommended to facilitate natural regeneration and to plant indigenous tree species on riverbanks as important areas for biodiversity and ecosystem services. C. B. Schmitt and others. Tree diversity in a human modified riparian forest landscape in semi-arid Kenya. [Forest Ecology and Management 433 645-655 2019] D

TROPICAL FORESTRY NOTES (17)

PLANNING FOR RESTORATION OF SUNDA CLOUDED LEOPARD IN SABAH

Changes in land use/cover are the main drivers of global biodiversity loss, and thus tools to evaluate effects of landscape change on biodiversity are crucial. In this study we integrated diverse methods from landscape ecology and genetics into a GIS-based analytical framework and evaluated the impacts of development and forest. The impact of restoration scenarios on landscape connectivity, operation dynamics and genetic diversity of Sunda clouded leopard (*Neofelis diardi*) in the Malaysian state of Sabah were evaluated. We also investigated the separate and interactive effects of changing mortality risk and connectivity. Our study suggested that the current clouded leopard population is larger (+26%) than the current carrying capacity of the landscape due to time lag effects and extinction debt. Additionally, we predicted that proposed developments in Sabah may decrease landscape connectivity by 23%, and when including the increased mortality risk associated with these developments result in a 40 to 63% decrease in population size and substantial reduction in genetic diversity. The negative impacts could be mitigated to only a very limited degree through extensive and targeted forest restoration. Our results suggest that realignment of roads and railways based on resistance to movement, without including mortality risk, might be misleading and may in some cases lead to decrease in population size. We therefore recommend that efforts to optimally plan road and railway locations base the optimization on effects of development on population size, density, and distribution rather than solely on population connectivity. Z. Kaszia and others. Integrating Sunda clouded leopard (*Neofelis diardi*) conservation into development and restoration planning in Sabah (Borneo). [Biological Conservation 235 63-76 2019] D

CACAO AGROFORESTRY LEAF LITTER NOURISHMENT IN MEXICO

Litter production and nutrient content were estimated at 35 and 55 years in an area under agroforestry in Tabasco, Mexico. Litter was collected every 15 days for a year and fractionated into cacao leaves, shade tree leaves, petioles, branches, stems, and cacao flowers and fruits. Samples were classified by age and season of the year, and chemically analyzed. Cacao agroforestry produces all year and thirty-five-year plot produced more litter than the 55-year old area (2042 kg/ha vs. 1570 kg/ha). The cacao leaf fraction was the principal source of litter. Neither age nor season of the year affected levels of N, K, Zn, and S content in litter. Age differences were found for P, Ca, and Fe. The litter of 35-year and 55-year old agroforestry cacao had enough N, P, K, and Ca, and Mg in the litter to recover the nutrients extracted by the cacao crop. J. Pérez-Flores and others. Leaf litter and its nutrient contribution to the cacao agroforestry system. [Agroforestry Systems 92 (2) 365-374 2018] D

EFFECT OF *RADIATA* MANAGEMENT ON BRAZIL STREAM QUALITY

We report on 23 years of monthly water quality monitoring from a steep headwater catchment within the Waikato Region of New Zealand. Three experimental sub-catchments were planted in different proportions of *Pinus radiata*: PW2= 100%, K-pine =57%, PW3=36%. PW2 and PW3 were historic pastoral sites in the first rotation of plantation forestry and K-pine was harvested and subsequently planted in a second rotation of forestry. All sites underwent two phases of stand thinning six and eight years after planting. The most significant effect was the increase in nitrate and total nitrogen concentrations in response to both stand planting and stand thinning. Planting resulted in significant increases in nitrogen and phosphorus at one site. Over a four-year planting period significant increases in total nitrogen and NO₃-N were detected at all three experimental sites. Whereas nitrogen concentrations may increase in response to the establishment of plantation forestry, we envisage that these will decline if plantation forestry continues beyond the first rotation. Research highlights the

complex nature of the response of stream water to changes in catchment land use. A. O. Hughes and others. The effect of forestry management activities on stream water quality. [Forest Ecology and Management 439 41-54 2019] D

BEE SPECIES AND TREE COVER IN AUSTRALIA

World-wide, bees have an important role in ecosystem function and the provision of ecosystem services as pollinators. The diversity of bee species is influenced by land use and management practices. In Australia we systematically sampled wild bees in four types of landscape: (1) open farmland, (2) scattered farmland trees, (3) roadside vegetation, and (4) streamside vegetation. The species richness and abundance of bees was greater at sites containing little or no tree cover. In contrast, species evenness was greatest in wooded sites, indicating that these were less dominated by abundant generalist species. Greater functional diversity based on species traits was found in open farmland and tree-less roadsides. These results suggest that a suite of the extant bee fauna can transition from former extensively wooded ecosystems to open agricultural landscapes. However, not all species can make the transition between sites and may disappear with further loss of wooded vegetation. Hall and others. The response of wild bees to tree cover and rural land use is mediated by species traits. [Biological Conservation 231 1-12 2019] D

ELEPHANTS AND CROP DAMAGE IN BOTSWANA

Elephant crop damage is a consequence of interactions between people and elephants that affect people's livelihoods and efforts to conserve biodiversity. Conflicts between people and elephants usually occur when there is overlap in elephant and human use of space leading to competition for resources. In the eastern Okavango Panhandle (Botswana) >16,000 people shared resources with 18,000 elephants. Using data from 20 GPS-collared elephants we investigated elephant space-use during the day and night throughout the year and during the dry, wet, and crop-damage seasons of 2014-2016. Elephant space-use was determined primarily by distance to waterholes and areas away from agricultural fields. Predicting elephant space-use was challenging, in particular during the crop-damage season when the relationship between crop-damage events and elephant distribution was found to be non-linear. This revealed that areas that elephants frequently use might not be good indicators of the likelihood of crop-damage. We suggest steering elephants from people's crops to reduce elephant impacts. We encourage future studies to focus on protecting elephant corridors and supporting farmers to collaboratively work to decrease crop-loss. R. A. Pozo and others. Elephant space-use is not a good predictor of crop damage. [Biological Conservation 228 241-251 2018] D

INDUSTRIAL PLANTATIONS BENEFICIAL IN UGANDA

Some 93% of the Uganda households report benefits from the industrial plantations. Fuelwood and employment were the most mentioned benefits. About 48% responded that they had lost benefits due to the establishment of the plantations, with access to land was the most mentioned lost benefit. Local livelihoods should be integrated into plantation plans. P. Byakaqaba and others. Industrial forest plantations in Uganda. [Journal of Sustainable Forestry 36 (4) 375-387 2017] D

POTENTIALS OF CASHEW AGROECOSYSTEMS IN AFRICA

Three types of cashew stands were selected according to plantation age to monitor carbon. Carbon stocks varied according to age: 14.51 tC/ha for 0-10 yr, 34.78 tC/ha for 10-20 yr, and 40.02 tC/ha for older plantations. Carbon sequestration values also varied by age of stands at \$53.50/ha/yr, \$63.35, and \$73.95 for each age, respectively. Carbon storage in these stands was evaluated at \$ 3,279. A development plan for such agroecosystems should be considered to conserve endangered species. V.

N. Noumi and others. Floristic structure and sequestration potential of cashew agroecosystems in Africa. [Journal of Sustainable Forestry 36 (3) 277-288 2017] D

PARTICIPATORY FORESTRY IN KENYA

Participatory forest management in Kenya, in the Eastern Mau Forest Reserve has changed the ability of various actors to benefit from forest resources. Participatory forest management has provided new opportunities for adjacent communities in seedling production and beekeeping. To attain objectives of forest conservation and livelihood enhancement, further concession of rights should go to the Community Forest Associations. J. M. Mutune and others. The implementation of participatory forest management in Kenya. [Journal of Sustainable Forestry 36 (3) 230-249 2017] D

SUSTAINABLE FOREST MANAGEMENT IN THE GABON

Sustaining forest management is the process of managing forest to achieve one or more objectives without diminishing the forest's capacity to continue. We show how the Tropical Timber Organization principles, criteria and indicators for the sustainable management of African forests, can help timber companies assess their progress toward this goal in Gabon. Through a partnership with the World Wildlife Fund and the ministry responsible for forests in Gabon, audits were conducted between 2012 and 2014 to evaluate the implementation of sustainable forest management in 14 forest concessions in Gabon. Principle 4, linked to the well-being of workers and local populations, proved the most difficult. Principle 3, dealing with maintaining ecological functions, was the least problematic. A number of companies were found to be experiencing significant difficulties implementing management plans. It is also clear that independent forest certification has become a key element for assuring successful implementation of sustainable forest management. A. O. Ahimin and others. [Journal of Sustainable Forestry 38 (1) 46-53 2019] D

MEETING UNITED NATIONS GOALS

The United Nations goals are for social, environmental, and economic development. Current progress is assessed relative to these goals. Tropical regions host the highest levels of biodiversity and yet high rates of urbanization and human development. Under the UN Goals biodiversity must be preserved while meeting goals for social and economic development. Here, we provide a rapid overview and qualitative assessment of the academic and policy literature on development and tropical forests, using the framework of the SDGs to examine issues broadly relevant to both tropical forests and sustainable development. Our assessment gathers existing knowledge and reveals critical knowledge gaps. In doing so, we identify key synergies between SDGs and tropical forests. We also suggest potential pathways of influence to improve social, environmental, and economic conditions in these rapidly developing regions of the world. L. Swamy and others. The future of tropical forests under the United Nations Sustainable Development Goals. [Journal of Sustainable Forestry 37 (2) 221-256 2018] D

TROPICAL FORESTRY NOTES (18)

BIODIVERSITY CONSERVATION OUTSIDE MOZAMBIQUE PARK

Habitat loss and fragmentation threaten wildlife outside of protected areas amid rapid land use changes in Africa. We studied how human activities affect the distribution and composition of a medium-to large sized mammalian community with various habitat requirements in a sustainable-use forestry concession in central Mozambique. We deployed 75 motion-detecting cameras from June to October 2017 and photographed 30 mammalian species. We used hierarchical multi-species niche occupancy models to estimate species richness at each station. We compared the relative effects of natural and anthropogenic features on the presence of individual species and groups of species when categorized into taxonomic functional groups and body sized groups. Predicted richness at each station varied from 3 to 17 species and both human and natural parameters varied in their importance for the occupancy likelihood for different animals. When species are grouped by taxonomies and diets, settlement proximity negatively affected the occupancies of species in all body-size groups. Overall, mammalian richness was highest far from human settlements in the concession and close to rivers. T. Easter and others. Opportunities for biodiversity conservation outside of Gorongosa National Park, Mozambique. [Biological Conservation 232 217-227 2019] D

STATUS OF THE WORLD'S RAPTORS

In all, there are 557 raptor species. Indonesia has the highest number of native raptors (119 species), of which 63 are declining. Raptors, and especially Old-World vultures, are more threatened than birds generally. Raptor species that require forest are more likely to be threatened than those that do not. The most frequently identified threats are agriculture and logging. Poisoning is especially detrimental to Old World vultures. Highest priority conservation actions prevent mortality and preserve key sites and habitats. Improved long term monitoring could allow for more appropriate targeting of conservation interventions. C. J. W. McClure and others. State of the world's raptors. [Biological Conservation 227 390-402 2018] D

PROTECTION FROM CERTIFIED MANAGED FORESTS IN CAMEROON

Managed forest concessions increasingly have been recognized as complement to protected areas in meeting conservation targets. Similarly, programs for third party voluntary certification of concession management aim to create incentives for logging companies to manage forests more sustainably. Yet where forest loss is low this frequently reflects factors other than certification, such as parks and other future uses not requiring deforestation. S.P. Jimenarico and others. Impacts of certification of concessions on forest loss in Cameroon. [Biological Conservation 227 160-166 2018] D

OCCUPANCY AND DETECTABILITY OF POACHERS IN RAINFOREST OF BRAZIL

A study was made in 2013 and 2014 on 39 sites in a protected area within the Atlantic Forest of Brazil. Species selections of vegetation types considered both occupancy and detectability, supported by 7,020 trap days. Occupancy and detectability were higher near water resources and forest edges. Detectability was higher also near human settlements and nights with moonlight. The practices of this study are applicable elsewhere where poaching hotspots are key sites for conservation. C. Ferregueti and others. One step ahead to predict potential poaching hotspots: Modeling occupancy and detectability of poachers in a neotropical rainforest. [Biological Conservation 227 133-140 2018] D

PROTECTED MANGROVES OF COSTA RICA, PANAMA, AND COLOMBIA

In this study, we identify potential drivers of land use and land cover change adjacent to mangroves on the Pacific shorelines of Colombia, Panama and Costa Rica. Mangroves are among the most productive ecosystems in the world, but are invaded by neighboring agriculture and logging. Mangroves in the indicated coastal areas lost 564 ha between 2000 and 2012, representing an average loss rate of only 0.02% per year. Of this area, 138 ha was within environmentally protected areas. Results suggest current conservation policies for mangrove protection in the study countries are effective at reducing deforestation and set a positive example for regions where mangroves are in decline. A. Tilley and others. Land use patterns and influences of protected areas on mangroves of the eastern tropical Pacific. [Biological Conservation 227 82-91 2018] D

LORD HOWE ISLAND AND ITS CHERRY GUAVA

Lord Howe Island, tropical, east of Australia, is a World Heritage Site because of unique native taxa. It was also home to more than 800,000 invasive plants of cherry guava, of which about 700,000 were removed in a 12-year project, leaving an estimated 102,091 plants on the island, the elimination of which appears to be an achievable goal. The complete elimination of the invader is estimated to require 20 years. Eradication to date has proceeded where it was less costly in time than will be elimination of the remaining plants. There is an environmental prize for those who eliminate the scourge. Experience so far has shown that, under limited funding, improvement of efficiency is the most promising way to continue removal. An inventory is needed to detect where and how removal will be the most rewarding. This must be followed by recruitment of recovery workers. M. Baker and others. Modelling the spread and control of cherry guava on Lord Howe Island. [Biological Conservation 227 252-258 2018] D

WHY FARMERS FARM STEEP SLOPES IN VIETNAM

In Vietnam intensive cultivation of steep slopes causes sedimentation of reservoirs, interfering with hydroelectric power generation. Corn is seen as the most profitable crop, although a source of low income. Sustainable crops on the same steep lands are grass, fruit trees, and timber. The farmers need guidance from research concerning the potential earnings from these alternative non-erosive crops compared to those causing more erosion. H. C. Zimmer and others. Why do farmers still grow corn on steep slopes in northwest Vietnam. [Agroforestry Systems 92 (6) 1721-1735 2018] D

FOOD SECURITY FROM SRI LANKA HOMEGARDENS

Interest is growing in agroforestry because of its potential to mitigate threats to household food security from food prices, and also as carbon sinks. In Sri Lanka homegardens are crop and timber production land use systems considered to be sustainable. Significant merits of home gardens include food security at low cost while sustaining numerous ecosystem services. Of 92 articles relevant to food security from these gardens, 27% directly quantified aspects that are relevant to food security. quantified indirect aspects that have relevance for food security, including climate, soil, ecosystem services, structural and floristic diversity and economic aspects. Comparisons are needed with other crop and forest systems. E. Mattson and others. What is good about Sri Lankan homegardens with regards to food security? A synthesis of the current scientific knowledge of a multifunctional land-use system. [Agroforestry Systems 92 1469-1474 2018] D

BIRD CONSERVATION AREAS IN DRY FOREST IN PERU

Neotropical dry forests possess important levels of bird species but are considered a highly endangered ecosystem. The Protected Areas Network covers 8.4% of the total area of these forests. It

is still unknown if these protected areas adequately represent its biodiversity. We selected 695 bird species associated with neotropical dry forests and used zonation software to assess species distributions and representativeness within the Protected Areas Network. Current protected areas cover only 10% on average of the distribution of the avifauna inhabiting these forests. Of the highest priority species (restricted range and threatened), 77% have 10% of their distribution protected. Use of our prioritization scheme would increase the protection coverage to 17%. This would match the Aichi targets and substantially increase the representativeness values, covering an average of 36% of all species and 62% for the highest priority species. Priority conservation areas identified in Peru (23%), Brazil (21%), Ecuador (19%), and Bolivia (11%). Our findings are an important step to guide future establishment of new and efficient conservation areas across the Neotropical dry forests. D. A. Prieto-Torres and others. Identifying priority conservation areas for birds associated to endangered Neotropical dry forests. [Biological Conservation 228 205-214 2018] D

TROPICAL FORESTRY NOTES (19)

AGROFORESTRY ENHANCES BIODIVERSITY AND ECOSYSTEM SERVICES

Agroforestry systems have been recommended as a cost-effective strategy that integrates production and biodiversity conservation. A comparison was made of effects of different types of agroforestry systems on biodiversity and ecosystem services with those found in conventional production systems. In general, both agroforestry and conventional systems have low values for mean effects on biodiversity and ecosystem services. However, effects vary between systems. Some biodiverse agroforestry systems had higher values of mean effect size. Results support environmentally friendly public policies for biodiversity and ecosystem services. F. Santos and others. Can agroforestry systems enhance biodiversity and ecosystem services provision in agricultural landscapes? A meta-analysis for the Brazilian Atlantic Forest. [Forest Ecology and Management 433 140-145 2019] D

SUCSESSES AND FAILURES OF ACACIA MANGIUM IN SARAWAK

Development of acacia plantations, mainly *Acacia mangium*, in Sabah and Sarawak has progressed for three decades. Despite some disease problems, *A. mangium* is still the preferred plantation species. It is fast growing and adapted to poor and degraded soils. However, reports of root-rot and wilt from Indonesia have caused alarm. The success or failure of the species depends on the progress of these two diseases in Sabah and Sarawak. S. S. Lee and others. Observations on the successes and failures of acacia. [Journal of Tropical Forest Science 30 (5) 468-475 2018] D

MANGROVE FOREST RESILIENCE TO COASTAL DISTURBANCES

Mangroves not only protect coastlines, but are vulnerable and resilient to coastal disturbances, such as tsunamis, hurricane-generated surge, and sea level rise. Energy reduction depends on mangrove structure, topography, and bathymetric features. Their vulnerability and resilience depend on the intensity, duration, and frequency of coastal disturbances. H.L. Koh and others. Mangrove forests: Protection against and resilience to coastal disturbances. [Journal of Tropical Forest Science 30 (5) 446-460 2018] D

IUFRO ANNOUNCES SUSTAINABLE FORESTRY OPERATIONS (SFO)

The International Union of Forest Research Organizations (IUFRO) announced a newly published study entitled Sustainable Forest Operations (SFO): Described as "a new paradigm in a changing world and climate", indicates that climate change, as well as the increasing demand for forest products require a rethinking of forest operations Areas to be addressed through SFO:

- More wood removal from less available forest landscapes
- Promoting wood as a renewable and ecologically friendly raw material
- Improving forest operations under climate change
- Minimizing the ecological effects of harvesting
- Improving safety and ergonomics for forest operations.

E. Marchi and others. Sustainable Forest Operations (SFO): A new paradigm in a changing world and climate. [Science of the Total Environment 634 1385-1397 2018]. D

FENCING OF PROTECTED AREAS IN AFRICA

In a study of 63 fenced and 121 unfenced protected areas in Africa, respondents reported that fencing had been installed primarily to mitigate human-wildlife conflicts. Fencing exists largely in Southern and East Africa and yet support for fencing is greatest in West Africa, where there are high

human and livestock densities and high threats from bushmeat harvesting, livestock encroachment, and logging. Most of the fences were not adequately maintained to restrain lions and elephants. A. Pekor and others. Fencing Africa's protected areas: Costs, benefits, and management issues. [Biological Conservation 229 67-75 2019] D

FROM ACACIA TO EUCALYPTUS PLANTATIONS IN SUMATRA

Indonesia's pulp and paper industry needs a large area of sustainably grown plantations to support its continued development. Disease pressure on *Acacia mangium* is expected to require large-scale conversion to *Eucalyptus pellita*. At four sites in Sumatra, the impacts of plantation species and nitrogen management were characterized for soil moisture, soil water depletion, and depth to ground water under stands of *A. mangium* and *E. pellita* over the first 2 to 3 years after establishment. Soil moisture and soil water depletion were not influenced by plantation species. These two were strongly influenced by shallow groundwater at two of the four sites. Depth to groundwater did not influence stem growth. Results suggest that large-scale conversion from *Acacia* to *Eucalyptus* in these regions is unlikely to result in increased moisture stress, nor is conversion of plantation species likely to lead to substantial differences in catchment hydrology. M. Hardie and others. Effects of eucalyptus and acacia plantations on soil water in Sumatra. [New Forests 49 (1) 87-104 2019] D

TRANSMISSION LINES: A THREAT IN BRAZIL?

Transmission lines in Brazil, about which knowledge is neither accurate nor current, are a potential environmental threat. The Legal Amazon region contains 39,625 km of verified transmission and distribution lines impacting 23,467 km² of land. By 2026 the transmission network of the Legal Amazon is expected to grow by 37%, and direct forest impacts by 70%, enough to require including them in planning of the Amazon region. L. H. Stephanie and others. Transmission lines are an underacknowledged conservation threat in the Brazilian Amazon. [Biological Conservation 228 343-356 2018] D

ANTEATER RESPONSE TO HABITAT LIMIT IN BRAZIL

The Giant Anteater (*Myrmecophaga tridactyla*) is currently listed as vulnerable by IUCN, due to habitat fragmentation and mortality due to collisions with vehicles. Minimum patch size and maximum road density were estimated from samples to evaluate impacts on the species. Suitable habitat for the giant anteater requires a lack of fragmentation and a patch size of at least 250 km² and tolerates a road density up to 0.55 km/km². F. A. S. Pinto and others. Giant anteater (*Myrmecophaga tridactyla*) conservation in Brazil: Analysing the relative effects of fragmentation and mortality due to roads. [Biological Conservation 228 148-157 2018] D

BUTTERFLIES OF EUCALYPTUS OR OF THE FOREST

In a comparative study, it was found that plantations harbor a reduced assemblage of fruit-feeding butterflies than forests, with lower richness and a few, very abundant species. The occurrence of some very abundant species differentiates plantations from forests. Small forest fragments harbor a significant portion of the butterfly diversity, and it is clear that *Eucalyptus* plantations cannot substitute forests for a majority of fruit-feeding butterflies. But these plantations are better than other land use practices in sustaining part of the fauna and acting as potential corridors for butterfly conservation. N. Vasconcelos and others. The role of *Eucalyptus* and planted forests for fruit-feeding butterflies' conservation in fragmented areas of the Brazilian Atlantic Forest. [Forest Ecology and Management 432 115-120 2019] D

PLOTS FOR BIODIVERSITY MANAGEMENT

A study investigates how plot size and shape affect sample estimates of species composition. Two census datasets from distinct ecosystems were used. Fifteen combinations of plot size and shape were simulated. Similarity in species composition decreased with increasing difference between two plot sizes. Plots with varying shapes were found to have different species composition but could be similar in the number of species. For less species-rich forests, a circular plot 0.25 ha is recommended. For species-rich forests a 0.05-0.1 ha rectangular plot with aspect ratio of at least 1:20 is recommended. T. R. Yang and others. A simulation study on the effects of plot size and shape on sampling plant species composition for biodiversity management. [Journal of Sustainable Forestry 38 (2) 116-129 2019] D

TROPICAL FORESTRY NOTES (20)

SHIFT IN UK TROPICAL TIMBER SOURCES

This paper identifies changes in the United Kingdom (UK) hardwood importing sources between 1853 and 1992 and changes in UK sawn hardwood sources between 1999 and 2015. A comparison was made of the changes of UK importing sources between the two sets of data. The comparisons are useful to determine alternative sawn hardwood sources for the UK after the UK leaves the European Union (EU), i.e. the BREXIT negotiations. Massive reduction in UK importing sources has taken place both in Africa and in Asia. The UK will need to expand the number of sources in Africa, Asia and in Latin America and the Caribbean. The UK imports significant proportions from EU member states. Following BREXIT, there may be severe restriction on UK/EU trade. These changes of sources may mean a change in cost and in imported species. J. W. Bull and others. Changes in the United Kingdom hardwood importing sources from 1853 to 2015. [Journal of Tropical Forest Science 30 (1) 126-134 2018] D

PLYWOOD QUALITY FROM FAST GROWING PLANTATIONS FROM KADAM

Fast-growing plantation species include batai (*Paraserianthes falcataria*), eucalyptus (*E pellita*), and kelempayan (*Neolamarckia cadamba*). Plywood quality was determined according to the Japanese Agricultural Standard for Plywood. Plywood with seven layers performed better than with five layers, showing higher modulus of rupture, modulus of elasticity, and bonding shear. Plywood from kelempayan and eucalyptus performed better than plywood containing batai veneers. S. M. Fitri and others. Mechanical properties of plywood from three fast-growing plantation trees [Journal of Tropical Forest Science 30 (1) 58-66 2018] D

NUTRIENT ENRICHMENT BY FUNGUS-GROWING TERMITES IN NAMIBIA

A fungus-growing termite (*Macrotermes termitaria*[M]) collects water with nutrient enrichment in its termitaria. To test the nutrient superiority of this termite over non-fungus-growing termites, a comparison was made in Namibia of the termitaria of *Macrotermes termitaria* with those of two non-fungus growing termites (*Trinervitermes trinervoides*[T]) and (*Nasutitermes triodiae*[N]). Comparing adjacent topsoils, *Macrotermes termitaria* significantly enriched soil in 18 elements, whereas T and N were enriched in only one and five elements, respectively. Nutrients particularly enriched by M included Ca (by a factor of 12x), Mg (2.9x), Co (2.8x), Fe (2.4x), Mn (2.3x), Se (2.2x), and Cu (2.0x). We suggest that fungus-growing termites have the potential to boost soil fertility to a greater degree than non-fungus growing termites, and thereby the nutrients available to plants and herbivores. J. Mills and others. Nutrient enrichment of ecosystems by fungus-growing versus non-fungus-growing termites. [Journal of Tropical Ecology 34 (6) 385-389 2018] D

COMPLETENESS OF PRESCRIBED BURNING IN AUSTRALIA

Predictability of prescribed burning completion and coverage are important for forest management. The success of prescribed burning depends on fuel, weather, and operational constraints. A study of prescribed burns in Victoria, Australia, from 2009 to 2015 showed that about 30% of the “burns” were never burnt. The size of the burn influenced the likelihood of completion or being postponed. Of burns completed, median coverage was 84%. An ability to foresee the outcomes of prescribed burn programs is important for managers in designing effective risk reduction programs. J. Duff and others. Determining burnability: Predicting completion rates and coverage of prescribed burns. [Forest Ecology and Management 433 431-449 2019] D

SOIL PREPARATION FOR REGENERATION IN AMAZONIA

Above the Jirau Dam in the Madeira River of Rondonia, Brazil, on land previously covered by African pasture grasses, a 3,000 ha forest buffer zone has been established. Tree restoration was undertaken with (1) no intervention, (2) harrowing and herbicides, and (3) harrowing and herbicide plus tree planting. At 18 months stem density ranged from 2,500 to 14,490 per ha. In 5 years, tree cover reached 81%, virtually eliminating grass cover after 36 months. Future restoration efforts should first evaluate the potential of natural regeneration and then gradually eliminate barriers to regeneration by harrowing and herbicides. M. Rezende and others. Forest restoration in southern Amazonia: Soil preparation triggers natural regeneration [Forest Ecology and Management 433 93-104 2019] D

ACACIA PRODUCTION BY SMALLHOLDERS IN AUSTRALIA

In Vietnam experimental production was carried out with clones of *Acacia mangium* x *A. auriculiformis* to examine factors determining total wood production and apportionment between sawlogs and pulpwood. The site was on sloped, eroded land with shallow soil and 20-30% laterized stones. MAI in merchantable volume over bark at the first rotation at age 8.8 years was 17 m³/ha/yr. In the second rotation at age 7.6 years it was 20 m³/ha/yr. Application of phosphate fertilizer (14-86 kg/ha) increased stem diameter over the second rotation and potassium (14 kg/ha) gave no growth response. Growth rate was similar under weed control by herbicide and manual means. With simple management practices including conservation of site organic matter and early stand management, appropriate for local small growers, the second rotation yielded 46% of harvested volume as sawlogs and the balance as pulpwood. The current regime does not yield saw logs. Log quality can be influenced by changes in stocking, intensity of management, and rotation age. E. Harwood and others. Managing wood production from small grower acacia hybrid plantations on eroded soils in central Vietnam. (Australian Forestry 80 (5) 286-293 2017] D

SIREX, WOOD WASP OF AUSTRALIA

Sirex noctilio is an exotic pest of pines that has had been in Australia for more than 65 years. The expenditure on *Sirex* control covers the period of 1952 to 2014. Large-scale tree mortality occurred in three outbreaks. The combined cost of the control program and the outbreaks is estimated at \$34 million. Of this, \$25 million was for the program and \$9 million was the cost of timber losses. The National Sirex Control Program is an expensive governmental response to the threat of exotic pests to pine plantations. N. L. Cameron and others. Economic appraisal of Sirex wood wasp (*Sirex noctilio*) control in Australian pine plantations. [Australian Forestry 81 37-45 2018] D

AFRICAN APES COEXIST WITH LOGGING

Ape nest counts before, during, and after logging in the Congo made it possible to assess the impact of timber harvesting and variation in environmental conditions, including food availability, habitat, and rainfall on sympatric chimpanzees and gorillas. Chimpanzees were found near their preferred tree foods. Gorillas had a broader habitat and were attracted to recently logged areas with abundant herbaceous vegetation. Both avoided areas with active timber exploitation and roads. These findings led to recommendations to improve certification standards aimed at safeguarding ape populations. Morgan and others. African apes coexisting with logging: Comparing chimpanzee (*Pan troglodytes troglodytes*) and gorilla (*Gorilla gorilla*) resource needs and responses to forestry activities. [Biological Conservation 218 277-286 2018] D

BATS MARK FOREST SUCCESSION IN AMAZONIA

Amazonian secondary forest regeneration affects bat assemblages. Forest regeneration was found to positively affect diversity. However, 30 years of secondary forest regeneration were not enough for the recovery of bat assemblages to the levels of continuous forest. Restoring degraded habitats while protecting primary forest will be an important strategy for safeguarding diversity of bats and their vital contributions to ecosystem functioning. F. Z. Farneda and others. Functional recovery of Amazonian bat assemblages following secondary forest succession. [Biological Conservation 218 192-199 2018] D

COLLABORATIVE MANAGEMENT OF PROTECTED AREAS IN AFRICA

Africa's protected areas are under severe and growing human pressure, and many are failing to fulfill their ecological, economic, or social potential. Collaborative management partnerships permit non-profit organizations to partner with state wildlife authorities with ability to facilitate financial and technical support. A review of 43 protected areas in 16 African countries exposed three types of collaboration: (1) The non-profit shares government responsibility with the state and is delegated full management, (2) the non-profit shares government with the state, and (3) the non-profit supports the state without formal decision-making authority. Strengths and weaknesses are apparent for each model. Many are successful and already playing a significant positive role in conservation. M. Baghai and others. Models for the collaborative management of Africa's protected areas. [Biological Conservation 218 73-82 2018] D