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¡Bienvenidos a México!

The Natural History of Tequila and Mezcal, or, The Tequila Connection, Take Two

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This year our annual meeting will be held in the heart of beautiful Morelia, a colonial city in Central Mexico. Perhaps some of you already picture yourselves drinking a frozen margarita in one of the many restaurants and bars that give life to downtown plazas in front of the majestic 17th century cathedral. While you sip from your margarita or, for the more adventurous, from your straight shots of tequila or mezcal, we invite you to meditate on the natural history of these drinks.

In short, a mezcal is the distilled spirit from the fermented sugars of mature agaves, also known as century plants. Contrary to popular belief, these plants do not live for a hundred years, but most species still take 10 or more years of growth to produce their inflorescence, after which they die. Tequila is just an up-scale mezcal, made with a particular variety of agave in a defined area of central Mexico. In the countryside, people call the agaves *mezcales* or *magueyes*. *Agave* is one of the most speciose genera of the Mexican flora. García-Mendoza (2004) estimated the diversity of the genus as more than 200 species, and including the herbaceous taxa that are phylogenetically part of the genus (Good-Avila *et al*. 2006) we have more than 250 species, making *Agave* the third largest genus in Mexico (Villaseñor, 2004).

Why is it possible to make these wonderful drinks, and why do we have so many species of *Agave*? We think that both questions have a single answer: the interaction of agaves with their main pollinators, long-nosed bats of the genus *Leptonycteris*. Almost 30 years ago, Schaffer and Schaffer (1977, 1979) and Howell and Roth (1981) suggested that *Leptonycteris* visited only the *Agave* inflorescences with the largest number of flowers, thus selecting for very large floral displays, forcing the plants to use a high percentage of their resources in building flowers. In other words, the foraging pattern of bats selected for a single, spectacular but suicidal reproductive event in the plants. This large concentration of flowers and nectar made the agaves incredibly successful, producing hundreds of seeds which, coupled with physiological adaptations to an arid habitat, made agaves one of the most competitive plants in North America. As you will see if you visit the countryside, very large areas of Central Mexico are covered by *Agave* natural or planted populations, and there are several species of *Agave* in almost all Mexican environments (with the notable exception, as we are sorry to tell the hard-core tropical ecologist in you, of the rain forest). Humans have been taking advantage of the resources used by the plants for building the inflorescence since the dawn of time. Native Americans found that mature agaves, if

A plantation of Agave tequiliana in Estipac, Jalisco, Mexico. In the background are the remains of the original deciduous tropical forest.

cooked, turned into a candy. Cooked agave "heads" (*i.e*., the central part of a mature plant, after removing the leaves) can still be found in fairs and markets in the heart of Mexico, and can be tasted in traditional bootlegger "factories" deep in the sierras, where traditional mezcal is still made.

Recently, molecular evidence has shown that *Agave* is a very recent genus, less than 10 million years old. We documented at least two peaks of intense diversification. The earlier one corresponds with a sharp climatic change in central Mexico that turned the area warmer and drier, coupled with extensive geological activity that isolated populations and forced agaves to adapt to different environments. A second peak involved the secondary evolution of the herbaceous taxa, when the environment changed back to more mesic conditions (Good-Avila *et al*., 2006). Data gathered by our student Nuria Flores-Abreu suggest that the origin of the genus *Leptonycteris* took place at about the same time, providing further evidence for the hypothesis of a coevolution between *Agave* and long-nosed bats. We will be addressing some of these results in the ATBC meeting.

In general, bat pollinated flowers are very accessible and sturdy, producing incredibly copious amounts of nectar and pollen. This cornucopia of resources is very attractive to a motley crew of animals, from bees to hummingbirds, and from moths to orioles (Rocha *et al*., 2006). Does this diversity of visitors contribute to the diversity of agaves? In the Barranca de Metztitlán, in the state of Hidalgo in central Mexico, 12 species of *Agave* coexist, along with a complex flora dominated by columnar cacti and *Bursera* trees. While the five most common *Agave* species are visited by *Leptonycteris yerbabuenae*, the proportion of other pollinators is very variable. *Agave striata* produces nectar earlier in the day than the other species, which are nocturnal, and the morphology of the flowers seems more adapted to visits by diurnal pollinators, mostly bees and hummingbirds. *Agave* species seem to minimize competition for pollinators by flowering in different times of the year, by presenting different physiological adaptations, and by using different environments (Rocha *et al*., 2005). We are also using genetic markers to reconstruct the evolutionary history and speciation pattern of this group of closely related species.

Back in the 1980s, a decline in several populations of long-nosed bats was documented, prompting the inclusion of the two North American species in the list of US threatened species. Using the catchy idea of a "tequila connection", we expressed our concern about a possible impact of such declines on wild populations of agaves (Arita and Wilson, 1987). The basic concern was that if bat populations decreased, then the rate of pollination services provided would decline as well, eventually reducing the populations of agaves. We advanced the idea that the conservation of long-nosed bats was of paramount importance in maintaining healthy wild populations of *Agave*, to provide a reservoir of genetic variation for possible application in cultivated clonal lines. As usual, reality proved to be more complex. First, many populations of long-nosed bats now seem to be increasing. This is very difficult to estimate, but it is the common opinion of most people studying the bats or the plants that they pollinate (besides agaves, columnar cacti and tropical trees, in particular *Ceiba* and *Pseudobombax*). Second, most agaves produce such a large amount of resources that they can be efficiently pollinated by many animal species, producing seeds even in the absence of bats. (However, the reduction in seed production if the flowers are not visited by bats can be drastic; see Molina and Eguiarte, 2005). Finally, many wild populations of agaves propagate clonally, with no intervention of animal partners.

And this leads us to another part of the story: tequila plants (*A. tequilana*, known in Mexico as *agave azul*,) are basically a single clonal genotype of *A. angustifolia*, a wild relative. Gil-Vega *et al*. (2001) used a molecular marker (RAPDs) to document a total lack of genetic variation in the plants of the two main regions where tequila agaves are grown. This is because this agave is efficiently propagated by small rosettes that are produced in the base of older plants, and because of efforts by *tequileros* to homogenize the cultivated plants. These findings should make the tycoons of the huge tequila industry uneasy, but luckily, recent explorations by Colunga and Zizumbo (2007) have revealed a vast pool of genetic resources in the dry forests of Jalisco and Colima, in western Mexico. Still, the problem remains as many of these populations are disappearing at an alarming rate.

Undoubtedly, tequila is one of the success stories of Mexican agro-technology, but at the same time it has become an important problem for conservation and management of genetic resources, showing that the tequila connection goes well beyond the plants and their pollinators. As tequila fans worldwide have pushed the demand for the product to historically high levels, the price of the plants has been steadily increasing over the years, and many areas of Western Mexico have been deforested and converted into plantations of *A. tequilana*. Thus, large areas of the very fragile and endangered dry forest of Mexico have been destroyed for tequila plantations. Also, the industrial planting strategies not only imply using a single genotype, now in many cases developed by tissue culture, but also that all other plants are removed, completely exposing the soil to erosion. This of course makes very difficult the use of land for cultivating other crops or for implementing programs of restoration of the original flora. More worrisome, many traditional *milpa* plots, where *Agave* was traditionally planted along with landraces of corn, squash, bean and chile, have been converted, and thus the landraces, their adapted and managed gene pools, and the traditional knowledge are all being lost at a rapid rate.

The story with the mezcal is similar, although mezcal is made both with cultivated and wild plants. Very large areas of the state of Oaxaca have had the same fate as the tequila area, as most *mezcales* there are derived from plantations. In the case of wild populations the situation is even worse, as *mezcaleros* routinely collect all individuals that are about to reproduce, thus in fact precluding any recruitment in the plant populations. In the states of Michoacan, Jalisco, and Guanajuato, both tequila and mezcal are produced. We hope you will have the opportunity to taste the genuine traditional mezcal of Michoacan, increasingly more difficult to find, but still made with wild plants of *Agave cupreata*, called *maguey papalote* (butterfly agave).

So, ¡Salud! Drink with moderation and toast to the health of the wonderful bats that have allowed us to taste the flavorful and pungent aromas of these wonderful plants. (And please, do not ask us about the worm in the mezcal bottles. We have no idea what they are supposed to be doing there!)

Upper photo: Flowers of Agave angustifolia from Xochicales, Morales. Photo by Luis Eguiarte. Lower photo: A Leptonycteris yerbabuenae that spent a month in our lab (he arrived by himself!) Photo by Rodrigo González Chauvet)

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Women in Tropical Biology - a Discussion Forum for ATBC 2007

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A special panel discussion is scheduled for the upcoming annual meeting in Mexico to consider the role of women in tropical biology. ATBC members Priya Davidar, Julie Denslow, and Meg Lowman, accompanied by our President-elect Pierre-Michel Forget, will discuss the current status of women in ATBC and beyond. Concern about this issue was catalyzed by the recent ATBC-Asian Chapter meeting, where it was admitted that women were under-represented in numbers proportional to our membership in some high-visibility activities of the society— for example, at the podium during the annual dinner in China; as awardees over the history of the Society; and frequently in field expeditions. The Ecological Society of America just completed a WAMIE survey (Women and Minorites in Ecology) with disappointing results indicating that women are still under-represented in leadership positions in ecology, receive significantly less pay for equivalent positions, and seem to disappear from the career path despite a fairly healthy number of women PhD graduates. This obvious brain drain may also exist in tropical biology, as it does for the American ecology scene.

The upcoming panel presentation hopes to provoke an animated discussion to insure that ATBC is advocating on behalf of women (and other under-represented groups) in all aspects of tropical biology, and that women biologists serve as role models for other women and minorities in tropical biology. The option of creating an action plan for ensuring that the Society enhances the role of women in tropical biology will be discussed.

Obituary: Professor John Proctor (1944-2006)

Professor John Proctor, one of the foremost researchers on tropical forest ecology and on the ecology of areas with ultramafic soils, sadly passed away in August 2006 in Lancashire, England. Proctor was born in 1944. During his early years he was obsessed with the local football team and hoped to be spotted by one of their talent scouts. When he realised this wasn't going to happen, he put his energies into his studies and obtained a scholarship to the University of Oxford to read botany. He gained a first class degree in 1965 and stayed on to do research for his D.Phil. thesis entitled *Studies in Serpentine Plant Ecology*. After gaining a lectureship at the University of Stirling in Scotland he continued work on ultramafic (or serpentine) plant ecology.

Shortly after his marriage and the birth of his daughter, he was selected to join the Royal Geographical Society's (RGS) year-long expedition to Gunung Mulu, on the island of Borneo, in 1977-78. Having a young family did not prevent his enthusiastic and energetic participation in the expedition where his team carried out a huge amount of work on forest structure, floristics and dynamics.

With his combined interest in tropical forests and ultramafic soils, John spent many summers on research expeditions to ultramafic areas in south-east Asia, mainly Malaysia and the Philippines. He also worked and had research students in many other areas including Costa Rica, India and Zimbabwe. John was invited to join two further RGS expeditions to Maracá Island in Brazil in 1987-88 and to Brunei in 1991-92 and was awarded the RGS's Busk medal in 1991 for being 'the country's foremost tropical forest ecologist'.

In 1992 he discovered Barito Ulu in Central Kalimantan, Indonesia. He focussed his work here on plant-soil interrelations until his retirement in 2005. After his retirement he returned to his home county of Lancashire where he re-married in 2006 shortly before his death later in the year.

John had a number of interests outside of academia including supporting his local football team (even when they were relegated from the league), and he had a passion for vintage cars and motorcycles, one of which, he claimed, once belonged to Lawrence of Arabia. He was always interested in local people and their culture and was held in high esteem by field assistants in all the areas where he worked. He had a unique sense of humour and was always ready to see the amusing side in any situation.

John's published output include over one hundred papers, six edited volumes and one book, but perhaps the most important legacy he left behind was the researchers he trained and who now teach and conduct research all over the world.

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Planning for a fantastic ATBC 2007 in Morelia, Mexico

July 15 will be the start of the ATBC 2007 meeting! The venue has been moved to the Colegio Primitivo y Nacional de San Nicolás de Hidalgo, a colonial building with more than 450 years of history which is part of beautiful downtown Morelia, recognized as a Heritage of Humanity site by UNESCO. This will allow delegates to enjoy the cultural atmosphere of Morelia while also providing the logistic facilities required for a successful meeting.

At the close of abstract submission, more than 700 contributions were received, including 222 distributed in 25 symposia (see titles below), 286 oral presentations, and about 200 posters. About 60% of these contributions are related to genetics, ecology, evolution, systematics, and taxonomy and about 40% will involve issues related to human dimensions of tropical biology. A special panel convened by Meg Lowman will address the past, present, and future role of women in tropical biology. Furthermore, at least two workshops (one on bat monitoring methods, and one on integrating ecology and phylogeny in the study of tree community assemblages) have been scheduled. A special effort was made to enrich the meeting with a variety of keynote lectures, which will be delivered by outstanding academic leaders.

Delegates will come from 34 countries, four continents (Asia, Europe, Oceania, and America), and 365 academic institutions. Thirty three percent of the delegates will be masters and PhD students. For the Al Gentry award, 120 students (69 talks and 51 posters) have registered.

Consistent with the urgent actions needed to confront ecological and environmental challenges imposed by climate change due to green-house gas emissions, ATBC meetings will, starting with Morelia, strive to be carbon-neutral. We have calculated the amount of carbon that the Morelia meeting will release to the atmosphere by estimating all plane flights and terrestrial transport that delegates will use to attend the meeting as well as all electricity consumed and waste materials produced during the meeting activities. To be carbon-neutral, we will ask to participants to pay an additional carbon offsetting fee. The collected money will be used to support carbon sequestering programs (tree plantations using native species in degraded tropical rain forest areas) in Mexico and Ecuador. Organizers are reducing as much as possible the use of non-recyclable materials, and they will provide meeting kits made with natural products by local artisans.

As part of the meeting program, the organizing committee has scheduled a variety of unique and enjoyable cultural activities. At the opening ceremony, traditional dances of Michoacan (the Mexican state of which Morelia is the capital) will be performed by the outstanding folkloric group of the Michoacan State University. Monday night, another folkloric group will play Latin-American music within the "Conservatorio de las Rosas" one of the first music conservatories in America. Tuesday night will feature classical and organ music performed by the Symphony Orchestra of Michoacan State in the spectacular Morelia cathedral. The ATBC Banquet will take place in the Government Palace, a beautiful and historical building where you will find unique murals from Alfredo Zalse, an outstanding Michoacan artist and disciple of the great Mexican painter Diego Rivera. Also please remember, lunch from Monday to Thursday as well as the banquet are included in your registration fee.

Field trips have been scheduled to let you select among distinct tropical ecosystems (dry and wet lowland forests, mangroves, mountain forests) where research and studies of sustainable management are conducted. Field trip information can be obtained at http://www.oikos.unam.mx/atbc/english/Tour.htm

Keynote Lectures at the ATBC 2007 Morelia Meeting

José Sarukhán, Instituto de Ecología, Universidad Nacional Autónoma de México - *Challenges for Tropical Biology in the context of the future of Mexico and the world*

Victoria Sork, Department of Ecology & Evolutionary Biology and Institute of the Environment, University of California, Los Angeles - *Evolutionary conservation science in practice: designing evolutionary and ecological landscapes of the future*

Kamaljit S. Bawa, Department of Biology, University of Massachusetts Boston - *Title to be announced*

Lisa M. Curran, Tropical Resources Institute, Yale School of Forestry & Environmental Studies, Yale University - *Effects of tropical land use change: a case study in Borneo*

John Vandermeer, Department of Ecology and Evolutionary Biology, University of Michigan - *Ecological theory, political reality and the role of agroecosystems in a new conservation paradigm*

Christine Padoch, Institute of Economic Botany, The New York Botanical Garden - *Title to be announced*

Philip Hedrick, Life Sciences Faculty, Arizona State University - *Recent Developments in Conservation Genetics*

Julia Carabias, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico - *Title to be announced*

Scott Armbruster, University of Portsmouth, School of Biological Sciences - *Floral Specialisation: From developmental precision to ecosystem services*

Scheduled Symposia for ATBC 2007

The Influence of Human Demography and Agriculture on Natural Systems in the Neotropics.
Approaches to the Study of Ecosystem Services Provided by Tropical Systems
Linking Tropical Biology with Human Dimensions in the West Indies
Natural Services in Local Context: Opportunities and Barriers to Uptake
Managing Tropical Agricultural Landscapes to Enhance Biodiversity
Biosphere reserves: a sound strategy for the conservation of biological diversity and development in the American tropics?
Landscape Ecology of Bats: From Population to Community Level
Ecology of Coffee Agro-ecosystems
Seed Dispersal and Seed Predation in Neotropical Palms
The Impact of Plant Phylogenies on Tropical Ecology and Evolutionary Studies
Tropical Oaks: Diversity, Ecology and Conservation
Diversity and Evolution of Pollination and Mating Systems of Tropical Monocots
Debating the Tropical Extinction Crisis
Conservation of the Biodiversity and of the Environmental Services of the Forest: Basis for the Sustainable Development of the Amazon
Gradients in Plant-Herbivore Interactions Involving Tropical Systems
Ecological Theory and Tropical Ecology: Bridging the Gap for Mutual Gain
Science Communication Strategies in Tropical Countries: Mexico as a study case
Ecology of Insect-Plant Interactions in the Tropics
Functional Ecology of Tropical Plant Communities
Ecology and Management of Climbing Plants
TROPI-DRY: Human and Biophysical Dimensions of Neotropical Dry Forests: Results from a Collaborative Research Network
Conservation Genetics of Tropical Animals.
The Evolutionary Ecology of Multispecific Interactions in Changing Environments
Primates at Risk: Conservation Concerns and Indigenous Anthropogenic Landscapes

The Biological Station of Chamela: a privileged site for research

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In 1971, the Universidad Nacional Autonoma de Mexico (UNAM) established the Estación de Biología Chamela in the Pacific lowlands of Jalisco, Mexico. Occupying an area of 3,319 hectares, the station provides excellent access to a variety of habitats in the tropical deciduous forest of western Mexico. Infrastructure and services at the station include dorms for 38 researchers, kitchen and dining room for 30 persons, two open-air labs and two air conditioned labs with basic equipment and chemicals for standard analytical and biological tests, a lecture

room, a meteorological station, two shade houses, and a library with the largest collection in Mexico of theses, journals and books specialized on the ecology of tropical deciduous forests. The Station includes also one of the largest collection of insects, and regional reference collections of vertebrates and plants.

The Biological Station is part of the Chamela-Cuixmala Biosphere Reserve (19°29' N 104°59' W), which represents the first effort within Mexico to protect the Tropical Deciduous Forest (TDF). This forest system (also known as dry forest, seasonal dry forest, or *selva baja caducifolia*), which in Mexico stretches from southern Sonora to Chiapas, has been recognized worldwide as one of most endangered of tropical forests (Murphy & Lugo 1995). In Mexico, only 27% of the original cover of tropical deciduous forest remained as intact forest in 1990, and less than 10% of the area still covered with deciduous forest is under some type of protection (Trejo and Dirzo 2000).

This is especially unfortunate because the TDF from western Mexico is among the most diverse and rich in endemic species in the world (Gentry 1995, Ceballos, 1995, Trejo & Dirzo 2002). For instance, just in the 13,142 hectares of the Chamela-Cuixmala Biosphere Reserve, more than 1,200 species of vascular plants have been recorded (of which 314 are endemic to Mexico). The same area contains 19 species of amphibians (of which 11 are endemic to Mexico), 68 species of reptiles (with 31 Mexican endemics), 270 species of birds (including 24 endemics), and 70 species of mammals (of which 16 are endemic to Mexico) (Noguera et al. 2002). Furthermore, for two amphibians (*Craugastor hobartsmithi* and *Eleutherodactylus modestus*), four reptiles (*Eumeces parvulus, Coniophanes lateritius, Dipsas gaigae* and *Pseudoleptodeira uribei*), and one mammal (*Xenomys Nelsoni*), Chamela is the only, or one of the few sites where these species have been recorded (Ceballos and Rodriguez 2003, García and Ceballos 1994).

Beside tropical deciduous forest, which is the dominant vegetation, the reserve encompasses more than 8 different habitats, including semi-evergreen forest, riparian vegetation, thorn forest, Manzanillera forest, coastal dune vegetation, wetlands and mangroves. Because of this outstanding biodiversity, the Reserve is part of the World Network of Biosphere Reserves of the UNESCO's Man and the Biosphere Program (MAB), and part of the RAMSAR network of Wetlands of International Importance. Furthermore, several turtle nesting beaches in the region are protected under the Inter-American Convention for the Protection and Conservation of Sea Turtles, and recently, 9 islands of the Bahía de Chamela were recently established as wildlife refuge.

In addition to protecting one of the most pristine deciduous forests in México, biologists and ecologists have been doing research at the Chamela Biological Station for over 30 years, making this perhaps the most thoroughly studied tropical deciduous forest in the world. There are nearly complete inventories of plants, fish, reptiles, amphibians, mammals and birds (Noguera et al. 2002) and it is one of the few sites in Mexico where long-term monitoring studies on hydrological dynamics, energy and biogeochemistry are being carried out (Burgos et al. 2007). Other research includes projects on bat pollination; effects of fragmentation on plant genetic structure; landscape movements and habitat use by birds; moderate and large mammals; plant-animal interactions; herbivory by insects; and seed and fruit dispersal, among others. These themes are critical for understanding the effects of ecosystem perturbations and the role of biodiversity in ecosystem structure and function. Studies like these need to be continued and expanded. Other areas of knowledge, such as effects of climate change on ecosystem structure and function, interactions between managed and intact ecosystems, and human dimensions of landscapes and ecological processes, have been only just begun to be explored at this site.

Today, the Biological Station of Chamela of the Universidad Nacional Autonoma de Mexico is a privileged site for research because of its location within the large Chamela-Cuixmala Biosphere Reserve, its excellent infrastructure for field research, and its extensive collection of baseline biological data for tropical dry forest. More information on the station can be found at the web site, http://www.ibiologia.unam.mx/ebchamela/

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Rain Forest Phylogenetics and History

Bermingham, E., C. W. Dick, and C. Moritz (eds) 2005. Tropical Rain Forests: Past, Present and Future. University of Chicago Press, Chicago. ISBN 0-226-04466-1. 745 pp. Paper.

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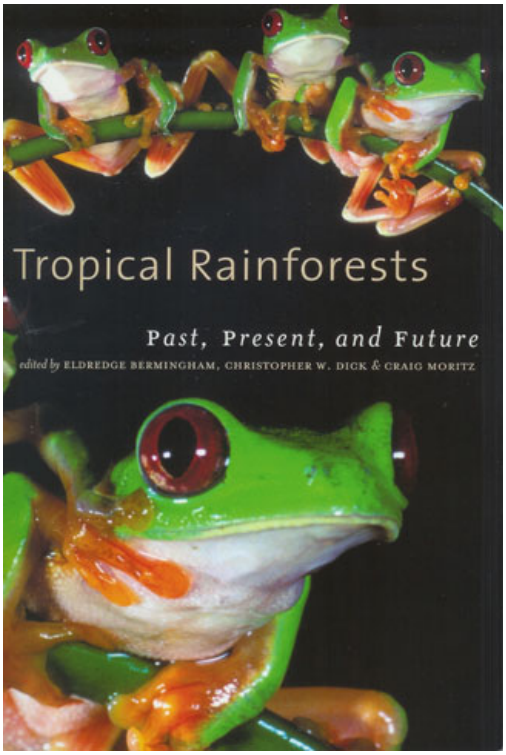
This extensive new treatment of tropical rain forests provides the latest word on the phylogenetics and history of tropical rain forest plants and animals. The book was conceived at a 1998 meeting between researchers from Australia and the Smithsonian Institution in Panama and is based on papers from that meeting that were subsequently revised by May 2003.

The twenty-eight chapters are divided into three parts. The first part considers how past geological, climatic, and evolutionary history and current ecological factors structure tropical rain forest communities and patterns of diversity. Many of the studies reported here use molecular methods to determine the timing of speciation events, and they find that speciation events in many rain forest groups are older than previously suspected. As a consequence, they conclude that Pleistocene refugia are less important in generating species diversity than previously thought. Present concentrations of species in rain forest areas can probably be attributed to earlier geological events and present environmental conditions.

One topic of special concern is how species richness at the community level compares with diversity at larger spatial scales. Most notable is the chapter by Stephen Hubbell, in which he provides a summary of his Unified Neutral Theory of Biodiversity and Biogeography. He uses this theory to predict patterns of species richness over space and time. A major advance of this theory over past models of island biogeography is that his model includes the process of speciation. Other papers in this section use this and related approaches to test ideas that can help explain the assembly of tropical forest communities, with an emphasis on plants. Evidence supporting and contradicting the Neutral Theory in these papers suggests that explanations for patterns in rain forest diversity will incorporate many different theoretical and ecological approaches. There will still be a need for ecological and natural history studies that describe the unique characteristics of individual species and groups of species, and include gradients such as shade tolerance, soil types, drought tolerance, timing and mode of reproduction, levels of predation, and other such characteristics. Papers in this section have a strong representation from Latin America, and Panama in particular, reflecting the contributions of Smithsonian researchers.

The second part uses the Australian Wet Tropics as a case study to examine rain forest species patterns. This rain forest area is especially well studied, in particular by scientists associated with the Australian Research Centre for Tropical Rain Forest Ecology and Management. The stated hope is that ideas and approaches developed in this region can be applied elsewhere. Logging has largely stopped in Australia's rain forests, and nature tourism has emerged as a major industry, with the rain forest and the Great Barrier Reef being the principal destinations. As of 1988, the Australian Wet Tropics has been designated as World Heritage Site. In these chapters, scientists working in this region write about their work on the evolutionary age of species in these forests and the importance of understanding how past geological and climatic history influence the modern distribution of species. Although past geological and climatic events still have a demonstrable influence on present distribution, the fact remains that current rainfall distribution represents the dominant influence affecting species distribution at the local scale within particular rain forest blocks. As conditions in Australia become warmer and rainfall patterns are affected by climate change, and as habitat is further fragmented by a rapidly increasing human population, many of these restricted-range species will face loss of habitat and possible extinction. This section would have been strengthened if the authors could have provided specific examples of how the approaches described in these chapters had been applied to other regions, such as New Guinea, and had led to practical conservation efforts.

Part three includes three chapters addressing the future of the tropical rain forest, with special emphasis on Australia, Brazil, and Indonesia. A chapter by Kathy MacKinnon was notable for its pessimistic view of the future of rain forests in Indonesia. Despite huge amounts of money being spent on conservation projects by multinational banks and conservation organizations, only a few examples with mixed outcomes could be offered as partial successes of conservation efforts. The essential problem is that local efforts toward conservation in developing countries such as Indonesia are unlikely to be successful in the face of national level corruption, widespread illegal logging, and a breakdown of law and order in rural areas. Given the limited success of Integrated Conservation and Management Programs—the model advocated by many international conservation organizations for developing tropical countries—realistic options for conservation are few. Even in projects that appeared to be successful, once the funding ends, the protection of the forest often ends as well. While the authors of many chapters throughout the book repeatedly stress the need to protect evolutionary processes, at present the most effective conservation strategy is likely to be well-funded national parks that protect existing species concentrations. If species evolved over millions of years, then protecting such processes over such long periods is not a realistic goal of conservation management. Probably the best that we can do from an evolutionary perspective is to protect environmental gradients of elevation, moisture and vegetation structure that generate adaptive variation within species.



This hefty book and its many excellent chapters provide clear evidence that a better understanding of tropical rain forests is possible with a phylogenetic approach and historical perspective. In that sense, the book fulfills much of its promise. Given this specific focus, the book omits other significant topics, such as ecosystem processes, a subject of very active current research as it relates to global climate change and ecosystem services. The use of direct payments for ecosystem services provided by natural areas is emerging as a crucial element in efforts to protect rain forest habitat, particularly in montane areas that protect water supplies and soils.

This book is meant for the serious scientist who wants to gain new insights into current research directions relating to tropical rain forests. The limited number of natural history examples and photos highlight this specific target audience. The book will be especially appropriate for researchers who are from Australia and those who want to apply the lessons learned in Australia to their own research.

Seed Biology in the Tropics

Vozzo, J.A. (Ed.) 2002. Tropical Tree Seed Manual. Washington, D.C. USDA Forest Service, Agriculture Handbook 721. Free of charge (soft cover). 899 pp.

Reviewed by Adriana Sautu
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Email: sautua@si.edu

Tropical tree management is a relatively new subject, so it is easy to appreciate the significant six-year effort involved in producing this volume that gathers contributions from 63 researchers working in 19 countries. Considering that tropical countries often lag behind temperate countries in terms of access to information, this manual represents a valuable resource that will be extremely useful to technicians, professors and researchers.

The first third of this large volume is a discussion of theory and a review of seed-related biological concepts. It also includes a major section providing descriptions and up-to-date botanical, ecological and seed information for 196 species, the vast majority (154) native to the Neotropics. The Manual has apparently been published in English and Spanish, which is consistent with this emphasis on the Neotropics, but it is not clear how one might find copies of the Spanish version.

The completeness of chapter 1 is remarkable. Eugenia Flores has done an excellent job with this chapter that is profusely illustrated with 64 high-quality color drawings and 157 photos, making it almost a text book in itself. Plant reproductive biology offers the basic concepts needed to understand seed research. This is especially true for seed storage management, where seed morphology and anatomy at maturity, seed oil content and dormancy must be characterized before any storage behavior is assumed.

Seed Collection is the topic of Chapter 2. John K. Francis gives a complete enumeration of factors to consider when planning seed collection, with lots of field examples that make it clear why costs tend to scale with the number of species in any project within a biodiverse tropical region.

Chapter 3 on seed storage provides complete information on seed storage behavior categories and tropical seed storage challenges. In keeping with the broad perspectives of previous chapters, the authors establish that basic understanding of species biology and ecology will allow better and more consistent collection, processing and storage of viable seeds.

Orthodox and recalcitrant seeds, the topic of Chapter 4, describes important physiological seed characteristics related to seed storage behavior and the current state of knowledge in a variety of tropical species. Since orthodox, intermediate and recalcitrant seed storage behavior was also described in chapter 3, this chapter might better be titled "physiology of desiccation tolerance."

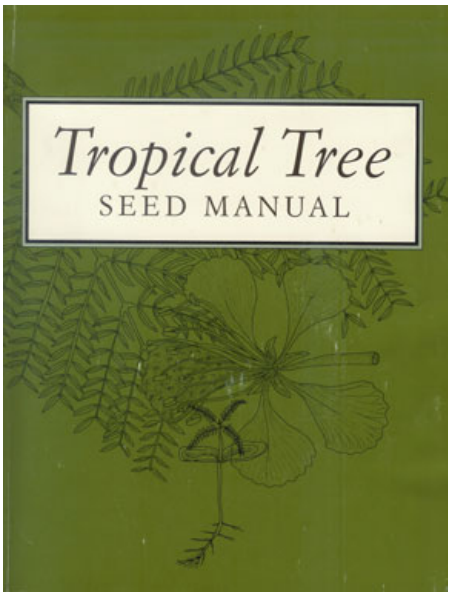
Chapter 5, on dormancy and germination, describes germination syndromes and seed biology, dormancy and storage behavior relationships. Although dormancy definitions are not clearly stated in any of the classifications available, the authors provide a good account of germination pretreatments and an important note calling for the development of standard rules for germination tests for tropical tree species.

Chapter 6, pathology, is divided in two parts: "principles" and "practice," the latter with detailed examples of fungal infections. This topic, of special importance for seed trade legislation, could be improved with the addition of some examples of seed infestations by insects.

The study of seeds has many facets and should not be limited to collection, storage and sowing. Chapter 7, on ecological life histories, describes seed and seedling stages as life cycle stages in an ecological context. This will be a great advantage of this manual for many extension agents and foresters who do not have a strong ecological science background.

Part II contains botanical descriptions, geographical ranges, phenology, uses and seed biology for 196 species, illustrated with drawings of twigs with flowers and fruits. The amount of information available for each species varies. Overall, most species' information on seed biology is rather scant, confirming that still there is much tropical tree seed research to be done.

I found that many foresters and extension agents in Panama were not aware of the existence of the manual and were enthusiastic when I shared my copy with them. Although the book in its English version is available online (http://rngr.net), a second edition of the manual would be justified; especially a Spanish version. A second edition could be improved with the addition of some practical information such as simple descriptions or examples of storage facility designs for different field and research situations and for different budgets in the chapter on storage, or the principal germination test rules in the section on germination. Also, following the broad context on which the manual has been built, chapters on ethnobotany and tropical dendrology would be helpful. The first could concentrate on the role of trees for tropical civilizations and the second could add practical examples on how to document the botanical identity of seed sources. Finally, it would be helpful to add a species list by page number in the "Contents" section.



This volume is an important contribution because, in addition to compiling information from an extremely wide group of sources, it emphasizes the wide variety of knowledge from taxonomy, morphology, anatomy, physiology and ecology to be applied towards understanding seed -stage biology. Tree seed management is crucial for natural forest conservation and management, as well as for reforestation or restoration programs and, of course, for domestication of tree species of economical and social value in tropical countries.

Postdoctoral Position in Tropical Successional Vegetation Dynamics

A postdoctoral position is available to work with an international team of tropical plant ecologists on a comparative study of long-term vegetation dynamics during secondary succession in rain forest areas of Mexico, Costa Rica, and Brazil. Project investigators work in NE Costa Rica (Robin Chazdon, Bryan Finegan), Chiapas, Mexico (Miguel Martinez-Ramos, Frans Bongers), and Manaus, Brazil (Rita Mesquita, Bruce Williamson). The postdoctoral associate will be directly supervised by principal investigator Robin Chazdon, but will work with all project investigators. The major duties of the postdoctoral associate are to 1) supervise implementation of standardized vegetation monitoring methodology in three study areas 2) coordinate field monitoring with local research assistants, visiting each site on a yearly basis 3) incorporate vegetation sampling data into a single, combined relational database from the three study areas 4) assemble detailed metadata for each study plot and study area 5) collaborate with project investigators on data analysis and comparative studies and 6) initiate their own line of research in collaboration with project investigators. Requirements: A Ph.D. degree in ecology, forestry, or related field, research experience in tropical forests, and proficiency in Spanish or Portuguese. The postdoctoral position is guaranteed funding for two years through an NSF grant to the University of Connecticut. Start date is flexible, but preferably before 1 January 2008.
Applications will be accepted until the position is filled. Application materials: Detailed CV, reprints of publications, statement of research interest (1-2 pages), and names of 3 references. Please send application materials or requests for further information to: Robin L. Chazdon Department of Ecology and Evolutionary Biology, Unit 3043, University of Connecticut, Storrs, CT 06269-3043 USA. Phone: 860-486-4057. Fax: 860-486-6364 e-mail: chazdon@uconn.edu

Tropical Forests Under Siege

Laurance, William F. and Carlos A. Peres (eds). 2006. Emerging Threats to Tropical Forests. The University of Chicago Press, 563 pages.

Reviewed by Gary Hartshorn
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Email: ghartshorn@worldforestry.org

Despite two to five decades of concerted efforts by local and foreign conservationists, national and international non-governmental organizations, and bilateral and multilateral agencies, tropical forests continue to be under assault nearly everywhere they have survived. In fact, ever-better data indicate that tropical deforestation is increasing in most host countries. Though prime threats such as the inexorable advance of the agricultural frontier into tropical forests are well-known, there are new and troubling synergies emerging. This excellent book tackles both old and emerging threats to tropical forests. Intended for researchers, students, and conservation practitioners, the book is a rich assemblage of cutting-edge syntheses and data-rich analyses.

This is a timely and thorough compendium of 23 mostly high quality chapters covering climatic and atmospheric change, synergistic effects, pathogens and invaders, insidious and poorly understood threats, solving and mitigating emerging threats, and a summary chapter on implications. Each chapter ends with a concise set of conclusions and implications. The literature-cited section is both comprehensive (79 pages) and up-to-date.

The two editors are well-known, highly experienced, and prolific tropical biologists, who have assembled a stellar cast of 49 authors from 12 countries (nearly half of them tropical). The book's focal studies are from Australia, Brazil, Gabon, Guatemala, Indonesia, Mauritius, México, Perú, Republic of Congo, southern Africa, Uganda, and Venezuela.

The editors define "emerging threats" in four ways: Their categories are: 1) threats that have only been recently documented, e.g., chytrid fungal decimation of amphibians; 2) threats that are rapidly growing or are occurring at unprecedented scales, such as forest-floor fires; 3) those that are still poorly understood, such as the indirect effects of global climate change; and 4) environmental synergisms and interactions, e.g., defaunation.

The book opens with an excellent chapter on *Impacts of global change on the structure, dynamics, and functioning of South American tropical forests* by S. Lewis, O. Phillips and T. Baker (with contributions by 31 other scientists). From a minimum of three sequential censuses of 50 permanent plots in old-growth tropical forests, the authors conclude that stem recruitment, mortality and turnover as well as biomass growth, loss, and turnover are all increasing significantly. Based on their extrapolations, the authors state that neotropical old-growth forests are functioning as a huge carbon sink, sequestering on the order of 0.5 to 0.8 gigatons of carbon per year.

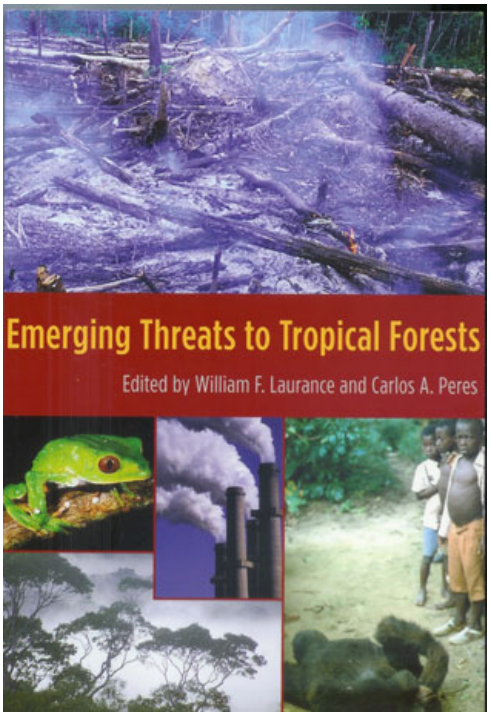
Addressing hydrological processes, Avissar, Ramos da Silva, and Werth report that, "among continental regions, the U.S. Midwest is most negatively affected by deforestation in Amazonia and Central Africa during spring and summer" (p. 74), with the simulated decline in rainfall in the 10-20% range. These authors as well as the senior editor assert that "Amazonian rainfall might decline precipitously as the regional hydrological system collapses" (p. 94).

Olupot and Chapman's chapter on *Human encroachment and vegetation change in isolated forest reserves—the case of Bwindi Impenetrable National Park, Uganda* reaffirms the pantropical syndrome that a "protected" area's buffer zone increasingly comes out of the designated conservation area rather than peripheral to the protected area's boundaries.

In their chapter on *Emerging threats to birds in Brazilian Atlantic forests*, Ferreira Develey and Metzger conclude that the "local maintenance of a species-rich avian community in the southern Atlantic forest will require focusing conservation actions on landscapes with more than 30% remaining forest cover" (p. 287). Below that threshold, forest restoration is imperative to the survival of local avian assemblages.

As is well-known by most tropical biologists, the future of Indonesia's tropical forests is particularly bleak. K. MacKinnon concludes that at the "present rates of exploitation … the lowland forests of the Sunda Shelf … will be almost totally destroyed outside protected areas in Sumatra and Kalimantan within the next decade" (p. 304). She also notes that even "generous budgets and international pressure have failed to stem illegal logging and continuing forest loss within these parks" (p. 305).

Part V is the most important section of this book, for it brings together very thoughtful and compelling arguments for how to save tropical forests. Whitten and Balmford make a cogent case that developed nations must step up their commitments to tropical forest conservation. Niesten and Rice argue for conservation incentive agreements as an alternative to tropical forest exploitation. Because of the vast Amazonian forests and the scale of deforestation and habitat degradation, Fearnside states that the Brazilian Amazon has great potential for contributing to or helping mitigate future global climate change. He eloquently urges major policy changes to recognize and promote "avoided deforestation" (p. 375). Based on their long involvement with the Queensland wet tropics, Turton and Stork analyze the actual and potential effects of nature-based tourism in tropical forests. Elkan *et al.* present an encouraging analysis of some success managing threats from bushmeat hunting in a timber concession in the Republic of Congo. Fagan, Peres and Terborgh offer an ambitious protected-area strategy for the 21st century that calls for upping the current 11% coverage to 50%. The authors explicitly recognize that any increase in protected areas is only half the war; ensuring all protected areas are implemented, consolidated, and made viable in the long run is an even greater challenge.



The final chapter by Laurance, Peres, Jansen and D'Croz is an excellent synthesis of what we know and what we don't know about emerging threats to tropical forests. In this reviewer's opinion, not only is this book a welcome and valuable contribution to the scientific literature on tropical forests, it is also a must have for anyone concerned about the threats to and future of these globally important natural resources.

The Margarita Declaration

Understanding the human, biophysical and political dimensions of tropical dry forests in the Americas

Communicated by **Dr. Arturo Sanchez-Azofeifa,** Earth and Atmospheric Sciences Department, University of Alberta, Edmonton, Alberta, Canada T6G 2E3 e-mail: arturo.sanchez@ualberta.ca

29 July 2006

We, the members of the Tropi-Dry research network, gathered for the first time officially on Margarita Island, Venezuela, representing six countries and multiple natural and social science disciplines,
• having witnessed the rapid decline in the quantity and quality of tropical dry forests throughout the Americas,
• recognizing the strong interdependence of human societies and these ecosystems,
• aware of the limited scientific understanding of their ecological and social dynamics, and
• aspiring to maintain the integrity of tropical dry forests in order to support their long-term persistence and enhance human well-being, **call for**
1) a significant increase in funding for enhancing the local scientific capacity and improving the knowledge of the human, biophysical and political dimensions of tropical dry forests in the Americas, and
2) the application of this knowledge to the development of policies for the conservation and sustainable use of these ecosystems.
We commit ourselves to work in close cooperation with nongovernmental organizations, academia, private sector, governmental agencies, and local communities in this effort.

DECLARATION

Considering that,

1) Tropical dry forests are the most threatened ecosystems in the world.

Tropical dry forests currently occupy a little over 1,000,000 km2. Two-thirds of them are located in Meso and South America. It is widely recognized that tropical dry forests are the most threatened major terrestrial biome on Earth. At least 60% of tropical dry forests in Latin America already have been converted by agriculture, cattle raising, urbanization, and other forms of land use. Between 1980 and 2000, Neotropical dry forests experienced a 12% decline in area. Similarly, most Asian dry forests (> 80%) have already been converted to other land uses. The future of tropical dry forests in Meso and South America is threatened by climate change, fragmentation, fire, conversion to agriculture, and expanding human populations. Indirect impacts of these activities, such as the alteration of ecological processes (e.g. seed dispersal, pollination and natural regeneration), or the incremental risk posed by other threats (e.g. livestock browsing, firewood gathering, and hunting), remain largely unknown. Despite these pressing threats, however, there is hope: out of nearly 300,000 km2 of tropical dry forests are included in the world's protected areas, 72% is located in South America (38% of tropical dry forests in South America are protected). A prime target for the creation of new protected areas in tropical dry forests is Mesoamerica, where only 6% of them are protected.

2) Tropical dry forests are the first choice for human settlement in the Neotropics.

Most human settlements in the Neotropics are located in tropical dry forests: 19 of the 21 national capitals of Meso and South American countries are found in this type of ecosystem. This is because environmental conditions are better for humans in tropical dry forests compared to other tropical life zones, which tend to be too cold, too hot, too dry, or too wet. Therefore, dry forests have been the preferred zones for agriculture and human settlement, and are among the most heavily utilized, perturbed, and least conserved of the large tropical ecosystems.

3) Tropical dry forests are the source of numerous ecosystem goods and services for society.

Human societies derive numerous benefits from tropical dry forests. Soils in these forests are richer in nutrients than their humid counterparts. In Meso and South America, tropical dry forests are located in the most fertile zones for agroindustry and ecotourism development. Tropical dry forests provide freshwater, climate regulation, maintenance of soil fertility, and protection against the negative impacts of floods. Animals and plants are harvested directly as sources of food and fiber. National and international tourists are key contributors to local economies while appreciating the scenic beauty of tropical dry forests.

4) Knowledge about the location, extent and the status of forest areas, combined with the understanding of the causes and consequences of land cover change through time, are key for informing the policy process regarding the conservation and sustainable use of tropical dry forests.

Currently, dry forest research has lagged behind research in tropical moist or rain forests, where, for many complex political and institutional reasons, international funding has been more prominent. Our understanding of the human and biophysical dimensions of tropical dry forest change and its cumulative effects are still in the early stages of academic discovery. Efforts aimed at generating information regarding tropical dry forests are scattered, isolated and limited to a few sites worldwide. Long-term, systematic and coordinated efforts must be undertaken to understand and integrate our biological knowledge of tropical dry forests with the social and ecological drivers that determine their change. Our principal objective is the development of a common multidisciplinary strategy in collaboration with local and national policymaking organizations within the network. We aim to develop a critical mass of local scientific capacity able to conduct comparative studies on tropical dry forests using standardized protocols, and to make this information widely available to all major stakeholders.

CALL FOR ACTION

We call for

1) a significant increase in funding for enhancing the local scientific capacity and improving the knowledge of the human, biophysical and political dimensions of tropical dry forests in the Americas, and
2) the application of this knowledge to the development of policies for the conservation and sustainable use of these ecosystems.

Specifically, we propose to:

1) Bring together researchers in conservation biology, ecology, remote sensing, and social sciences to develop a comprehensive, "state-of-the-art" understanding of tropical dry forest ecosystems.
2) Determine the current spatial extent and status of tropical dry forests, assess their recent change, and project their expected future configuration under predicted socioeconomic scenarios.
3) Build scientific capacity in tropical dry forest research, by providing students in Meso and South America with academic opportunities within the network.

The first meeting of the ATBC Asian Chapter

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The formation of an Asian Chapter of ATBC was agreed at the ATBC 2006 meeting in Kunming and announced in the September 2006 issue of Tropinet. This is an experiment for ATBC, since the obvious advantages of regional chapters – lower transport costs, more frequent meetings, and the opportunity to focus on regional conservation issues – are at least partly offset by the loss of the pantropical breadth of knowledge, experience and ideas that is the big attraction of the annual ATBC meetings. Asia seemed the obvious place to start since the region has a large number of active field biologists, but low ATBC membership, and very low attendance at ATBC meetings outside the region.

The new chapter held its inaugural conference at the Temple Bay Hotel in Mahabalipuram, near Chennai, India, on 6th-8th March, 2007. The French Institute of Pondicherry, which has a significant tradition in research in tropical forest ecology in India and S. E. Asia, was the chief sponsor of the meeting. ATBC Councilor Priya Davidar was the Convenor and she and her team ensured that everything ran very smoothly. Attendance considerably exceeded expectations for the first meeting, with a total of 128 participants from 60 institutions in 19 countries, including 48 students from 14 countries. The meeting received financial and other support from the French Institute of Pondicherry, which many participants also visited on a post-conference field trip.

The conference theme was "Averting biodiversity meltdown in the Asian tropics", but the papers were not all gloom and doom. The 10 symposia were more or less equally divided between understanding regional ecosystems and trying to conserve them in the face of varied and increasing threats. The advantages of a meeting that focused on the shared biology of tropical Asia were apparent in the vigorous debates on a wide range of issues, both within and outside the conference halls. The issue of hunting proved particularly controversial, as did WWF's "Heart of Borneo" project.

These debates also highlighted a contrast between the relative stability of many South Asian landscapes and the very rapid changes in much of Southeast Asia. This contrast could be crudely summarized as "the worst is over" versus "the worst is yet to come", but there were exceptions from both sides of the region. Peter Ashton dealt with the causes and consequences of this contrast in his opening address, and also pointed out that the Asian Chapter provides a unique opportunity for the exchange of experiences between the people working in different parts of the region. This was followed by Madhav Gadgil's inaugural address on the traditional protection of fish diversity in rivers, which provided a perfect example of both the role of tradition in resource management in India and how this role is threatened.

This was not only the first meeting of the Asian Chapter but also, technically, the last, since the members voted to repeal Wallace's Line and change the name to the Asia-Pacific Chapter. This expansion makes a great deal of sense, particularly in view of the active involvement of many Australian scientists in Southeast Asia and the fact that Indonesia spans the biogeographical boundary. Attracting broader representation from this expanded area is a challenge for the future. Indeed, the one major disappointment of the meeting was the low level of participation from the "Sundaland" countries of Indonesia, Malaysia, Singapore and Brunei. Better representation from this region is essential if ATBC Asia-Pacific is to have a strong regional voice on conservation issues. Plans to hold the next meeting in Kuching, Sarawak, in June 2008 should go a long way towards improving this situation, but it is also clear that ATBC needs to find some way to increase its membership throughout the region.

Proposals and Courses

Proposals for Canopy Access in French Guiana

The French Centre National de la Recherche Scientifique (CNRS) calls for proposals for a new canopy access system in French Guiana. The Canopy Operating Permanent Access System (COPAS), built at the Nouragues field station in French Guiana, was conceived as a way in which to reach the entirety of the canopy over a 1.5 ha area. This device offers scientists from various disciplines new ways to conduct observations and experiments in the different vegetative layers of the canopy, in a region of the Amazonian forest that is particularly rich and well preserved.

The system will be functional by the end of 2007. If you are interested in using COPAS, please send a short (one to two pages) "pre-project" proposal indicating your major aims to charlesd@cayenne.ird.fr and alain.pave@cnrs-dir.fr.

The CNRS Nouragues field station, located in an uninhabited area in the heart of the Nouragues forest reserve where the fauna and flora has remained undisturbed, welcomes scientists from various countries. The philosophy of the CNRS Nouragues field station is to efficiently aid scientists in conducting studies on this ecosystem and to collaborate with the international community. Once their projects have been selected, the scientists have only to cover the costs of the air \ travel and food. Accommodations and the use of the different pieces of equipment are free.

The website http://www.nouragues.cnrs.fr/ offers further information, including a description of COPAS and information about the living and working conditions at the Nouragues field station.

Field Biology course in China

The Center for Tropical Forest Science-Arnold Arboretum Field Biology Course will be held Sept 02- Oct 13 2007 at Xishuangbanna Tropical Botanic Gardens, Yunnan, China. The field course is aimed at graduate entry-level students and will provide a broad-based introduction to the ecology of tropical forests in SE Asia. The closing date for applications is 31st May 2007. The 6-week field course includes an introduction to various taxa, an investigation of different ecosystems, and a student independent project. Further information, including a draft program

and application forms, are available on the CTFS-AA website at http://www.ctfs.si.edu/doc/article.php?id=12

Research in the Osa Peninsula, Costa Rica Friends of the Osa announces the opening of the Osa Biodiversity Center, a research and education facility that will serve as a base of operations for tropical ecology research and environmental education programs on Costa Rica's Osa Peninsula. The OBC provides comfortable accommodations and research facilities for students, scientists, and conservation professionals working on the Osa. The center can house up to 25 people in three cabin-style buildings, each of which has three bedrooms. The center provides a laboratory and secure storage room as well as dining facilities that can be used for group meals and meetings. The center, located on an800-acre forested property, provides easy access to some of the most diverse old-growth rainforest in Central America. For more information, see: www.osaconservation.org

MEETINGS CALENDAR

2007

Society for Economic Botany Annual Meeting, 4-7 June, 2007, in Chicago, Illinois. The theme will be "The Search for New Plant-based Therapies." Visit http://www.seb2007.com/

Biodiversity Crisis on Tropical Islands, 11-13 June, 2007, sponsored by the Department of Biology at Universiti Brunei Darussalam. The Conference will be held at the Universiti campus. There will be opportunities for mid-conference field visits. Information:http://www.ubd.edu.bn/news/conferences/bcti1206/

The Biodiversity Extinction Crisis, a Pacific and Australasian Response, 10-13 July 2007, in Sydney, Australia. Sponsored by the Australasian section of the Society for Conservation Biology. Held at the University of New South Wales.

7th Flora Malesiana Symposium, Leiden, Netherlands, hosted by the Nationaal Herbarium Nederland, 17-22 June, 2007. see http://www.nationaalherbarium.nl/FMVII/

Annual Meeting of the Society for the Study of Evolution (SSE), the Society of Systematic Biologists (SSB), and the American Society of Naturalists (ASN), 16-20 June, 2007, Christchurch Convention Centre, Christchurch, New Zealand. Information at: http://www.evolution2007.com.

9th International Pollination Symposium on Plant-Pollinator Relationships: Diversity in Action. 24-28 June 2007, at the Scheman Center, Iowa State University, Ames, Iowa, USA http://www.ucs.iastate.edu/mnet/plantbee/home.html

Society for Conservation Biology, 21st Annual Meeting: One World, One Conservation, One Partnership. 1-5 July, 2007, Port Elizabeth, South Africa.

Plant Biology Botany 2007, 7-11 July 2007. Joint meeting of the Botanical Society of America (BSA), American Bryological and Lichenological Society (ABLS), American Fern Society (AFS), American Society of Plant Taxonomists (ASPT), & Phytochemical Society of North America (PSNA) - Hilton Chicago, Chicago, Illinois, USA http://www.aspb.org/meetings/pb-2007/

2007 Association for Tropical Biology and Conservation Annual Meeting, 15-19 July, 2007. Morelia, Michoacán, Mexico. Theme: "Linking Tropical Biology with Human Dimensions." Information at: www.oikos.unam.mx/atcb.

Ecological Society of America, with the Society for Ecological Restoration, "Ecological Restoration in a Changing World", 5-10 August, 2007, in San Jose CA. http://www.esa.org/sanjose/

Tropinet is published three times a year by the Association for Tropical Biology and Conservation (ATBC) and the Organization for Tropical Studies (OTS) and is available at http://www.atbio.org to all interested readers. ATBC is an international society that promotes tropical biology and conservation in its broadest sense. ATBC publishes the quarterly journal BIOTROPICA and sponsors annual meetings and symposia. Information: W. John Kress, ATBC Executive Director, Department of Botany, MRC-166, National Museum of Natural History, Smithsonian Institution, P.O. Box 37012, Washington, DC 20560. OTS is a non-profit consortium of 63 academic and research institutions in the United States, Australia, Latin America, and Asia. Its mission is to provide leadership in education, research and the responsible use of natural resouces in the tropics. Graduate, undergraduate, and professional training and research facilities are provided at three field stations in Costa Rica. Information: http://www.ots.duke.edu, or at OTS, Box 90630, Durham, NC 27708-0630.

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2008

8th International Conference on Cycad Biology, 12-18 January, 2008, in Panama City, Panama. Panama City, Panama. For information, contact Dr. Alberto Taylor (sidney@cwpanama.net).

19th World Orchid Conference: "Orchids – Nature's Masterpiece, " 23-27 January, 2008, at the Sheraton Miami Mart Hotel in Micame. For more information, see: http://www.19woc.com/

Underutilized Plants for Food, Nutrition, Income and Sustainable Development. 3-7 March, 2008, Arusha, Tanzania. The meeting is sponsored by the International Society for Horitcultural Science. For more information: http://www.icuc-iwmi.org/Symposium2008

ATBC Annual Meeting 2008, 9-14 June, 2008, Paramaribo, Surinam. Plan to be there!

Monocots IV and Fifth international Symposium on Grass Systematics and Evolution, 11-15 August 2008, Copenhagen, Denmark. For more information: <http://www.monocots4.org/>