

# WHAT'S UP?

## The Newsletter of the International Canopy Network

PMB 612, 2103 Harrison Ave. NW, Olympia, WA 98502-2607

*Nalini M. Nadkarni, Editor*

*Amber Neilson, Editorial Assistant*

### REPORTING OUT FOR 1999: ANNUAL MEETING OF THE ICAN BOARD OF DIRECTORS

The by-laws of the International Canopy Network call for an annual meeting of our six-member Board of Directors (Fig. 1). The Board used this opportunity to stage a two-day retreat in a rustic cabin located within the foothills of Mt. Hood, Oregon, beneath the canopy of old-growth Douglas-fir trees. The Board discussed past activities, present commitments, and future opportunities of our organization, now in its sixth year of operation.

The first portion of the meeting was devoted to reviewing the past year's activities. Finances and our membership are sound, and our core communication activities (monitoring the email bulletin board, circulating the quarterly newsletter, updating the ICAN member directory) have been maintained. Over the past year ICAN has also been working extensively on its citations database, which now contains over 1300 scientific references on forest canopy studies. This database is now on-line for ICAN member use.

We noted that this has been a prime year for outreach, with numerous talks given by the Board and ICAN members to schoolchildren, civic groups, and natural history organizations. The "crown" of these activities was the airing of the National Geographic television special, "Heroes of the High Frontier", a documentary film on forest canopy organisms and interactions. This film was facilitated in part by ICAN. This film was seen by over 20 million viewers, and its release was accompanied by a lot of media attention, resulting in many requests for information on forest canopies by school groups, environmental education organizations, and individuals. We also created a "companion website" that provided in-depth scientific information and references

to those that saw the film and wanted to learn more about what they saw. Many ICAN members contributed to this website, and it is linked to many other sites worldwide.

ICAN provided workshops and co-sponsorship at a number of scientific meetings, including the 2nd International Canopy Conference (Sarasota, FL), the European Science Foundation (ESF) workshop of the Tropical Canopy Programme (Oxford, U.K.), and the Agro-eco-urban Visions Workshop (Honolulu, Hawaii). ICAN is supporting the publication of the proceedings of the latter. ICAN will also have a major role in organizing a joint workshop of the upcoming ESF/NSF workshop on canopy research planning in November 1999.

Future projects that are currently under development and will be acted upon in the upcoming years, relate to our mission of including and linking research, education/outreach, and conservation. One such project we discussed is creating learning materials for Project Learning Tree, a nationwide organization that provides educational materials for science teachers in primary and secondary schools. This is our first "formal" pathway of communication that will have further-reaching effects than talks to individual classrooms.



Photo: Denise Joines

Fig. 1. ICAN Board of Directors, from left to right: Kevin Hillery, Denise Joines, Maureen McConnell, David Shaw, Nalini Nadkarni, Joel Clement.

Other outreach projects include consulting to new and established environmental education and ecotourism centers that have (or are planning) canopy walkways, aerial trams, or canopy platforms.

Exciting conservation projects to push forward include the development of a “canopy hot-spot program”, a suggestion that was raised at the Canopy Conference in Sarasota, Florida, last year. The concept is to establish a variety of criteria for prioritizing conservation sites (e.g., high diversity or endemism of canopy organisms, existing infrastructure such as cranes or platforms, existing long-term data collections). ICAN will then accept nominations for examples of such sites, and make recommendations to existing conservation and land protection organizations (e.g., The Nature Conservancy, World Wildlife Fund) to protect them.

Another conservation project that we are considering is eco-restoration, i.e., assisting the renewal and restoration of degraded or clear-cut forests. More information about a recent test project in Costa Rica will appear in future issues of this newsletter.

We also discussed the possibility of a “canopy gear-matching program” — approaching climbing equipment companies to make donations of canopy access gear to specific researchers in developing countries who lack even basic equipment to carry out canopy studies.

Another goal is to bring together regional meetings for canopy researchers, modeled on working group meetings held by forest insect and forest pathogen researchers. The first such regional meeting is planned for spring 2000 and will be held in the Pacific Northwest, as a western regional meeting of forest canopy researchers, arborists, and educators.

ICAN is also looking into developing several other databases relating to forest canopies. Using the technology and software gained through establishing the on-line citations database, other future database projects include a canopy projects database (listing sites, investigators, and access mechanisms) and a database on safety issues. The latter will include accounts of accidents and safety protocols in order to promote high safety standards among those who gain access to forest canopies.

The Board also discussed the need to create a funded position for an Executive Director and other staff, which in the past have been subsidized by volunteers, ephemeral research grants, or the institutions that house ICAN Board members. We recognized that such funds are difficult to obtain, and that the best strategy would be to write proposals for specific projects and activities that would include the “overhead costs” of staff positions.

The move to create an Advisory Board that will help the administration and development of ICAN was a main fo-

cus during this meeting. The function of an Advisory Board is to broaden and deepen the expertise available to the ICAN Board and members in the implementation of our mission. A number of individuals were nominated and will be extended invitations to join the Advisory Board over the next several months.

Areas for future projects include: a focus on urban trees and forest canopies and the wildlife they support; a “plants in prisons” programs - to bring incarcerated people in contact with epiphytic plants for horticultural therapy or as a means of earning money; a canopy structures referral service, whereby ICAN serves as a disseminator of information on companies and individuals experienced in the building of canopy structures to those who want them; and a “scientists-in-schools” program, whereby ICAN provides slides, interpretive materials, and local contacts for scientists who are willing to speak to children in primary and secondary schools, and that would complement our existing “Ask Dr. Canopy!” Program.

The general spirit of the meeting was positive. This volunteer Board of Directors is extremely dedicated to the goals of our organization, and encourages help and suggestions from its members.

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## THE CANOPY CITATIONS DATABASE IS NOW AVAILABLE THROUGH THE WORLD WIDE WEB

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The database contains over 1300 citations regarding canopy ecology. ICAN members can search for authors, titles, dates, journals, keywords, or words within the abstract. Take an opportunity to visit the webpage at <[www.evergreen.edu/canopycitations](http://www.evergreen.edu/canopycitations)> and send us your comments or feedback. Also, sending us your reprints, bibliographies, or databases will help the database to grow rapidly.

Support for this project came from the National Science Foundation Database Activities Program (BIR 93-07771, BIR 96-30316), and the LTREB Program and POWRE Supplement (BIR 96-15341). The Evergreen State College Faculty Sponsored Research Program provided student funds for the project and the Computer Applications Laboratory provided equipment and expertise. Contributors to the project included: Grethe Thilly (webpage designer); Steve Rentmeester (data and logistics management); Judy Cushing and Nalini Nadkarni (provided project oversight); and Jon Higgins and Rip Heminway (provided networking support).

## BOARD OF DIRECTORS BIO-SKETCH

In order to acquaint ICAN members with the Board of Directors, the next several issues of "What's Up?" will feature a brief introduction into the visions of the ICAN Board.



Photo:Denise Joines

Joel Clement, a forest canopy ecologist from Seattle, Washington, is ICAN's co-founder and Secretary/Treasurer. He holds a Master's degree in environmental studies and through his consulting business, Forest Dy-

namics, he works with environmental groups, eco-tourism facilities, and research institutions worldwide to protect natural resources and to provide biodiversity information. His current research focuses on the biodiversity within temperate rain forest canopies in North and South America, but he has also climbed and conducted research in the tropical rain forest canopies of Costa Rica and Madagascar. Consulting projects have taken Joel to Costa Rica, Dominica, Madagascar, Chile, Alaska, northern British Columbia, and the Pacific Northwest. Some of his work in North America was featured in the January 1997 issue of National Geographic Magazine. His hobbies include telemark skiing and sailing.

"I realized that my destiny lay in the forest canopy after climbing my first tree on the Osa Peninsula of Costa Rica. I had spent the previous three years at sea and the exuberance of living things I was seeing in the canopy absolutely blew my mind. I decided I needed to learn more about this habitat. This connection was on the level of a religious experience and is renewed every time I set foot in a primary rain forest or climb into a tree."

"As one of the founders of the ICAN, I felt that there was a need for an organization that could build bridges between canopy science and the rest of the world. As a lifelong environmentalist, I knew that a little scientific outreach could go a long way in the global effort to protect forests. Without it, particularly fascinating fields such as canopy studies could become nothing more than pop sideshows in the public mind. The ICAN is a modest attempt to neutralize "professional isolation" and create more research and conservation opportunities worldwide. My hope is that this notion will grow and ICAN will evolve into a role as a facilitator, clearinghouse, and instigator of research and conservation partnerships."

## ANNOUNCEMENTS

The Council for Agricultural Science and Technology (CAST), an international consortium of 36 scientific and professional societies, has released a major policy report on biological diversity entitled "Benefits of Biodiversity." The report details recommendations on the importance of conservation of biodiversity and its links to maintaining agricultural productivity. The report can be purchased in text format from: CAST, 4420 West Lincoln Way, Ames, Iowa, USA; or downloaded at <<[www.cast-science.org/biod/biod.htm](http://www.cast-science.org/biod/biod.htm)>>.

A new mailing list called *sciencelinks* is a service where scientists, news organizations, and individuals with an interest in science can get the latest information -via website links- on research, news, and homepages pertaining to the scientific establishment. *Sciencelinks* is not a discussion list; it is a collection of hyperlinks and URLs to allow you to keep up-to-date with all areas of scientific study. To subscribe, visit: <<<http://www.onelist.com/subscribe/sciencelinks>>>.

A listserv on arthropod galls that features discussions on the biology, ecology, chemistry, genetics, and evolution of galls on plants, their elicitors, and associated organisms is available. Subscribers are encouraged to post brief summaries of recent research findings and to seek collaborations with others. Participation is open to anyone with an interest in plant galling systems or tumorigenesis in general. To subscribe send the following message: "SUBSCRIBE GALLS-L YOUR NAME" to <[listserv@lists.psu.edu](mailto:listserv@lists.psu.edu)>.

*Species Diversity and Richness II* is a program to aid ecologists and environmentalists in the calculation and application of diversity indices and estimating total species richness for a habitat. The program is available for Windows 95/98. The new release includes: diversity measures; beta diversity; data simulation from a variety of models; distribution fitting (geometric, log series, truncated log normal and broken stick); and between-sample comparisons of diversity using randomization tests. For more information visit the web site at <<<http://www.irchouse.demon.co.uk>>>.

Looking for a potential study site in Borneo for research/field courses? A field research station in the middle of one of the best remaining patches of mixed Dipterocarp forests in Borneo is available. Contact: Colin Maycock, Research Coordinator, Kuala Belalong Field Studies Center; <[cmaycock@ubd.edu.bn](mailto:cmaycock@ubd.edu.bn)>.

**RESEARCH REPORT:**

**THE DISTRIBUTION OF EPIPHYTES ON WESTERN HEMLOCK TREES IN AN OLD-GROWTH TEMPERATE FOREST.**

The role of western hemlock in supporting epiphyte communities in temperate forests of the Pacific Northwest has not been quantified. In 1996 and 1997, we conducted field research on the distribution of epiphyte functional groups on three height classes of western hemlock in an old-growth forest using the Wind River Canopy Crane Research Facility (WRCCRF) in Carson, Washington. Our primary objectives were to quantify patterns of epiphyte distribution at distinct spatial scales and among different height classes of trees, and to assess the relationship between crown structure variables and epiphyte abundance. Only a portion of the results will be presented here (for a full account, see Lyons 1998).

A total of 30 western hemlock trees, 10 in each of three height classes, were sampled for epiphytes. The height classes were defined in relation to known light levels within the forest canopy, and correspond to the lower (< 12 m), middle (12-37 m), and upper canopy (>37 m) strata (Parker 1997). The percent cover of epiphyte functional groups was estimated for three positions along each sampled branch for a total sample of 961 branches and 2701 plots. Epiphytes were categorized into one of four functional groups (alectorioid lichens, bryophytes, cyanolichens, and 'other' lichens) and a single species (*Sphaerophorus globosus*) following McCune (1993). All trees were cored to determine tree age.

Strata:	Height Class			Total
	Small	Medium	Large	
Upper(>37)	-	-	20	<b>20</b>
Middle(12-37)	-	10	24	<b>17</b>
Lower(<12)	8	19	14	<b>10</b>
<b>Total</b>	<b>8</b>	<b>11</b>	<b>23</b>	<b>14</b>

Table 1. Total epiphyte cover by height class and canopy strata. Both height classes and strata were defined in relation to known light levels at the site.

Differences in epiphyte abundance between height classes and canopy strata were examined using a Kruskal-Wallis test. The relationship between tree age, tree size, and epiphyte abundance was examined using correlation analysis and ANOVA.

Epiphytes were present in 76% of all plots. There were significant differences in total cover between the canopy strata and height class ( $p < 0.001$ ). Total cover was greatest in the upper stratum and least in the lower stratum (Table 1). As in other studies (Clement 1995, McCune *et al.* 1997, Pike *et al.* 1977), epiphyte functional groups were stratified vertically in the canopy (Fig. 1). Alectorioids and 'other' lichens peaked in abundance at higher positions; bryophytes decreased with height in the canopy, and cyanolichens and *Sphaerophorus globosus* reached greatest abundance in the lower to middle canopy strata.

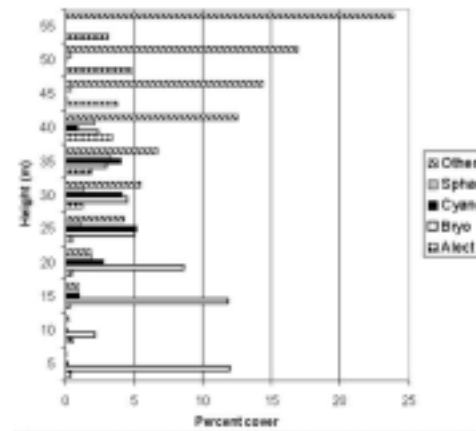


Figure 1. Vertical distribution of epiphyte functional groups

Epiphyte cover in large trees (23%) was roughly twice that of medium trees (11%), and nearly three times the cover of small trees (8%). The height classes also differed in community composition. Small trees were dominated primarily by bryophytes; the other height classes exhibited a more diverse epiphyte community (Fig. 2). The ANOVA revealed significant differences in age among the height classes ( $p = 0.01$ ), but a post-hoc Tukey test indicated these differences were only significant between large and small trees ( $p = 0.05$ ). Tree age was not correlated with tree height (Fig. 3). Epiphyte abundance was more closely correlated with tree height than tree age.

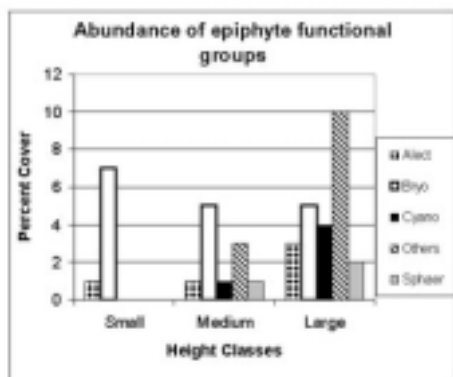


Figure 2. Abundance of epiphyte functional groups by height class

The distribution patterns documented in this study can be used to speculate on the process of epiphyte succession in this forest. All sample trees were less than 250 yr old, but the stand is estimated to be nearly 500 years old, so the study trees must have originated in the understory. Some trees were apparently able to grow out of the low light zone into the middle and upper canopy strata, while others remained suppressed in the understory. Differences in epiphyte abundance and composition between these height classes probably reflect the effects of changing environmental conditions, and may suggest a sequence of epiphyte succession. Other conclusions from the results are: 1) tree size may not be a reliable indicator of tree age in some old-growth forests; 2) an increase in tree age does not necessarily lead to increased abundance or diversity of epiphyte functional groups; and 3) tree size may be a better an indicator of epiphyte abundance than tree age.

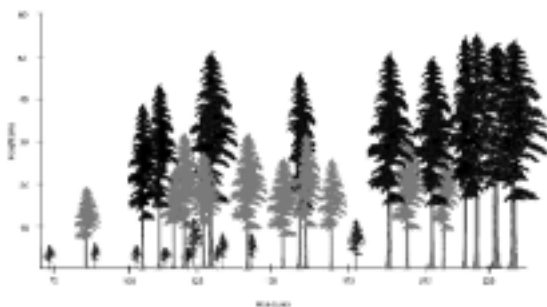


Figure 3. Relationship between tree height (m) and age (yr) among western hemlock trees in an old-growth forest.

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## FUNDING OPPORTUNITIES

**1999 Universiti Brunei Darussalam (UBD) Research Fellowship.** UBD offers one-year post-doctoral research fellowships within the Faculty of Science for research in Brunei Darussalam. Preference given to continued research on already established projects. Current research interests include: mangroves, peat swamps, heath and mixed dipterocarp rainforests, and marine and coastal ecosystems. Contact: *Colin Maycock; FAX: 673-224-9502; <cmaycock@ubd.edu.bn>.*

**James F. Lynch Conservation Biology Fund.** In honor of the work of the late James F. Lynch, a conservation biologist, this fund supports new scientists working in conservation biology in Central America and East Africa. Contact: *James F. Conservation Biology Fund, c/o Jeanine Robert, Smithsonian Environmental Research Center, PO Box 28, Edgewater, MD 21037.*

**Bullard Fellowships in Forest Research,** Harvard University. These fellowships promote advanced study, research, or integration of subjects pertaining to forest ecosystems. The awards are intended to provide individuals with an opportunity to interact with Harvard University faculty in order to develop their own scientific and professional growth. Fellowships are available for periods of time between four months to one year and can begin at any time during the year. Applications from international scientists, women, and minorities are encouraged. Fellowships are not intended for graduate students or recent post-doctoral candidates. The annual deadline for application is February 1st. Contact: *Committee on the Charles Bullard Fund for Forest Research; Harvard University; Harvard Forest; PO Box 68, Petersham MA 03166, USA.*

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## FEATURE ARTICLE: CONSERVATION REPORTS

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### THE DISAPPEARANCE OF THE HIGH ALTITUDE *POLYLEPIS* FORESTS.

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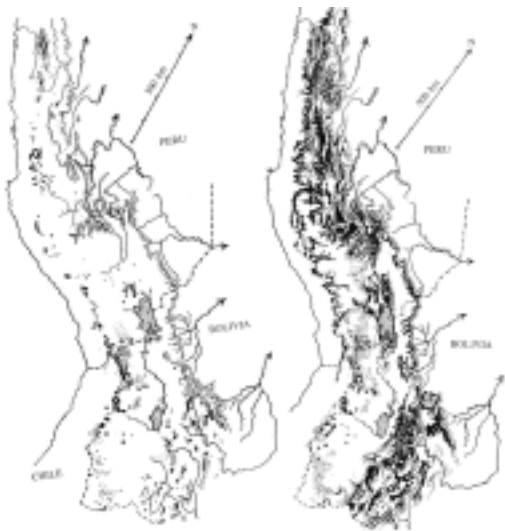


Fig. 1. Left: The black dots represent areas where *Polylepis* are presently found. Horizontal shading represents a humid treeline environment with admixed *Polylepis*. Right: The black dots and other blackened areas represent the potential distribution of *Polylepis* under current climatic conditions. (Fjeldsa, J. & M. Kessler. 1996. NORDECO, Copenhagen, Denmark)

The spectacular snow-capped peaks of the Andes Mountains sets the backdrop for one of the more ecologically interesting and biologically diverse ecosystems on the planet. Extending down the length of western South America, the alpine system is interspersed with barren slopes, steep grassy meadows, thick heather-like shrubbery, and several woody tree species. Of particular interest are the high altitude *Quenua* (*Polylepis*) forests, which are found above tree line (4000 m), in well-drained patches associated with steep hillsides and rocky boulder fields. These trees, although restricted in their distribution, typically form almost pure stands of forest.

The genus *Polylepis* (Rosaceae) includes 20 species of shrubs to small-sized trees found in ecologically distinct environments in Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile, and Argentina. Surprisingly, at the high Andean altitudes, several species are able to reach heights of more than 15 m, thus providing an ecologically unique biological oasis for other plants and animals. The trees have trunks up to 2 m thick with twisted branches that possess thin exfoliating reddish orange bark. The dense canopy of *Polylepis* dramatically reduces the light that penetrates to the forest floor, an array of plants have adapted to the moderate light conditions.

These forests have sometimes been described as enchanted, owing to the variety of vegetation that festoons the gnarled branches in this harsh environment. *Polylepis* obtains water from streams that are derived from surrounding glaciers and are also able to “comb” moisture from the surrounding air. This enables lichens, bromeliads, orchids, and other plants to accumulate on the branches. Despite their small geographical extent, these forests represent unique ecological islands of biodiversity that are vanishing rapidly. Only 2% of the original *Polylepis*

forests remain in Peru and 10% in Bolivia. Human occupation in the Andean highlands have led to considerable destruction of *Polylepis* forests (Fig. 1) (Fjeldsa and Kessler 1996). Increasing population pressures have extended the destruction into even the more remote Andean areas. However, the primary reason for the loss of these forests stems from unsustainable management practices, especially the periodic burning of forests to stimulate the growth of grasses to graze animals. An additional assault on the forests stems from the introduction of exotic species that are more productive and competitive than native species. In particular, eucalyptus trees have been planted to such an extent over the past 100+ years that many indigenous people consider it native. This has had a profound effect on the ecology of the forests and their associated species.

Many social, cultural, and political issues must be addressed before the remaining forests can be protected. Indigenous Andean people must direct any preservation initiative. Management plans must be directed at a grassroots level, by which community people are taught the value of their resources and why sustainable practices will work for them. Those who use the land are generally unaware of ecosystem services and the consequences of forest loss. Many are not aware that much of the Andean highland was at one time forested and do not realize the extent of the damage that has been done. Long-standing agricultural practices adopted from the Spaniards hundreds of years ago have replaced the sustainable pre-Columbian techniques and these have significantly altered the ecology of the highlands.

My colleagues and I seek help from those who are interested in issues concerning the Andean canopy system. I have spoken with several Peruvian congressmen about potential projects that could be put in place to halt the destruction of the *Polylepis* forests and they have been receptive to a number of ideas.

Stephen R. Madigosky, Widener University, Department of Environmental Science, Chester, PA 19013  
<madigosky@pop1.science.widener.edu>

## EFFECTS OF HABITAT FRAGMENTATION ON EPIPHYTIC BROMELIADS IN THE UNA REGION OF BRAZIL

This project is part of the RestaUna project, which investigates how reduction and isolation of forest tracts affects patterns of local biodiversity in an Atlantic region of Brazilian rainforest. Results of this project will support conservation strategies designed for the region, by isolating potential areas for protection and identifying the role of cocoa plantations in habitat conservation.

The Atlantic Brazilian rainforest is one of the most endangered ecosystems in the world. It has been reduced to less than 5% of its original extent. Most of the forest is scattered, confined to small and disturbed patches. The Brazilian cocoa region - located in southern Bahia - is one of the largest remnants of Atlantic rainforest, with a considerable extent of continuous forest tracts. In much of the region, the understory is cleared and native trees furnish shade for the smaller cocoa trees. Often, some of the trees that form the canopy are also removed, while the remainder furnish habitat for many species of epiphytes, mammals, and birds.

In this study, the epiphytic flora is being surveyed, focusing mainly on bromeliads. Both cocoa plantations as well as large forest remnants (> 800 ha) and their edges are being inventoried in three replicates. One more replicate - the control area - is the Biological Reserve of Una. All data presented here refer to the first results of the forest and cocoa plantation research.

The forest remnants and cocoa plantations show differences in their component species and density of genets on host trees (Fig. 1, Table 1). The remnant trees in cocoa plantations support higher densities of bromeliad than forest trees. Abiotic conditions (sunlight, wind, temperature) favor high frequencies of bromeliad genets. However, remaining trees in cocoa plantations experience colonization of a very different epiphyte community trees in undisturbed forests. The original species of the understory (e.g., *Lymania* spp.), canopy (e.g., *Aechmea* spp.), and upper trunk species (e.g., *Vriesea* spp.) are completely lacking on trees of the cocoa plantation. Future investigation will address how epiphytes might be affected by habitat simplification in the entire region, edge effects, and how original species are replaced by different ones after years of managed logging.

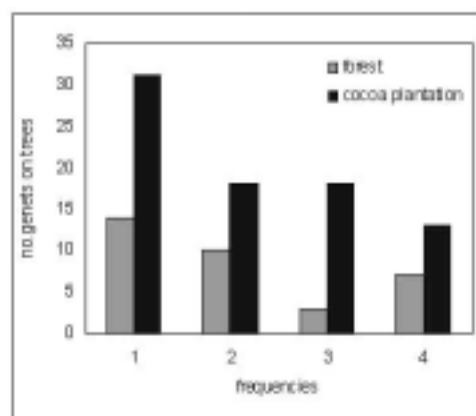


Fig. 1. Partial results of bromeliad epiphytic species in Una Region. When compared to forest, remnant trees on cocoa plantations present higher number of genets in all frequency classes: 1 = 1 bromeliad; 2 = 2 - 4 bromeliads; 3 = 5 - 10 bromeliads; 4 = > 10 bromeliads.

SPECIES	HABITAT	
	FOREST	COCOA PLANTATION
<i>Aechmea leonard-hortiana</i>	X	
<i>Aechmea longiflora</i>		X
<i>Aechmea zosterifolia</i>		X
<i>Aechmea</i> sp. 1	X	
<i>Araococcus purpuriflorus</i>	X	
<i>Catopsis berteroviana</i>		X
<i>Catopsis sessiliflora</i>		X
<i>Holcbergia blanchetiana</i>		X
<i>Holcbergia</i> sp. 1	X	X
<i>Lymania atrovirens</i>	X	
<i>Lymania aurea</i>	X	
<i>Lymania zosterifolia</i>	X	
<i>Microspora longispala</i>	X	X
<i>Streptocarpus curvatus</i>	X	
<i>Tillandsia speculosa</i> var. <i>ustulata</i>		X
<i>Vriesea bitorquata</i>	X	X
<i>Vriesea duperoyana</i>	X	
<i>Vriesea duralana</i>	X	
<i>Vriesea pilosissima</i>	X	
<i>Vriesea procera</i>		X
<i>Vriesea pottiana</i>	X	

Table 1. Bromeliad epiphytic species within different habitats of Una region

### Acknowledgments:

The present work is a supplementary part of the Resta Una project financed by Universidade Estadual de Santa Cruz (UESC), Programa de Biodiversidade (PRONABIO/PROBIO) of the Brazilian Ministry of the Environment, Water Resources and the Amazon Region (MMA), with the support of CNPq, the Global Environmental Facility (GEF) and the World Bank (BIRD).

Talita Fontoura, Assistant Professor, Universidade Est. de Santa Cruz/Dep. Biologia, Rod. Ilheus-Itabuna km16, 45650-000 Ilheus, Bahia, Brazil; <talita@jacaranda.uesc.br>.

## MEETINGS OF INTEREST

**The 79th Annual Meeting of The American Society of Mammalogists.** Seattle, Washington, USA. June 20-24, 1999. This year's program includes a keynote address by Dr. Thomas Kunz of Boston and special symposia on methods for studying bats. The meetings will also feature ASM socials, ideal for professional interaction. Contributed papers will address all aspects of mammalian biology. Contact: *Dr. Steven West, College of Forest Resources, University of Washington, Box 352100, Seattle, WA, USA 98195-2100; Phone 206-685-7588; <sdwest@u.washington.edu>*.

**The Forests and Atmosphere – Water – Soil Forum.** Soltau, Germany. July 2-5, 1999. This forum is one of a series presented by The World Exposition "EXPO 2000 Hannover". In dialogue between all parties concerned, the forum will establish recommendations for sustaining the functions of forests as regulators in energy fluxes and matter cycles. This forum is intended to encourage the relevant social parties to participate in decision making on forest issues, thus promoting the world-wide implementation of the recommendations of the Agenda 21 that were established at the UNCED 1992 in Rio de Janeiro. Contact: *Alfred Toepfer Akademie für Naturschutz (NNA), Forum Office, Hof Moehr, D – 29640, Schneverdingen, GERMANY; Phone: 49-5199-989-21; <<http://www.forests.in.focus.comlink.apc.org>>*.

**XIVth International Plant Protection Congress: Plant Protection Towards the Third Millennium - Where Chemistry Meets Ecology.** Jerusalem, Israel. July. 25-30, 1999. The main topics of this conference are ecological and biotechnical issues in plant protection, resistance to pesticides, innovative approaches in pesticide chemistry and chemical ecology, and eco-toxicology and fate of pesticides in the environment. Contact: *Secretariat, XIVth International Plant Protection Congress, P.O. Box 50006, Tel Aviv 61500, Israel; <ippc@kenes.com>; <<http://www.kenes.com/IPPC>>*.

**The VII International Aroid Conference.** Missouri, USA. August 9-11, 1999. This conference will provide a forum for presentations and discussions on current topics in the family Araceae, including their biology, ecology, taxonomy, and horticulture. Attendees are invited to present a poster on any of these topics. Contact: *Beth L. Cosgriff, Secretary General, Missouri Botanical Garden, PO Box 299, St. Louis, MO 63166-0299, USA; <bcosgriff@lehmann.mobot.org>; <<www.mobot.org>>*.

**Building Cities of Green; 1999 National Urban Forest Conference.** Seattle, Washington, USA. August 31-September 3, 1999. This conference will offer workshops and guest presenters that address ways of improving biodiversity and green space in urban areas. Contact: *Dan Dewald, American Forests, Local Arrangements Committee Chair; Phone: 425-452-6048; <<www.americanforests.org>>*.

**The 2nd Annual Earth Technologies Forum.** Washington, DC, USA. September 27-29, 1999. Three days of conference sessions will include discussions of global climate change policy and technology issues. There will be a focus on both the international and domestic implementation of issues such as emissions trading, credit for early action to reduce greenhouse gas emissions and voluntary programs to reduce emissions. Contact: *Ms. Erika Fischer; Phone: 703-807-4052; Fax: 703-243-2874; <<http://www.earthforum.com>>*.

**Technology in the Wildlife Profession: Research, Application, and Education.** Stateline, Nevada, USA. October 24-27, 1999. This symposium is sponsored by the GIS, Remote Sensing, and Telemetry Working Group of the Wildlife Society and will take place during the 4th Microcomputer applications in Fish and Wildlife Conference. This symposium will bring together presentations dealing with the use of GIS, GPS, Remote sensing and telemetry technology in the study, management, and politics of wildlife, or in wildlife education. Contact: *Scott Klopfer, Fish and Wildlife Information Exchange, 203 West Roanoke St., Blacksburg, VA 24061; Phone: 540-231-7348; <sklopfer@vt.edu>; <<http://fwie.fw.vt.edu/ofwim/meet99.htm>>*.

**MC-ECOM - The Millennium Conference on Environmental Education and Communication.** On-line conference, December 9-10, 1999. Organized by the European Environmental Education Newsletter in liaison with UNEP, UNESCO, GreenCOM, and the North American Association for Environmental Education. This internet-based conference makes void the barrier of time and geography, since it is taking place in the world wide web. An intensive two-day dialogue is planned for the 9th and 10th December 1999. Participation is free for people and institutions from developing countries, as well as for those working at NGOs. A conference book containing key papers presented at the meeting will be published in the early 2000 to provide a long-term record of the scheme. Contact: *<een@realworld.de>; <<http://crossroad.de/millennium>>*.

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**WEBSITES OF INTEREST**


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**The On-line National Library for the Environment** has many available resources, including bibliographies, databases, daily e-mail delivered news services, environmental dictionaries/glossaries, contacts for federal agencies and international organizations, maps, newsletters, environmental conference listings, and numerous other resources; <<<http://www.cnie.org>>>.

**AGRICOLA and AGRIS are now available online.** Two major international databases of entomological and agricultural literature are now available for free on the web. AGRICOLA and the catalog of the USDA National Agricultural Library are located at: <<<http://www.nal.usda.gov/ag98/ag98.html>>>. AGRIS includes the FAO agricultural-journal article database; <<<http://bwg.fao.org/agrisnew/>>>.

**The Sylva** web site is a computer-assisted learning and teaching tool in forest biology, including several resources, e.g. a virtual forest, courses in plant biology, and links to forestry and environmental sciences. This resource is mainly in the French language; << <http://sylva.sbf.ulaval.ca>>>.

**Flora of North America** is a comprehensive website featuring a set of taxonomic treatments for all North American plant species and infraspecific taxa. In addition to the taxonomic treatments, the volumes contain distribution maps, keys, illustrations, graphics, botanical databases, and botanical libraries; <<<http://www.fna.org/>>>.

**BOREAS, the Boreal Ecosystem-Atmosphere Study**, is a large-scale international experiment in the boreal forests of Canada designed to understand how boreal forests "interact with the atmosphere, how much CO<sub>2</sub> they can store, and how climate change will affect them; <<[http://boreas.gsfc.nasa.gov/BOREAS/BOREAS\\_Home.html](http://boreas.gsfc.nasa.gov/BOREAS/BOREAS_Home.html)>>.

**Dendrome: Forest Tree Genome Database**, is a project of the Institute of Forest Genetics (USDA Forest Service) that acts as an electronic resource for the study of forest tree genomes. This site includes information on several genome resources (with genetic maps), links to research institutes, upcoming scientific meetings and courses, and job opportunities; <<<http://dendrome.ucdavis.edu/ifg/index.html>>>.

**The Audubon Watch List**, is a site identifying North American bird species whose populations are in decline, have limited geographic range, and/or are experiencing threats such as habitat loss on their breeding and wintering grounds; <<<http://www.audubon.org/bird/watch/>>>.

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**PUBLICATIONS OF INTEREST**


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**Parks in Peril.** 1998. Edited by Katrinal Brandon, Kent H. Redford, and Steven S. Sanderson. This book looks in the pros and cons of protecting national resources within national parks of Latin America. The region's challenge of aligning economic growth with social equity, sustainably managing biologically diverse areas, and controlling urban growth and environmental problems are among the topics addressed. ISBN: 1-55963-608-4. Orders: *Island Press, Box 7, Dept 2NET, Covelo, CA 95428, USA; Phone: 707-983-6414; <<[www.islandpress.org](http://www.islandpress.org)>>*.

**Urban Forest Landscapes: Integrating Multidisciplinary Perspectives.** 1995. Edited by Gordon A. Bradley. The goal of urban forestry is to understand the ecological, institutional, and human issues at work in the urban landscape. These collective essays cover several topics, including: the development of urban forestry in the United States and the use of trees in urban environments in the European and North American cultural tradition; management of greenbelts and forest remnants; wildlife habitat design; energy-efficient landscapes; water conservation; and fire-safe landscapes. Orders: *University of Washington Press; Phone: 206-543-8870; <uwpond@u.washington.edu>*.

**Tropical Forest Remnants; Ecology, Management, and conservation of Fragmented Communities.** Edited by William F. Laurance and Richard O. Bierregaard, Jr. This book presents a compilation of essays from over 70 contributors addressing the various biological and cultural consequences of forest fragmentation. ISBN: 0-226-46898-2. Orders: *University of Chicago Press, 11030 South Langley Ave., Chicago, IL 60628; Phone: 773-702-0279.*

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**CONTRIBUTE TO "WHAT'S UP?"**


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*What's Up?; Newsletter of the ICAN*, is distributed to members all over the world and is a resource for networking information. ICAN accepts articles, meeting and workshop announcements, related web site addresses, and citations for our spring newsletter. Contributions are due by August 15, 1999, and can be sent via e-mail attachment or snail mail. Articles up to 1500 words are accepted (WORD format preferred) and black and white graphics are welcomed (.jpg format preferred). Please contact the ICAN office for details.

*Amber Neilson, Outreach Coordinator; Phone: 360-866-6788; <canopy@elwha.evergreen.edu>*.

## RECENT CITATIONS IN CANOPY SCIENCE

[Ed. note: Since there is no central journal on canopy science, it is useful to publish citations on canopy studies in the recent literature. Some of the papers listed below were obtained from ICAN subscribers sending in reprints; most were discovered through monthly literature searches (AGRICOLA, CAB, and FORESTRY ABSTRACTS).

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