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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*

The ACEER- A Model for Community Based Research, Education, and Development

The Amazon Center for Environmental Education and Research (ACEER) Foundation is dedicated to rainforest conservation by providing environmental education and research opportunities to both North and South Americans. The Foundation is a a non-profit organization with a U.S. office in Helena, AL and Peruvian Office in Iquitos, Peru. The ACEER facilities are located on 250,000 acres of primary tropical rain forest, three hours northeast by boat from Iquitos, Peru. The site includes a canopy walkway, laboratory, ethnobotanical trail, and facilities for scientific researchers and students studying tropical botany, ethnobotany, herpetology, ichthyology, entomology, conservation, and other disciplines. The center promotes research and education, focusing most of their efforts on increasing local community awareness.

Research

The ACEER Foundation supports basic and applied research projects at its facilities in the Peruvian Amazon. The internationally renowned ACEER canopy walkway is situated near the field station and provides researchers with the opportunity to study organisms and abiotic processes of the Peruvian rain forest canopy. The walkway is suspended in the treetops over 100 feet above ground and is approximately ¼ mile in length. It is owned and managed in partnership with Conservación de la Naturaleza Amazonica del Peru, A.C., a Peruvian nonprofit conservation organization.

Photo by Bud Hunter. : The ACEER canopy walkway research facility; Reprinted with permission from the ACEER Foundation

Since 1991, nearly 100 researchers of varying disciplines have carried out research at the ACEER canopy walkway. Examples of a few studies that haven taken place on-site are: parental care in a species of *Osteocephalus* frog, apparent gliding behavior by the canopy-dwelling ant *Cephalotes*, population dynamics and diversity of epiphytes, and canopy bryophytes. This undisturbed forest canopy houses one of the most biodiverse rain forest canopies in South America and attracts researchers from all over the world.

The ACEER promotes research development on a local community level by providing technical training and geographical information system (GIS) programs to Peruvian scientists. More than 60 scientists have attended workshops on GIS to study and map ecological habitats and apply satellite imagery to assess global environmental resources. The ACEER created the first GIS, ARC/INFO, and IDRISI (GIS software programs) training manuals in the Spanish language. Participants in the program have included scientists at the National Agrarian University Conservation Data Center, Natural Resources Agency, National University of the Peruvian Amazon, Institute for the Investigation of the Peruvian Amazon, and Pro-Naturaleza.

Community Education

The ACEER has several educational programs that encourage community outreach and environmental awareness. The ACEER offers an annual environmental education teacher training course that includes three workshops covering such subjects as botany, ecology, and horticulture. Teachers are trained to design field projects that are implemented with their students, including organic gardens,

small-scale fisheries, and other sustainable development projects which have a positive impact on local Amazon villages.

The Teachers Training Program is taught by Peruvian and American educators and naturalists who volunteer their time to teach the workshops and provide technical assistance. It has grown exponentially since its inception in 1995, and now has over 50 teachers enrolled with over 200 in the region that remain to be served. The Teachers Training Program also provides an opportunity for cultural exchange between sponsors and the teachers they "adopt" in the program. It is presented in partnership with the National University of the Peruvian Amazon, Loreto District Board of Education, Conservacion de la Naturaleza Amazonica del Peru, A.C., and the Institute for the Investigation of the Peruvian Amazon.

Community Resources and Programs

The ACEER Foundation's School and Community Library Program provides Spanish language books, maps, and other educational materials for rain forest schools and community libraries located in villages along the Amazon and Napo Rivers. Textbooks, research documents, and conservation resources are provided through the Fundación ACEER resource library, and the ACEER field station.

Another of ACEER's educational accomplishments is the Adopt-a-School Program. This program provides annual educational and school supplies to Peruvian children living in the villages along the banks of the Peruvian Amazon east of Iquitos. This program supports rural schools that rarely have books for teachers and students. The program also provides an opportunity for cultural exchange between sponsors and the over 50 Peruvian school groups participating in the annual program. It is presented in partnership with Conservación de la Naturaleza Amazonica del Peru.

In collaboration with its educational and corporate partners, the ACEER Foundation is also developing a land conservation program that will protect unique tracts of primary rainforest in the Peruvian Amazon. In addition, the ACEER Foundation supports the work of Conservación de la Naturaleza Amazonica del Peru, A.C in their efforts to protect the Amazon Reserve, a tract of 250,000 acres of pristine primary rainforest surrounding the ACEER field station and Napo Camp.

Contact: *Amazon Center for Environmental Education and Research (ACEER) Foundation, Ten Environs Park, Helena, AL 35080, USA; Phone: 205-428-1700; <<www.erri.psu.edu/web/aceer.htm>>.*

Diversity and Seasonality of Arthropoda in Sapotaceae and Lecythidaceae Tree Canopies at the Adolpho Ducke Forest Reserve, Manaus, Amazonas, Brazil

Using the canopy fogging collecting method, the diversity, abundance (density), dominance, and non-seasonal and seasonal variation of the arthropod fauna associated with canopy trees of nine species and five genera of the families Sapotaceae and Lecythidaceae were assessed. The work was carried out from July 1995 to June 1996 in the Adolpho Ducke Forest Reserve, Manaus, Amazonas, Brazil. The Sapotaceae species fogged were *Ecclinusa guianensis, Micropholis guyanensis,* and *Pouteria glomerata*. The Lecythidaceae species fogged were *Corythophora alta, Eschweilera atropetiolata, E. pseudodecolorans, E. rodriguesiana, E. romeu-cardosoi,* and *E. wachenheimii*. The tree canopy fogging was carried out early in the morning. A total of 40 trees were fogged once in the dry season, and again in the rainy season. Twenty 1 m2 trays were put beneath each canopy tree to collect the arthropods. Here we report only the results of 10 1 m2 trays for each tree (about 800 samples).

The annual average abundance (density) was 325.3 ind/m^2: 300.1 ind/m^2 in the dry season, and 357.5 ind/m^2 in the rainy season. Average abundance was recorded during the wet and dry season, and overall all abundance was also calculated (Table 1). Insecta was the most abundant class of Arthropoda collected, regardless of the evaluation method, season, species, genus, and family of tree.

The Arthropoda collected were classified into 36 taxa. Formicidae (51.7%) was the dominant group in the dry season (56.9%) and in the rainy season (47.3%). When Formicidae was excluded, other groups such as Diptera, Psocoptera, Collembola, and Hymenoptera dominated. The relative percentages of Formicidae, Thysanoptera, Hymenoptera, Diptera larvae, and Homoptera were higher in the dry season; those of Diptera, Psocoptera, Collembola, Acarina, and Araneida were higher in the rainy season. The abundance of arthropods collected in *E. wachenheimii* and *E. rodriguesiana* in the dry season were significantly higher than those collected in *E. atropetiolata*. Some species and genera of trees showed relative differences in arthropod composition and dominance between the two seasons. In general, the faunistic similarity (presence-absence) was high: families (94.4%), genera (77.1% to 91.2%) and species (71.0% to 93.8%).

Table 1. Seasonal and overall insect abundance (ind/m2) by tree species in the Adolpho Ducke Forest Reserve, Manaus, Amazonas, Brazil between July 1995 to June 1996.

tree species	dry season	wet season	overall avg.
Ec. guianensis	450.7	402.6	426.6
M. guyanensis	306.5	310.7	308.6
C. alta	249.9	298.5	274.2
P. *glomerata*	250.1	374.2	312.2
E. rodriguesiana	331.5	877.4	604.4
E. wachenheimii	389.9	387.5	388.7
E. atropetiolata	142.7	175.4	159.1
E. pseudodecolorans	308.8	260.1	284.4
E. romeucardosoi	244.2	431.2	337.7

Jose Camilo Hurtado Guerrero amd Claudio Ruy Vasconcelos da Foseca, Administração de Pós-graduação INPA/UA, Alameda Cosme Ferreira 1756, C.P. 478 - CEP 69011-970 Manaus, Amazonas, Brasil, S.A; <camilo@inpa.gov.br>.

The Use of Geographical Positioning Systems (GPS) Under Forest Canopies

[Editors Note: *In July, Douglas W. Yu circulated a query over the ICAN and ESA email list-servs regarding the use of GPS under forest canopies. Below is a summary of the responses.]*

All GPS signals, being high frequency, are attenuated by interference from tree canopies (mainly due to leaves) and are corrupted by multiple reception of the same signal as it bounces off tree trunks (termed multi-pathing). To get good signals, the general rules are to:

1) use a receiver that can track 12 satellites simultaneously, as opposed to sequentially. This maximizes the prob ability of getting a simultaneous reading of the 3 or 4 satellites necessary for an accurate reading;
2) work during the times when the satellites are in optimal positions overhead;
3) use an external antenna, preferably on a pole placed as high as possible.

In addition, one can:

1) use a US government GPS through the USGS or Forest Service, which have access to better quality signals (avoid Selective Availability, the US military's delib erate introduction of errors into GPS signals);
2) use a GPS receiver that gets both US and Russian sign als, which increases the number of satellites available;
3) use a Trimble professional-grade receiver;
4) use Differential GPS, which corrects in-the-field errors with readings taken from a separate, fixed-location base station (which can be a second hand-held unit);
5) use a backpack unit (e.g., Ashtech reliance sub-meter unit) with an antenna that can be lifted high in the canopy.
6) take a reading from an area where the signal can be received and then map other points using compass, clinometer, and measuring tapes.

Some of the models suggested are Garmin III, Garmin 12, Garmin 12XL, Eagle Explorer, and Magellan 315. David Inouye suggested Ball Variometers (Boulder, Colorado) as one inexpensive supplier of Garmins (as inexpensive as US$199.00 for a Garmin 12XL's). Information is available on the web (e.g., http://www.bridge.de/~tom/garmin.htm), which also links to a GPS newsgroup.

Some models must have their 'firmware' and hardware upgraded, sometimes several times in a single year. Upgrades can significantly improve performance over earlier versions of the same model. The latest versions are immune to Y2K and other date problems, as are most GPS's manufactured in the previous five years. If you own a GPS, you should check on software upgrades as an inexpensive way to increase performance of your equipment.

In the end, based on the recommendations of several GPS users, I have settled on a Garmin 12XL (199 British pounds) plus a Lowe external antenna (36 pounds, available from www.lowe.co.uk). This model fits my requirements of low price, extreme portability, rainproofness, maximum error of 100 m, low power consumption, storage of waypoints, and the fact that I am already used to climbing trees to get a fix.

Douglas W. Yu, NERC Centre for Population Biology, Imperial College at Silwood Park, Ascot, Berks SL5 7PY, UK, Phone: 1344-294-544; <d.yu@ic.ac.uk>

Adobe Systems Inc. grants ICAN updated software for "What's Up?"

The International Canopy Network thanks Adobe Systems Incorporated and Gifts-in-Kind International for their donation of computer software (Pagemaker 6.5 and Photoshop 5.0 LE). Gifts-in-Kind International is "dedicated to providing quality products and services nonprofits need to continue improving lives and communities around the world". This philanthropic organization works with Adobe, Attest, Autodesk, Lotus, and Microsoft on dispersing computer resources to non-profit organizations. For more information, visit: <<www.giftsinkind.org/>>.

Investigating Arthropods Associated with Tropical Cloud Forest Epiphytes

Dr. Nalini Nadkarni (The Evergreen State College, Olympia, Washington) has been investigating the ecology of epiphytes at the Monteverde Cloud Forest Preserve (MCFP), Costa Rica for nearly 20 years. Whereas her past work focused mainly on plant ecology and forest processes, recent additional funding from the National Science Foundation (DEB-9974035) will support more intensive research on arthropods associated with epiphytes. In November 1999, Nadkarni, Rodrigo Solano, and I will begin a two-year investigation of arthropod diversity in arboreal moss mats and in detritus accumulations associated with vascular epiphytes at the MCFP. Few workers have examined this system in detail, although Roger Kitching and associates have studies underway in Australian forests.

The heart of our arthropod project is a comparison of moss mat communities between primary and secondary forests in the MCFP. Solano and I will collect five 500 ml moss mat samples from each of seven trees in the two forest types, and we will extract arthropods from the moss using Berlese funnels. Collections will be made every other month, with alternate months used to gather data for four related research questions: 1) Within primary forest, do moss mats on different tree species support different arthropod communities?; 2) How do arthropod communities of canopy detritus mats quantitatively differ from arthropods in ground litter?; 3) Are moss mat arthropod communities of isolated trees (e.g., relict trees in pastures) similar to those trees in intact forest?; and 4) Does the greater diversity of arboreal microhabitats in primary forest promote greater arthropod diversity relative to younger forests, where moss is typically the dominant microhabitat?

Because many years of collecting and sample processing would be required to thoroughly address all of these questions for all abundant arthropod groups, we will initially restrict our quantification and identification efforts to ant and beetle assemblages. However, all arthropods collected in the project will be catalogued and retained for future study by our research group or other workers, as time and funds permit.

In addition to destructive epiphyte sampling and Berlese extraction, ants will be observed and collected from sugar- and protein-based baits placed on moss mats in selected trees. We anticipate that these bait studies will provide data related to foraging behavior, competitive interactions, and nutritional needs of the resident ant species. Bait studies, and observations of general arthropod activity will also be occasionally conducted at night under cool amber or red lighting to provide a more complete picture of the system.

Our main goal in presenting this summary is to solicit constructive criticism and advice from ICAN members. We welcome your opinions, suggestions, and links to references that are pertinent to our work. The project is in an early stage of data collection and we hope that we may avoid serious complications and oversights that will hinder our progress toward understanding the biology of epiphyte-associated arthropods in tropical cloud forests.

Contact: *Steve Yanoviak, The Evergreen State College, Lab 1, Olympia, WA, 98505, USA; (360) 866-6788; <yanoviak@hotmail.com>.*

Special invitation to publish in *Selbyana*

Selbyana is pleased to announce a special offer to members of ICAN. During the year 2000, members of ICAN can publish five free pages in *Selbyana*. *Selbyana,* which is issued twice a year, is a scientific journal devoted to publishing original research on tropical plants, especially epiphytes and their forest canopy habitats.

To qualify for the five free pages, all manuscripts must undergo standard review procedures and be accepted for publication by the Editor. Normal page charges of $75/page will apply for articles of more than five final, printed pages. ICAN members who take advantage of this offer will not receive a subscription to *Selbyana* unless they pay the individual subscription rate ($40 developing countries; $50 developed countries). Subscriptions to *Selbyana* can be made through the Allen Press web site <http://www.allenpress.com/cgi-bin/test-cat.cgi?journal=selbyana>. Manuscripts that do not fit into year 2000 issues due to space constraints will be given priority in the first issue of 2001.

For more information, contact: *Bruce Holst, Editor-Selbyana, The Marie Selby Botanical Gardens, 811 South Palm Av., Sarasota, FL 34236-7726 USA; Phone: 941-955-7553 x 12; < bholst@virtu.sar.usf.edu>; <<www.selby.org>>.*

Documentary on Tropical Forest Canopy ResearchWins International Awards

"Heroes of the High Frontier" has been awarded the Prix Special (Special Prize of the Jury) at the International Festival of Adventure Films, *les Ecrans de l'Aventure*, which took place in Dijon, France, October 14-17, 1999. The festival celebrated films that capture the spirit of adventure and exploration.This full-length National Geographic documentary on forest canopy researchers was produced by Tim Scoones of Oxford Scientific Films.

"Heroes of the High Frontier" is also:

* Joint winner, Caccialanza Prize for best scientific content, Valle D'Aosta International Nature Film Festival, Colne, Italy, 1999
* Short-listed for the Best Conservation/Environment film, Jackson Hole Wildlife Film Festival, 1999

Kitty Cox, Development & Production Co-ordinator, Natural History Team, Oxford Scientific Films, Lower Road, Long Hanborough, OXON OX8 8LL, UK; Phone: +44 1993 881 881; <kcox@osf.uk.com>.

Board Of Directors Bio-sketch

Denise Joines was born in North Carolina, USA. Her special interests include studying natural history and sea kayaking. Denise is currently the Executive Director for ONE/Northwest, a non-profit organization that promotes online networking for the environment. ONE/Northwest works with conservation organizations in the Pacific Northwest (Alaska, Washington, Oregon, Idaho, Montana, and British Columbia), advancing the use of electronic communications technologies in their work protecting the environment.

Denise has been involved in forest protection for over 15 years, working on local, national, and international campaigns. The beauty and complexity of the forest canopy is extremely compelling to her, both as a scientific exploration and as a mechanism to advance forest protection. Denise believes in ICAN's mission of combining science, education, and conservation to advance academic and the public's knowledge and awareness of forest canopy ecosystems.

The ICAN's Advisory Board

At a recent meeting of the Board of Directors, ICAN's progress over the last five years and new projects involving research, outreach and education programs, and conservation work were discussed. One of the most important actions at that meeting was to approve the creation of an Advisory Board. The Advisory Board consists of individuals from a diverse array of backgrounds who share with the ICAN Board and members a commitment to its mission of building bridges and establishing networks among canopy researchers and educators in the interests of forest conservation. This corps of advisors will provide the ICAN with the means to tap into niche-specific knowledge, experience, and expertise that the Board alone cannot provide. The next several issues of the ICAN newsletter will feature biosketches of the founding Advisory Board Members.

Featuring Fumito Koike

Fumito Koike was born in 1959 in Nagano Prefecture of Japan where beautiful forests surround villages and small towns. When Fumito was an undergraduate student of Chiba University, he studied forest community mechanisms. Since forest canopy processes are very important in forest community mechanisms, Fumito developed a method to determine spatial distribution of current foliage density from photographs. He also studied dynamic aspects of foliage as population dynamics of shoot and leaves. Fumito is an Associate Professor at the Institute of Environmental Science and Technology, Yokohama National University, and is studying community mechanisms.

Contribute to "What's Up?"

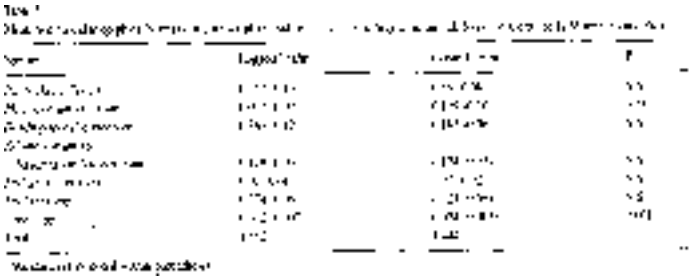
What's Up?; Newsletter of the ICAN, is distributed to members all over the world and is a resource for networking information. ICAN accepts articles, meeting and workshop announcements, related web site addresses, and citations for our spring newsletter. Contributions are due by August 15, 1999, and 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.

FEATURE ARTICLE: RECENT PUBLICATIONS IN CANOPY RESEARCH

Editor's note: The following research summaries are various articles on forest canopy research from scientific journals, reprinted with the permission of the respective publishers. For more information, see journal citation.

EFFECTS OF REDUCED-IMPACT LOGGING ON COMMERCIAL NON-VASCULAR EPIPHYTES IN A TROPICAL MONTANE FOREST IN COSTA RICA

Compatibility of different commercial uses of a montane tropical oak-bamboo forest in Costa Rica was assessed for selective logging and harvesting of non-vascular pendant epiphytes, a locally valuable non-timber forest product (NTFP). The non-vascular pendant epiphyte taxa examined were mosses (*Pilotrichella flexilis, Phyllogonium viscosum, Zelometerorium* sp., *Squamidium leucotrichum);* liverworts *(Frullania convoluta* and *Frullania* spp.*)*; and lichens *(Usnea* spp.*).* All of these species have pendant life-forms. They apparently play key roles in water interception, thereby influencing the hydrological balance in tropical montane ecosystmes. Since the growth of pendant non-vascular epiphytes depends on fog and mist, these species could be used as indicators of health of the tropical montane forests where they abound.



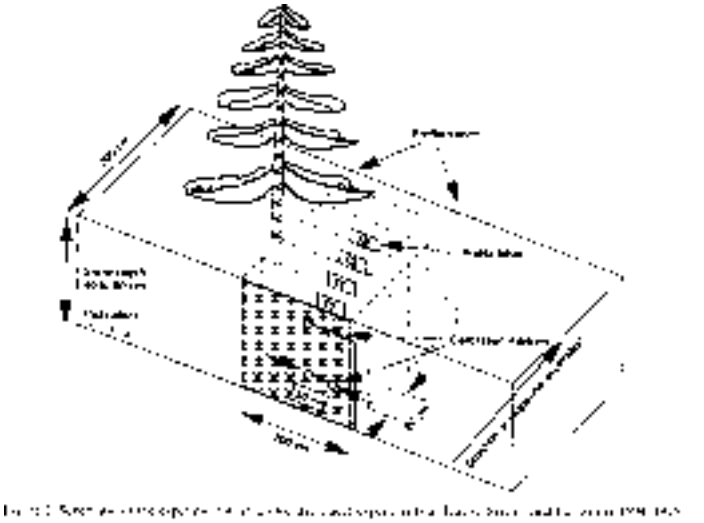
Nine years after careful selective logging, no negative impacts were detected on the biomass of these NTFPs at the heights at which they are commercially harvested (1-3 m) (Table 1). This result was established through comparisons of logged and non-logged plots on the basis of abundance (biomass) of the commercial bryophytes and related variables such as substrate length availability and substrate type (shade tolerant, pioneer species, or bamboo, and substrate diameter). Pendant epiphytes were most abundant on thin substrates (branches <1 cm in diameter); the highest biomass values per unit substrate length were found on branches of shade-tolerant species.

C. Romero. 1999. Forest Ecology and Management 118: 117-125

ROUTING OF CANOPY DRIP IN THE SNOWPACK BELOW A SPRUCE CROWN

Snow that is retained by a forest canopy may either sublimate or evaporate directly from the crown or drop as snow clumps or meltwater to the ground. Redistributed snow and meltwater affect the snow structure and prevent the formation of mechanically weak layers, which is the prerequisite for avalanche formation in forests.

In this paper we describe the results of dye tracer experiments conducted in a subalpine forest near Davos, Switzerland. Before a snowfall event, we stained snow-free branches of a spruce with a dye tracer solution. After snowfall, the



colored meltwater dripping from the branches down on to the snowpack stained the percolation pathways of the meltwater in the snowpack. Photographs of the snow profiles indicate

that the meltwater seeped almost vertically through the isothermal snowpack to the soil surface, not exceeding the projected crown edge. Meltwater of different events moves along different preferential flow channels in the snow suggesting that old channels are not non-conducting and additional meltwater fronts create new channels.

M. Bründl, M. Schneebeli, & H. Fluhler. 1999. Hydrological Processes 13:49-58. Copyright John Wiley & Sons Limited. Reproduced with Permission.

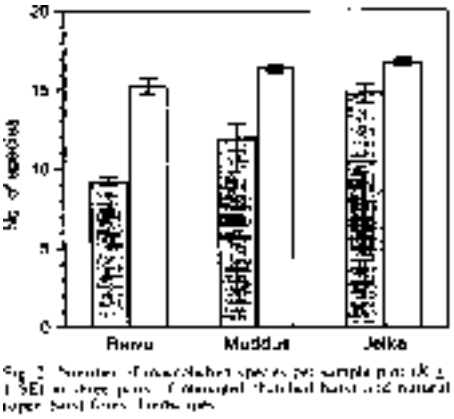
Energy balance above a boreal coniferous forest: a difference in turbulent fluxes between snow-covered and snow-free canopies

To evaluate the interactive effects of snow and forest on turbulent fluxes between the forest surface and the atmosphere, the surface energy balance above a forest was measured by the eddy correlation method during the winter of 1995-1996. The forest was a young coniferous plantation comprised of spruce and fir. The study site, Sapporo, northern Japan, had heavy and frequent snowfalls and the canopy was frequently covered with snow during the study period. A comparison of the observed energy balance above the forest for periods with and without a snow-covered canopy and an analysis using a single-source model gave the following results: during daytime when the canopy was covered with snow, the upward latent heat flux was large, about 80% of the net radiation, and the sensible heat flux was positive but small. During daytime when the canopy was dry and free from snow, the sensible heat flux was dominant and the latent heat flux was minor, about 10% of the net radiation. To explain this difference of energy partition between snow-covered and snow-free conditions, differences in temperature and differences in the bulk transfer coefficients for latent heat flux were necessary in the model. Therefore, the high evaporation rate from the snow-covered canopy can be attributed largely to the high moisture availability of the canopy surface. Evaporation from the forest during a 60-day period in midwinter was estimated on a daily basis as net radiation minus sensible heat flux. The overall average evaporation during the 60-day period was 0.6 mm day^{-1}, which is larger than that from open snow fields.

Y. Nakai, T. Sakamoto, T. Terajima, K. Kitamura, & T. Shirai. 1999. Hydrological Processes 13:515-529. Copyright John Wiley & Sons Limited. Reproduced with permission.

Epiphytic macrolichens in managed and natural forest landscapes: a comparison at two spatial scales

To maintain biodiversity in managed forests, we must understand how forestry affects various organisms across a wide range of spatial and temporal scales. We compared landscape structure, forest structure, and species richness and abundance of epiphytic macrolichens in three pairs of natural and managed boreal forest landscapes. Study landscapes (2500 ha) were located within and adjacent to three of the largest forest reserves in Sweden (Reivo, Muddus, Jelka). The structural heterogeneity within landscapes was higher in managed forests, whereas within-stand structural heterogeneity was higher in natural landsccapes. Species richness of macrolichens at the stand level (sample plot) was 23% higher in natural forests, but there was no difference at the landscape level. Most (86%) of the common species were more frequent in natural landscapes. Lichen abundance (estimated by lichen litter) was two times higher in natural than in managed landscapes, 5.6 and 2.7 kg ha^{-1} forest (pooled data), respectively. Both species richness and abundance were negatively related to cutting level (number and basal area). Lichen-rich forest stands were more numerous but covered a smaller area and were more isolated than in managed landscapes. This may have important consequences for dispersal of lichen propagules to second-growth forests. In conclusion, the results suggest that effects of forestry on epiphyte diversity and abundance are strongly related to the spatial scale (stand or landscape). To enhance biodiversity in managed forests, we must increase structural heterogeneity at the whole range of spatial and temporal scales.



H. Dettki & P. Esseen. 1998. Ecography 21:613-624.

Funding Opportunities

The Gates Millennium Scholars Program. The United Negro College Fund (UNCF) provides scholarships and fellowships for outstanding low-income African-American, Native American, Hispanic American, and Asian American students to attend the undergraduate and graduate institutions of their choice. Deadline is Feb. 1, 2000. Contact: *Camilla Strausfeld, Ph.D. Director, Research Support Office, University of Arizona, 1203 N. Mountain Tucson, AZ 85719; Phone: 1-877-690-4677 (in US) or 520-621-1469; <<http://www.gmsp.org/index.html>>.*

The Atlantic Center for the Environment (ACE) provides several grants/ fellowships for conservation leaders from Caribbean, Latin American, and Central and Eastern European countries to provide training and professional development. The fellowships focus on landscape conservation and the related topics of biodiversity conservation, rural economic development, and sustainable agriculture and forestry. Contact: *Brent Mitchell, Atlantic Center for the Environment Quebec, Labrador Foundation, 55 South Main Street, Ipswich, MA 01938 USA, Phone: (508) 356-0038, Fax: (508) 356-7322.*

Natural Resources Planning and Management. Asian Institute of Technology (AIT) offers grants for its Graduate Program entitled Natural Resources Planning and Management (NRPM), which covers tuition, and living expenses. The purpose of this program is to help create a league of natural resources planning and management professionals in the Asia-Pacific region. The program emphasizes interdisciplinary learning and multi-disciplinary teamwork. Contact: *Dr. Apisit Eiumnoh, Coordinator, NRPM Field of Study, School of Environment, Resources, and Development, Asian Institute of Technology, Km. 42 Paholyothin Hw, Klong Luang, Pathumthani, Thailand 12120; Phone: (66-2) 516-0110-29; FAX: (66-2) 516-2126.*

Bernard Lowy Fund for the Study of Tropical Botany in Latin America. The Department of Plant Biology of Louisiana State University (LSU) at Baton Rouge, and the family of the late LSU tropical mycologist, Bernard Lowy, established this fund to provide funding for research travel by graduate students and postdoctoral researchers studying diverse aspects of tropical botany in Latin America. Contact: *Lowy Fund Committee, Department of Plant Biology, Louisiana State University, Baton Rouge, LA 70803-1705, USA, FAX: (504) 388-8459.*

Websites of Interest

Virtual Library of Forestry. This webpage offers information on publications (including several searchable libraries) and organizations. *<<www.metla.fi/info/vlib/Forestry/>>.*

Taxonomy of Flowering Plants. This website was developed by Dr. Hugh Wilson, botanist at Texas A&M University, to provide a resource for those interested in the taxonomy of flowering plants. Hyperlinked lecture and lab notes as well as on-line data are included. *<<http://www.csdl.tamu.edu/FLORA/tfp/tfphome1.html>>.*

Biology Grants Website. This website, sponsored by the University of Buffalo at New York, is a comprehensive index of grant opportunities for biological research. *<<ublib.buffalo.edu/libraries/units/sel/bio/grants.html>>.*

Climate Change and its Impacts on Flora and Fauna Species. The Pacific Institute created this website to provide a searchable and frequently updated bibliography of literature on climate change and its impacts. *<<http://www.pacinst.org/wildlife.html>>.*

Department of Entomology National Museum of Natural History. This is an excellent resource for entomology searches, as it contains several databases, including world wide databases and a database of the collections at the museum. *<<http://160.111.87.10:591/entomology/data.html>>.*

Long Term Ecological Research (LTER) Network. This website, sponsored by the National Science foundation, presents over 20 US ecological research centers dedicated to understanding ecological processes over long periods of time and distances. It promotes collaboration and international research and offers research summaries and direct links to many of the LTER research centers. *<<http://lternet.edu/index.html>>.*

Tree Characteristics of Common Trees of the Eastern United States. This new website has been launched to detail tree characteristics for 80 common trees of Eastern United States with data on over 100,000 USDA Forest Service plots. It also provides current and potential future ranges for each species according to several possible climate change scenarios. *<<http://www.fs.fed.us/ne/delaware/atlas>>.*

Publications of Interest

Forest Ecosystems: Analysis at Multiple Scales. R.H. Waring, S.W. Running (eds.) 1998. ISBN: 0127354433. This book describes methods for integrating analysis of forests at the individual stand, landscape, regional, continental, and global scale. It provides a framework for quantitatively judging the implications of a wide variety of forest management decisions. Contact: *Academic Press, Inc., Order Fulfillment Department,6277 Sea Harbor Drive,Orlando, Florida 32887, U.S.A.; <apbcs@harcourtbrace.com>; <<www.academicpress.com>>.*

An Atlas of Current and Potential Future Distributions of Common Trees of the Eastern United States. General Technical Report NE-265. L.R. Iverson, A.M. Prasad, B.J. Hale, and E.K. Sutherland. 1999. Northeastern Research Station of the USDA Forest Service. This publication provides information on tree characteristics of 80 trees of the Eastern United States and includes current and possible future ranges for each tree according to different climate change scenarios. At present, this publication is available at no charge. Contact: *Dr. Louis Iverson, Research Landscape Ecologist, USDA Forest Service, 359 Main Road, Delaware, OH 43015, U.S.A.; Phone: 740-368-0097; fax: 740-368-0152; <liverson/ne_de@fs.fed.us>; <<www.fs.fed.us/ne/delaware/4153/4153.html>>.*

Announcements

"Ecosistemas" is a popular science magazine published by the Spanish Association for Terrestrial Ecology. This magazine is printed in the Spanish language. To receive a copy of the magazine, send your name and postal address to: *José M. Rey Benayas, Area de Ecología, Facultad de Ciencias, Universidad de Alcala, E-28871 Alcala, Spain; Fax: +34-91-8855090; <gljmrb@GEOLOG.ALCALA.ES>.*

The Gamboa Rainforest Resort provides a unique environment for educational travel and offers institutions an opportunity to study the complex relations of plants and animals living in the rainforest. This facility is located on the Panama Canal, approximately 45 minutes from Panama City. The Resort lies within a section of the town of Gamboa, and is surrounded by contiguous rain forest. The lodging facilities are 24 historical wooden quarters, consisting of 4 apartments per building. Educational exhibits include a frog pond, freshwater fish exhibit, orchid and botanical garden, butterfly nursery, turtle and iguana nesting area, and a reptile exhibit. Contact: *Wren Grigore, Educational Promotions; Toll-free Phone in the U.S.: (877) 800-1690; <gamboaresort@sinfo.net">.*

Meetings of Interest

EcoSummit 2000: Understanding and Solving Environmental Problems in the 21st Century. Halifax, Canada. 18-22, June 2000. This conference is being organized by Elsevier Science and will cover integrated modeling and assessment; complex, adaptive, hierarchical systems; ecosystem services; science and decision- making; ecosystem and human health; and the distribution of wealth and resources. Contact: *Amy Richardson, <a.richardson@elsevier.co.uk>; <<www.elsevier.nl/locate/ecosummit or contact>>.*

Ecology: Achievement and Challenge. Orlando, Florida, USA. April 9-13, 2000. The British Ecological Society and the Ecological Society of America are hosting this conference of British and American ecologists with the theme of recent achievement and challenge for the future of the field of Ecology. *Contact: Ellen Cardwell, Phone: (202) 833-8773 Ext. 219; <ellen@esa.org>; <<http://esa.sdsc.edu/bes-esa.htm>>.*

Integration of Societal and Landscape Heterogeneity: Problems and Solutions. Fort Lauderdale, Florida, USA. April 15 - 19, 2000. The 15th Annual Symposium of the U.S. Chapter of the International Association of Landscape Ecology and 2nd Conference of the Walt Dineen Society will focus on how landscape heterogeneity affects biodiversity as well as how conflicting human demands for housing, roads, natural resources, nature preserves, and the sustainability of ecosystems alter this heterogeneity. Contact: *Doreen DiCarlo, Florida Center for Environmental Studies 3970 RCA Boulevard, Suite 7401 Palm Beach Gardens, FL 33410; Phone: (561) 691-8553; Fax: (561) 691-8540; <ddicarlo@ces.fau.edu>; <<http://www.ces.fau.edu/iale2000>>.*

Advancing and Communicating Ecology. Snowbird, Utah, USA. August 6-10, 2000. The Ecological Society of America will host its 85th Annual Meeting to address ways to advance and communicate ecological information to students, the public, and across disciplines. Preceeding this conference will be a major LTER meeting. Contact: *Dr. Elaine Ingham, Soil Foodweb Inc., 1128 NE 2nd St, Suite 120, Corvallis, OR 97331; Phone: 541-752-5066; fax: 541-752-5142; <info@ soilfoodweb.com> <<http://esa.sdsc.edu/snowbird2000.htm>>.*

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).

CANOPY INVERTEBRATES

Buse, A., J. E. G. Good, S. Dury, and C. M. Perrins. 1998. Effects of elevated temperature and carbon dioxide on the nutritional quality of leaves of oak (Quercus robur L.) as food for the Winter Moth (Operophtera Brumata L.). Functional Ecology **12**:742-749.

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Golden, D. M., and T. O. Crist. 1999. Experimental effects of habitat fragmentation on old-field canopy insects: community, guild and species responses. Oecologia **118**:371-380.

McWilliam, H. A., and R. G. Death. 1998. Arboreal arthropod communities of remnant podocarp-hardwood rainforest in North Island, New Zealand. New Zealand Journal of Zoology **25**:157-169.

Montagu, K. D., and K. C. Woo. 1999. Effect of two insect pests on Acacia auriculiformis tree growth and form in Australia's Northern Territory. Journal of Tropical Forest Science **11**:492-502.

Strand, M., D. A. Herms, M. P. Ayres, M. E. Kubiske, M. G. Kaufman, E. D. Walker, K. S. Pregitzer, and R. W. Merritt. 1999. Effects of atmospheric CO2, light availability and tree species on the quality of leaf detritus as a resource for treehole mosquitoes. Oikos **84**:244-283.

Yanoviak, S. P. 1999. Effects of leaf litter species on macroinvertebrate community properties and mosquito yield in Neotropical tree hole microcosms. Oecologia **120**:147-155.

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Bullock, S. H., and N. E. Martijena. 1998. Growth and reproduction in forest trees of the cactus Opuntia excelsa. Biotropica **30**:553-558.

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Knightbridge, P. I., and J. Ogden. 1998. Establishment patterns and host tree preferences of the emergent hemi-epiphytic tree Metrosideros robusta in northern New Zealand. New Zealand Journal of Botany **36**:203-212.

Trummer, L. M., P. E. Hennon, E. M. Hansen, and P. S. Muir. 1998. Modeling the incidence and severity of hemlock dwarf mistletoe in 110-year-old wind-disturbed forest in Southeast Alaska. Canadian Journal of Forestry Research **28**:1501-1508.

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Merilä, P., M. Lindgren, H. Raitio, and M. Salemaa. 1998. Relationships between crown condition, tree nutrition and soil properties in the coastal Picea abies forests (Western Finland). Scandinavian Journal of Forest Research **13**:413-420.

Miller, P. M. 1999. Coppice shoot and foliar crown growth after disturbance of a tropical deciduous forest in Mexico. Forest Ecology and Management **116**:163-173.

Møller, A. P. 1999. Elm, Ulmus glabra, leaf asymmetry and Dutch elm disease. Oikos **85**:109-116.

Pinkard, E. A., and C. L. Beadle. 1998. Aboveground biomass partitioning and crown architecture of Eucalyptus nitens following green pruning. Canadian Journal of Forest Research **28**:1419-1428.

Planchais, I., and J.-Y. Pontailler. 1999. Validity of leaf areas and angles estimated in a beech forest from analysis of gap frequencies, using hemispherical photographs and a plant canopy analyzer. Annals of Forest Science **56**:1-10.

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