

WHAT'S UP?

The Newsletter of the International Canopy Network

2103 Harrison NW, Suite 2612 Olympia, WA 98502-2607

Nalini M. Nadkarni, Editor

Amber Neilson, Editorial Assistant

WHAT'S UP IN THE LAND DOWN UNDER? AUSTRALIA'S CANOPY CRANE

Tropical rainforests in far north Queensland cover less than 0.2% of Australia's land surface, but they contain two thirds of the country's butterfly species, half of the bird species and a third of the mammal species. Australia's lowland tropical rainforests contain incredible species diversity, much of which resides in the forest canopy. A research canopy crane is being erected in the Daintree lowland tropical rainforest near Cape Tribulation to enable researchers to conduct research on, and facilitate a more detailed understanding of, the flora and fauna of lowland rainforest canopies.

Australia's tropical rainforests are threatened due to resource extraction, human encroachment and natural disasters. Placing a research crane in this type of forest will provide the opportunity to gather critical information on this threatened ecosystem. This canopy crane will be made accessible to researchers around the world who are interested in studying the biodiversity of flora and fauna, canopy microclimate, forest processes, epiphytes, plant physiology, vertebrates, and invertebrates. It is critical that information about the lowland tropical rainforest be studied to promote healthy forest management and encourage the recovery of forests which have been previously affected by logging, feral pigs, and cyclones.

The Liebherr Tower-Crane is of the same type as those in forest canopies of Panama, Venezuela, and Washington State, USA. The crane tower is 50 m tall with an arm jib that extends to 55 m. Attached to the jib of the crane is a gondola (personnel basket) capable of holding up to three researchers

and their equipment. This gondola can traverse the length of the jib, and can be lowered and raised the full height of the tower. With a 360 degree pivot, the crane will cover an area of over one hectare, from the forest floor to above the forest canopy.

Deliberation and planning has taken two years because of the extensive consideration of potential impacts of this research facility. The Queensland Departments of Environment, Local Government and Planning, the Wet Tropics Management Authority, as well as the local Aboriginal community and other local community groups were consulted regarding the potential impacts of this project on the environment and community. In October 1998, the crane will be placed by helicopter into a pre-existing light gap. Although a few seedlings will be relocated, very little vegetation will be disturbed during construction. An access trail will be constructed to protect vegetation. Comprehensive management plans are being developed to monitor the ecological status of the site and, where there are impacts, put into place appropriate countermeasures.



Fan Palm (*Licuala ramsayi*) forest soon to be converted into a residential development block. Photo from Cape Tribulation Research Station, AUSTROP Foundation, <www.austrop.org.au>.

The Australian Canopy Crane Pty Ltd, which owns this facility, has been established by a consortium of universities composed of James Cook University, Griffith University, and the University of Queensland. The facility is available for hire to local and international researchers year-round. A laboratory will be built in close proximity to the crane where researchers can sort samples and undertake basic analyses and/or preservation of specimens. This facility will build on the international network of canopy cranes supported by the United Nations Environment Program.

For information, contact: Ms. Fiona Barron, Project Officer, Cooperative Research Centre for Tropical Rainforest Ecology and Management, PO Box 6811, Cairns QLD 4870, Australia; Phone: + 61 7 4042 1252; <fiona.barron1@jcu.edu.au> or <crctrem@jcu.edu.au>; <<www.cns.jcu.edu.au/crctrem/crane.html>>.

MORE CRANES ARE FLYING: THE SURUMONI PROJECT

The Surumoni Project is an interdisciplinary program with emphasis on long-term research on biotic and abiotic aspects of the rain forest canopy. In November 1995, a crane was installed in the neotropical rain forest of the Amazonian lowland in Southern Venezuela on a tributary of the upper Orinoco River. This joint Venezuelan-Austrian project has been regulated by an agreement in which the partners are equally entitled. The crane and the infrastructure have been financed by the Australian Academy of Sciences. The crane is the property of Venezuela and is maintained by the Australian Academy of Sciences.

The project's policy favors long-term research focusing on plant-animal interactions, and measuring and observing processes, rather than extensive sampling. Minimal disturbance to the study plot is a requirement for all investigations. The Surumoni project currently consists of nine research projects, conducted by scientists from seven participating universities and research institutes in Austria, Germany, and Venezuela. The topics covered by the ongoing projects are:

1. *Energy and water budget*: measuring vertical temperature, moisture, and windspeed gradients, and absolute and relative water-budget parameters such as precipitation, throughfall, and stemflow;
2. *Lichens in the canopy*: quantifying aspects of biodiversity and community dynamics;
3. *Ecomorphological significance of rainforest plant structures*: covering the inventory, mapping, and phenology of trees and lianas;
4. *Structure and dynamics of epiphyte communities*: describing structure and species diversity of epiphytes and analyzing factors which influence the structure of epiphyte communities;
5. *Communication and behavioral ecology in frogs and reptiles*: addressing questions of habitat use and acoustic communication of canopy species compared with ground-dwelling species;
6. *Ecology of birds*: investigating bird-plant interactions and behavioral ecology of acoustical communication;
7. *Sensory ecology of Orthoptera*: examining systematics and niche partitioning, and a comparative study on the acoustic environments in canopy and grassland;
8. *Interactions of epiphytes and ants*: examining the nature of nutrition, morphological, and anatomical structures and the impact of such associations (e.g., ant gardens) on host trees;
9. *Diversity of epiphytic communities*: focusing on species composition, distribution, and functional importance of these communities.

Complementary and collaborative proposals for crane use are encouraged. Submissions should include a detailed description of the scientific project and information on sources and amounts of funding to pay operational costs. Address the following in your proposal (separate from your proposal to funding agencies): title of project; abstract; principal investigator name; institution; address; phone and fax number; email address; nature of the proposed project including short statements of objectives; methods and time schedule; planned use for the crane.

For information, contact: Prof. Dr. Hans Winkler, Project Leader, Konrad Lorenz-Institute for Comparative Behavioural Research, Savoyenstrasse 1a, A-1160 Vienna, Austria; Phone: +43 1 486 212122; Fax: +43 1 486 212128; <surumoni@klivv.oeaw.ac.at>; <<www.oeaw.ac.at/~klivv/surumoni/welcome.html>>.

BIOSFERA — THE BRAZILIAN SOCIETY FOR THE ENVIRONMENT

BIOSFERA is an environmental NGO that has a wide range of international cooperation and exchange programs in Brazil and with other Latin American countries.

BIOSFERA activities include:

- 1) organizing workshops and training courses related to the environment;
- 2) organizing international congresses, seminars, fairs, and exhibitions concerning the environment, forests, ecotourism, environmental technology and sanitation.
- 3) providing environmental technical assistance to government organizations and Brazilian private companies.

BIOSFERA traditionally organizes the following international congresses:

- a) on biennial even years, a forestry event with emphasis on sustainable development of the Amazon Rain Forest;
- b) on biennial uneven years, an ecotourism event uniting Latin American and developed countries;
- c) periodically, an international event on environmental technology with participation from government organizations and private companies.

For information, contact: *BIOSFERA* at <<www.biosfera.com.br>>.

ECOLEAP: ASSESSMENT OF FOREST ECOSYSTEM PRODUCTIVITY BY THE CANADIAN FOREST SERVICE

One of the foundations of classical forestry is the computation of forest productivity at the stand level, an assessment of growth potential that is usually based on a site index (SI) derived from measurements of height and age, taken from dominant trees. The SI integrates the effects of the three main components of forest productivity: vegetation characteristics, climatic environment, and site properties. However useful, SI-based methods cannot discern which part of the overall productivity is due to any of these three components. With an increasing demand for sustainability of forest practices, and with the uncertainty engendered by the possibility of climatic change, we need tools to quantify the intrinsic productivity of a site, and the effects of external factors on productivity.

The first objective of the ECOLEAP project is to improve our understanding of the mechanisms that control forest ecosystem productivity. From this theoretical objective flows a host of practical ones such as the development of methods for monitoring forest productivity at the regional scale, the evaluation of the impact of external events on forest productivity, and the improvement of forest inventory methods in Canada.

The keystone of the ECOLEAP project is the modelling of tree growth processes. This modelling effort is supported by detailed measurements of tree architecture, ecophysiology, and growth (above- and below-ground), and physical environmental variables, in order to quantify the parameters and validate model results. Sites for field work are located in stands of sugar maple, balsam fir, and black spruce in eastern Canada. A canopy tower within each of five sites gives access to the canopy of selected trees. Measurements of photosynthetic rates and of the light environment within the canopies are performed from these towers. Complementary measurements of leaf area, leaf aggregation, and of spatial (vertical and horizontal) and temporal distribution of light transmission comprise the canopy measurements.

An understanding of controls on forest productivity is gained through the studies at the plot, tree, branch, and leaf level. Practical applications will be carried out at the stand, landscape, and regional scales. Our research efforts are directed to the development of tools for the spatial extrapolation of our results, especially the determination of key variables for the characterization of site productivity. We are also developing methods for large-scale measurements through remote sensing.

For information, contact: *Dr. Pierre Y. Bernier, Canadian Forest Service - Laurentian Forestry Centre, 1055 du P.E.P.S., P.O. BOX 3800, Sainte-Foy, Quebec G1V 4C7; Phone: (418) 648-4524; <pbernier@cfl.forestry.ca>.*

REMOTE RAINFOREST TOWER PROJECT

Christopher Lee is a graduate of Montana State University. His thesis involved designing a prefabricated tower to be used in remote rainforest sites that houses its occupants and provides them with basic field laboratory facilities. It was designed to solve a number of the pitfalls associated with this field of work (e.g., access to and from the station, environmental impact). Mr. Lee would like to share this information with anyone who is in a position to use or develop the idea.

For information, contact: *Christopher Lee* <ctlee@sisna.com>.

HEROES OF THE HIGH FRONTIER: NATIONAL GEOGRAPHIC SOCIETY HIGHLIGHTS CANOPY STUDIES

In 1994, the ICAN email bulletin board received a message from Tim Scoones, a producer/director for Oxford Scientific Films, in the United Kingdom. The message was a general query for information and contacts to produce a film on canopy studies in tropical forests around the world. Many of ICAN's members responded with advice and information.

Filming was carried out over the next two years. The film was shot on location in Costa Rica, Malaysia, Brazil, Ecuador, and Panama. Cameras and sound equipment were hauled high above the forest floor by film crews with long experience working in physically arduous locations. Two years in the filming, the program is now edited and is ready for airing at a soon-to-be-determined date and time, probably sometime in fall, 1998, on prime time television (NBC).

The ICAN will be working with the National Geographic Society to provide more in-depth information on the science behind the stories presented in more depth than is possible on television by linking to a special location on the ICAN web site.

We will keep you informed of the airdate via the ICAN email bulletin board.



Tim Scoones, Producer, and Neil Rettig, cameraman, on location in the Costa Rican Cloud Forest Canopy (photo by Nalini Nadkarni).

A CALL FOR PAPERS: *INSECT SCIENCE AND ITS APPLICATION*

You are invited to submit original research articles and short communications in tropical entomology for publication in *Insect Science and Its Application*. Under its new Editor-in-Chief, Dr. Hans R. Herren, the journal is developing editorial and publication to offer even better coverage of tropical entomology worldwide. *Insect Science and Its Application* encourages submission of papers with an integrated pest management (IPM) approach to solving pest problems in the following thematic areas:

- *forest entomology and wood product pests
- *disease vectors
- *host-insect relationships
- *biological control
- *plant resistance
- *arthropod ecology and biodiversity
- *arthropod physiology, morphology, pathology, immunology, and toxicology
- *arthropod taxonomy, population dynamics and genetics

Send your contribution as three hard disk copies and diskette to the editor. Instructions to authors are available from a recent journal issue or from the Editor-in-Chief at the address below.

For information, contact: *The Editor-in-Chief, Insect Science and Its Application, Insect Science and Its Application, PO Box 72913, Nairobi, KENYA <icip@cgnet.com>*.

ICAN'S WEB SITE REVITALIZED

ICAN's presence on the world wide web is being updated and expanded. Formerly administered by the Network Office of the Long-term Ecological Research program, our website will now be maintained and updated at ICAN headquarters at The Evergreen State College in Olympia, Washington.

We request that ICAN subscribers check out the site at its new address and send in comments, suggestions for links, and other information of interest to our subscribers.

Our new address is: <<www.evergreen.edu/ican>>



THE 1998 CANOPY CONFERENCE SET TO GO

Final preparations for the highly anticipated 2nd International Canopy Conference are being made. An international group of canopy researchers, educators, conservationists, and policy-makers will participate in this four-day affair (November 4-8, 1998) at the Marie Selby Botanical Gardens in Sarasota, Florida.

The complete agenda of talks, workshops, and public lectures was published in the Winter 1998 issue of *What's Up?* You can get more information by visiting the Selby Gardens website <<www.selby.org>> or by contacting Meg Lowman.

The conference will hold a Canopy Film Festival. Participants may contribute films to be shown throughout each day of the conference. Anyone who has a professional film of canopy research or an unusual documented event to share with the group is welcome to participate. Send a copy of your film in advance to Meg Lowman plus a title and short summary description of your film. Films will be returned at the end of the Conference.

A grant from the National Science Foundation has been received to facilitate the attendance of graduate students, scientists from developing countries, and to assist with publishing costs of the proceedings. To request funds, send in your Curriculum Vitae, budget, and official funding request. All funded participants must bring a manuscript to the conference suitable for publication in the proceedings.

Manuscripts are to be written in the format of the Gardens' journal *Selbyana*. See a recent issue for instructions, or fax a request for Authors' Instructions.

The International Canopy Network will have a display and member booth at the conference. We would appreciate any ICAN members to volunteer a few hours of their time at the Conference to man the booth. If you are

interested in helping, contact Amber Neilson, ICAN; Phone: (360) 866-6788; <canopy@elwha.evergreen.edu>.

Meg Lowman extends her thanks to all the chairs, volunteers, and scientists who have donated time and energy to put the conference together.

Meg Lowman, The Marie Selby Botanical Gardens, 811 South Palm Avenue, Sarasota, Florida 34236. tel: (941) 955-7553 x 15; FAX: (941) 951-1474 <lowman@virtu.sar.usf.edu>

FUNDING OPPORTUNITIES

Turner Awards for Graduate Research at La Selva. Awards between \$250 to \$1,000 will be made for preliminary investigations undertaken by students with a focus on thesis research. Contact: *OTS North American Office*, <nao@acpub.duke.edu>.

The Center for Field Research: Research Grants. These grants are funded by Earthwatch, an international non-profit organization dedicated to sponsoring field research and promoting public education in the sciences and humanities. Contact: *The Center for Field Research, 680 Mt. Auburn St., Watertown, MA 02272; <cfr@earthwatch.org>; <<www.earthwatch.org/cfr/crf.html>>*.

The John Z. Duling Grant Program. The goal of this grant program is to provide seed money to support research projects that address topics that benefit the everyday work of arborists. Grant awards of \$5000 or less, and will vary depending on the value of the project to the needs of the arboricultural industry. Proposals must be received by November 1 of the grant year. Recipients will be notified by March 31 of the following year. Contact: *The International Society of Arboriculture, Attn: Research Trust, PO Box 3129, Champaign, IL 61826-3129; Phone:(217) 355-9411; <<www.ag.uiuc.edu/~isa/>>*.

The Hyland R. Johns Grant Program. This program provides grant funds in excess of \$5,000 to qualified researchers for projects on interest and benefit to the arboriculture industry. Proposals must be received by April 1 of the grant year. Recipients will be notified by September 30. Research funded by the Trust must work within the mission statement (i.e., focus on biology, management and care of trees, and their relation to environmental, social and economic benefits). Contact: *The International Society of Arboriculture, Attn: Research Trust, PO Box 3129, Champaign, IL 61826-3129; Phone:(217) 355-9411; <<www.ag.uiuc.edu/~isa/>>*.

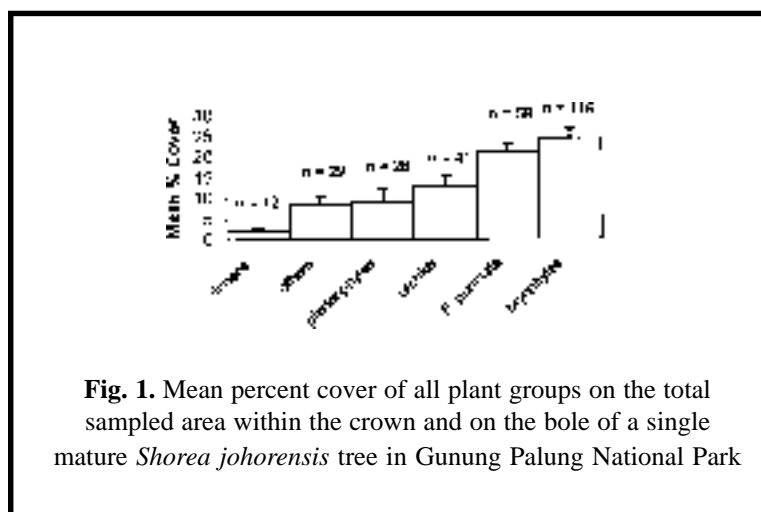
RESEARCH REPORT: EPIPHYTES IN SOUTHEAST ASIA

Epiphyte studies in the last decade have largely taken place in the neotropics and north temperate regions. Ecological studies of epiphytes in Southeast Asia have been few and restricted to vascular plant groups.

Our study was conducted at Cabang Panti Research Site in Gunung Palung National Park (GPNP), West Kalimantan, Indonesia, in October, 1997. The GPNP is a 90,000 ha preserve that encompasses seven habitat types. Annual rainfall is 4300 mm (M. Leighton, *unpubl. data*) with a short dry season (< 100 mm rainfall) between June and September. An uncharacteristic dry season occurred from July-October 1997. This study was confined to the lowland alluvial sandstone habitat type in lowland mixed dipterocarp forest. The dominant tree family in this habitat is Dipterocarpaceae. Some species reach 50-60 m in height and form continuous monofamilial stands.

Shorea johorensis is a common representative of the Dipterocarpaceae in these forests, occurring solely in lowland habitat (<100 m) and can grow up to 65 m tall with a diameter above buttress (DAB) of 2.5-3 m. Individuals are recognized by their characteristic leaf shape/size, flower size/color, fruit size and tree architecture. Trees are tall and symmetrical, with large diameter crowns and large buttresses. Boles may reach 30 m or more in height before branching. They are often found as emergents sharing the canopy with *Dipterocarpus sublamellatus*. Trees were rigged and climbed using single rope technique (SRT) and arborist techniques. Rigging trees above 30 m required the use of a customized 80 lb. compound bow with attached fishing reel/line and fiberglass fishing arrows.

Vascular epiphytes from twelve families occurred on a mature specimen of *Shorea johorensis* in GPNP (Table 1). Bryophytes, epiphyllous crustose lichens, and one species of foliose lichen were also found. Bryophytes and the hemiepiphyte *Ficus punctata* were the dominant epiphyte groups in the canopy in terms of total cover (Fig. 1). These two plant groups (bryophytes and *Ficus punctata*) were also the most evenly distributed and occurred on over 70% of all plots sampled in the tree.



Most available sites on this *Shorea johorensis* (≥ 10 cm diameter) were colonized by some sort of epiphyte or vine. All plots sampled had at least one of the defined epiphyte groups. The greatest abundance and diversity of plant groups was in the inner crown. Epiphyte diversity increased from the outer crown to the inner crown. The outer crown appeared to be a “biological desert” except for liverworts and *Ficus punctata*. Bryophytes were negatively correlated with bole height (RSQ = 0.22, $p < 0.05$). Pteridophytes were only found below 45 m, and orchids were only found above 35 m. Epiphyte groups were more defined towards the inner crown. For example, moss mats overlapped *F. punctata* vines. Pteridophytes were present only in the inner crown and to a minor extent on the bole.

Emergent trees are excellent places to study epiphyte distribution. The height of the tree lends itself to light and microclimatic differences within the crown. When other mature specimens in the dipterocarpaceae are sampled in the same habitat, a clearer picture of epiphyte distribution and abundance in the dipterocarp canopy at GPNP will emerge.

Table 1. Taxa occurring as epiphytes or vines on *Shorea johorensis* (after Benzing 1990). This table does not include bryophytes, epiphyllous lichens, and one species of foliose lichen because of unknown taxonomy.

Division Pteridophyta	Order Gentianales
Class Filicopsida	Family Loganiaceae
Subclass Polypodiidae	Genus <i>Fragrea</i>
Order Polypodiales	Family Asclepiadaceae
Family Dryopteridaceae	Genus <i>Ceropegia</i>
Genus <i>Dryopteris</i>	<i>Hoya</i>
<i>Polystichum</i>	Order Rubiales
Family Aspleniaceae	Family Rubiaceae
Genus <i>Asplenium</i>	Genus <i>Uncaria</i>
Family Davalliaceae	Class Liliopsida
Genus <i>Davallia</i>	Subclass Arecidae
<i>Humata</i>	Order Pandanales
Family Polypodiaceae	Family Pandanaceae
Genus <i>Drynaria</i>	Genus <i>Pandanus</i>
Class Lycopodiopsida	Order Arales
Order Lycopodiales	Family Araceae
Family Lycopodiaceae	Genus <i>Scindapsus</i>
Genus <i>Lycopodium</i>	Subclass Liliidae
Division Magnoliophyta	Order Orchidales
Class Magnoliopsida	Family Orchidaceae
Subclass Hamamelidae	Genus <i>Bulbophyllum</i>
Order Urticales	<i>Cymbidium</i>
Family Moraceae	<i>Dendrobium</i>
Genus <i>Ficus</i>	<i>Drymoglossum</i>
Subclass Asteridae	<i>Eria</i>

ANNOUNCEMENTS

Book donations are sought for the Graduate Program in Ecology and Conservation at the Federal University of Mato Grosso do Sul, Brazil, in biology, especially ecology, biostatistics, animal behavior, botany, zoology, wetlands and conservation. Donations and questions can be directed to: *Prof. Marial Eugenia Carvalho Amaral, Departamento de Biologia, Mestrado em Ecologia e Conservacao, Universidade Federal de Mato Grosso do Sul, CP 649, CEP 79.070-900, Campo Grande, MS, BRAZIL.*

Ecological Society of America (ESA) Listservers. ESA offers two listservers. ECOLOG-L is a discussion forum on ecological research and theory, and posts job and meeting announcements. ESANEWS provides postings of weekly environmental policy updates and ESA activities. To subscribe to ECOLOG-L, send the command "sub ECOLOG-L {your name}" to the address <listserv@umdd.umd.edu.>. To subscribe to ESANEWS, send the command "sub ESANEWS {your name}" to the address <listserv@umdd.umd.edu.>.

New Global Forests Website. The Canadian International Development Agency Forestry Advisers Network (CFAN) has published a new document on their website entitled "Sustaining Global Forests", <<www.cfan-rcfa.org/cida.info.tree.htm>>.

The Jason Project for Education will feature canopy research in its tenth anniversary broadcast in March 1999. Entitled, *Rainforests: A Wetland Wild Adventure*, the students will "travel" to the Hoh River Valley in Olympic National Park, WA, The Wind River Canopy Crane Research Facility, WA, and to the Amazon Center for Environmental Education and Research (ACEER), Peru, to observe forest scientists. Host scientist in the canopy will be Dr. Meg Lowman from Selby Gardens; host of the Jason Project will be Dr. Robert Ballard, <<www.jasonproject.org>>.

The Forestry Advisers Network (CFAN) of the Canadian International Development Agency (CIDA), is an informal network of professionals concerned about the future of the forests and the people who depend on them. CFAN has recently posted two new papers on its website. "Deforestation: Tropical Forests in Decline" examines the extent of deforestation in developing countries, its causes and consequences, and prospect of more sustainable land use alternatives. We invite your comments, <<www.rcfa-cfan.org>>.

PUBLICATIONS OF INTEREST

State of the World's Forests. 1997. Food and Agriculture Organization of the United Nations. The forestry industry is undergoing changes in response to worldwide political, economic, and social developments. This publication presents current information of the status the world's forests and examines major developments, recent trends, and future directions within the forestry sector. CONTACT: *FAO Information Division, Sales and Marketing Group, Viale delle Terme di Caracalla, 00100 Rome, ITALY, ISBN 92-5-103977-1.*

Canopy Arthropods. N.E. Stork, J. Adis, & R. Didham. 1996. A team of internationally recognized scientists have brought together a wide range of the most recent studies of arthropods living in forest canopies. This book is a must for canopy entomologists. CONTACT: *Chapman and Hall Publications, 2-6 Boundary Row, London SE1 8HN, UK. ISBN 0-412-74900-9; <needtoknow@chall.co.uk>; <<www.chaphall.com>>.*

Teaching about Evolution and the Nature of Science. National Academy of Science. This publication offers guidelines on how teachers can incorporate the concept of evolution into science teaching and why it is important to do so. This book is available at no cost at: <<www.nap.edu/readingroom/books/evolution98>>.

America's Forests: 1997 Forest Health Update. U.S. Forest Service. The document serves as a foundation for discussions about forest health. It is available at: <<http://162.79.41.7/fhv/fh_update/update97/index.html>>, or in hard copy from: *USDA Forest Service (202) 205-1600; <lclark/wo_ftcol@fs.fed.us>.*

How to Write and Publish a Scientific Paper, 5th edition. 1998. Robert Day. This book is a practical guide to organizing, writing, and submitting scientific research for publication in a scholarly scientific journal. CONTACT: *Oryx Press, P.O. Box 33889, Phoenix, AZ 85067-3889; Phone: (800) 279-6799; <<www.oryxpress.com>>.*

Global Overview of Forest Conservation 2. 1997. The Center for International Forest Research (CIFOR) and The World Conservation and Monitoring Centre (WCMC) have published a CD-ROM that analyzes the protective status of the world's forests. This resource includes GIS spatial data, files on protected areas and ecological zones, statistical analysis, figures, tables, maps and discussions. CONTACT: *Information Officer, World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge, CB3 0DL, UK. Fax: +44 1223 277136.*

MEETINGS OF INTEREST

People, Trees, and the Environment: 1998 Annual Training Conference of the Pacific Northwest Chapter of the International Society for Arboriculture, September 30-October 2, 1998, Eugene, OR, USA. CONTACT: *Chapter Office, PNW-ISA, PO Box 4202, Salem, OR 97302. Phone: (503) 585-4285; Fax: (503) 585-9429.*

Forest Ecosystem and Land Use in the Mountain Areas, October 12-17, 1998, Seoul, Korea. This meeting is sponsored by the International Union of Forestry Resources Organizations. CONTACT: *Don Lee, Seoul National University, College of Agriculture and Life Sciences, Department of Forest Resources, 103 Seodoondong, 4441-744, Suwon, Korea; <leedk@agri.snu.ac.kr>.*

Tropical Forests and Climate Change, October 19-22, 1998, Manila, Philippines. CONTACT: *Secretariat, UPLB College of Forestry, Environmental Forestry Program, College, 4031, Laguna, Philippines; Phone: +63 495 362 342; Fax: +63 495 392 34; <rd@mudspring.uplb.edu.ph>; <<www.laguna.net>>.*

National Atmospheric Deposition Program, October 26-29, 1998, St. Petersburg, FL, USA. The NADP will celebrate its 20th anniversary during this annual meeting. The NADP is recognized for long-term, high-quality measurements of precipitation chemistry. CONTACT: *Dennis Lamb, Meteorology Department, Penn State University, University Park, PA 16802. Phone; (814) 865-0174; <lno@psu.edu>.*

Forest Canopies 98: Global Perspectives, Second International Forest Canopy Conference, November 4-8, 1998, Marie Selby Botanical Gardens, Sarasota, FL, USA. CONTACT: *Meg Lowman, Director of Research and Conservation, Marie Selby Botanical Gardens, 811 South Palm Avenue, Sarasota, FL, 34236 USA; <lowman@virtu.sar.usf.edu>.*

Sustainable Management of Forest Resources: Challenge of the XXI Century, November 22-29, 1998, Valdivia, Chile. CONTACT: *Secretaria Congreso, Secretaria Relaciones Internacionales Corporación Nacional Forestal, Ave Bulnes 285 6° piso, Santiago, Chile; <dejecuti@iusanet.cl>.*

FOREST '98-Fifth International Congress and Exhibition on Forests, November 25-28, 1998, Curitiba Convention Center, Paraná, Brazil. CONTACT: *BIOSFERA at << www.biosfera.com.br>> or Andrew Hughes, International Exchange Coordinator <forest98@biosfera.com.br>.*

The Birds of Costa Rica: Tropical Bird Ecology For Birding Enthusiasts, December 8-21, 1998; April 13-26, 1999; August 24 - September 6, 1999; December 1999, Monteverde, Costa Rica. CONTACT: *Christina Hansen, The Monteverde Institute, Apdo. 69-5655, Monteverde, Puntarenas, Costa Rica; Telephone: (506) 645-5053; Fax: (506)645-5219; <mvipac@sol.racsa.co.cr>; <<mvi.cea.edu>>.*

Tropical Restoration for the New Millennium, May 23-28, 1999, San Juan, P.R, USA. Sponsored by the Society of Ecological Restoration, the International Union of Forestry Research Organizations, and the University of Puerto Rico. CONTACT: *J. Parrotta, International Institute of Tropical Forestry, USDA Forest Service, PO Box 25000, Rio Piedras, Puerto Rico 00928-5000, USA; <j_parrotta@upr1.upr.clu.edu>.*

Fourth Annual Airborne Remote Sensing Conference and Exhibition, June 21-24, 1999, Ottawa, Ontario, Canada. CONTACT: *ERIM Airborne Conferences, Box 134008, Ann Arbor, MI 48113-4008; Phone: (734) 994-1200 ext. 3234; Fax: (734) 994-5123; <wallman@erim-int.com>; <<www.erim-int.com/CONF/conf.html>>.*

1999 ESA Annual Meeting; "Landscapes, Legacies, and Limits: Bridging Borders", August 8-12, 1999, Spokane, WA, USA. CONTACT: *ESA Program Chair, Elaine R. Ingham, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331-2902; Phone: (541) 737-3451; Fax (541) 752-5142; <inghame@bcc.orst.edu>.*

The Impact of Logging on Biodiversity Meeting. The Center for International Forestry Research (CIFOR), October 18-22, 1999, Hanoi, Vietnam. CONTACT: *Titiek Setyawati, CIFOR, PO Box 6596, JKPWB, Jakarta 10065, Indonesia; Phone: +62 251 622622; Fax: +62 251 62210; <t.setyawati@cgnnet.com>; <<www.cgiar.org/cifor>>.*

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 by doing monthly on-line literature searches (AGRICOLA, CAB, and FORESTRY ABSTRACTS) and going through Current Contents on Diskette.]

Atmospheric Studies

- González, L.E., & P. da Silveira. 1997. The people's attitudes towards global environmental phenomena: a case study. *Climate Research* **9**:95-100.
- Kaya, G., & G. Tuncel. 1997. Trace element and major ion composition of wet and dry deposition in Ankara, Turkey. *Atmospheric Environment* **31**:3985-3998.
- Margolis, H.A., & M.G. Ryan. 1997. A physiological basis for biosphere-atmosphere interactions in the boreal forest: an overview. *Tree Physiology* **17**: 491-499.
- Tenhunen, J.D., R. Valentini, B. Köstner, R. Zimmermann, & A. Granier. 1998. Variation in forest gas exchange at landscape to continental scales. *Annales des Sciences Forestières* **55**:1-11

Canopy Animals

- Fenton, M.B., D.H.M. Cumming, I.L. (Naas) Rautenbach, G.S. Cumming, M.S. Cumming, G. Ford, R.D. Taylor, J. Dunlop, M.D. Hovorka, D.S. Johnston, C.V. Portfors, M.C. Kalcounis & Z. Mahlanga. 1998. Bats and the loss of tree canopy in African woodlands. *Conservation Biology* **12**:399-407.
- Hartley, M.J., & M.L. Hunter, Jr. 1998. A meta-analysis of forest cover, edge effects, and artificial nest predation rates. *Conservation Biology* **12**:465-469.
- Kaplin, B.A., V. Munyaligoga, & T.C. Moermond. 1998. The influence of temporal changes in fruit availability on diet composition and seed handling in Blue Monkeys (*Cercopithecus mitis doggetti*). *Biotropica* **30**:56-71.

Canopy Arthropods

- Hanula, J.L., & K. Franzerb. 1998. Source, distribution and abundance of macroarthropods on the bark of longleaf pine: potential prey of the red-cockaded woodpecker. *Forest Ecology and Management* **102**:89-102.
- Majer, J. D., H. F. Recher, & N. Keals. 1996. Branchlet shaking: a method for sampling tree canopy arthropods under windy conditions. *Australian Journal of Ecology* **21**:229-234.
- Recher, H. F., J. D. Majer, & S. Ganesh. 1996. Seasonality of canopy invertebrate communities in eucalypt forests of eastern and western Australia. *Australian Journal of Ecology* **21**:64-80.
- Recher, H. F., J.D. Majer, & S. Ganesh. 1996. Eucalypts, insects and birds: on the relationship between foliar nutrients and species richness. *Forest Ecology and Management* **85**:177-195

- Tassone, R., & J. D. Majer. 1997. Abundance of arthropods in tree canopies of *Banksia* woodland on the Swan Coastal Plain. *Journal of the Royal Society of Western Australia* **80**:281-286.

Ecosystem Ecology

- Hanchi, A., & M. Rapp. 1997. Stemflow determination in forest stands. *Forest Ecology and Management* **97**:231-235.
- Pook, E.W., A.M. Gill, & P.H.R. Moore. 1997. Long-term variation of litter fall, canopy leaf area, and flowering in a *Eucalyptus maculata* forest on the south coast of New South Wales. *Australian Journal of Botany* **45**:737-755.

Epiphyte Ecology

- Flanagan, L.B., C.S. Cook, & J.R. Ehleringer. 1997. Unusually low carbon isotope ratios in plants from hanging gardens in southern Utah. *Oecologia* **111**:481-489.
- Lüttge, U., M. Haridasan, G.W. Fernandes, E.A. de Mattos, P. Trimbom, A.C. Franco, L.S. Caldas, & H. Ziegler. 1998. Photosynthesis of mistletoes in relation to their hosts at various sites in tropical Brazil. *Trees* **12**:167-174.
- Montaña, C., R. Dirzo & A. Flores. 1997. Structural parasitism of an epiphytic bromeliad upon *Cercidium praecox* in an intertropical semi-arid ecosystem. *Biotropica* **29**:517-521.
- Muir, P.S., & A.M. Shirazi. 1997. Seasonal growth dynamics in the lichen *Lobaria pulmonaria*. 1997. *The Bryologist* **100**:458-464.
- Norton, D.A., & M.A. Carpenter. 1998. Mistletoes as parasites: host specificity and speciation. *Trees* **13**:101-105.
- Sosa, V., & T. Platas. 1998. Extinction and persistence of rare orchids in Veracruz, Mexico. *Conservation Biology* **12**:451-455.

Forest & Canopy Structure

- Ammer, C., & G. Krötz. 1997. Ecological light measurement in forests using the light degradation effect in hydrogenated amorphous silicon (a-Si:H). *Annales des Sciences Forestières* **54**:539-552.
- Bäumler, R. & W. Zech. 1997. Atmospheric deposition and impact of forest thinning on throughfall of mountain forest ecosystems in Bavarian Alps. *Forest Ecology and Management* **95**:243-251.
- Brunner, A. 1998. A light model for spatially explicit forest stand models. *Forest Ecology and Management* **107**:19-45.
- Cermák, J.-I., F. Riguzzi, & R. Ceulemans. 1998. Scaling up from the individual tree to the stand level in Scots pine. I. Needle distribution, overall crown and root geometry *Annales des Sciences Forestières* **55**:63-88.
- Hassika, P, P. Berbigier, & J.M. Bonnefond. 1997. Measurement and modelling of the photosynthetically active radiation transmitted in a canopy of maritime pine. *Annales des Sciences Forestières* **54**:715-730.
- Lyons, B. 1998. Crown structure and spatial distribution of epiphytes on Western hemlock, Wind River, WA. Masters of Environmental Studies Thesis. The Evergreen State College, Olympia, Washington.
- McCrary, R.L., & E.J. Jokela. 1998. Canopy dynamics, light interception, and radiation use efficiency of selected loblolly pine families. *Forest Science* **44**:64-72.

- Moravie, M.-A., J.-P. Pascal, & P. Auger. 1997. Investigating canopy regeneration processes through individual-based spatial models: application to a tropical rain forest. *Ecological Modelling* **104**:241-260.
- Niinemets, Ü. 1997. Acclimation to low irradiance in *Picea abies*: influences of past and present light climate on foliage structure and function. *Tree Physiology* **17**:723-732.
- Raulier, F., & C.-H. Ung. 1997. Influence of shading on the relationship between leaf area and crown surface area in sugar maple stands. *Ecological Modelling* **104**:51-69.
- Webb, E.L. 1997. Canopy removal and residual stand damage during controlled selective logging in swamp forest of northeast Costa Rica. *Forest Ecology and Management* **95**:117-129.
- Yanhong, T., & K. Naoki. 1997. A measuring system for characterizing spatial and temporal variation of photon flux density within plant canopies. *Forest Ecology and Management* **97**: 85-90.
- Zeide, B. 1998. Fractal analysis of foliage distribution in loblolly pine crowns. *Canadian Journal of Forest Research* **28**:106-114.
- White, J.D., K.C. Ryan, C.C. Key, & S.W. Running. 1996. Remote sensing of forest fire severity and vegetation recovery. *International Journal of Wildland Fire* **6**:125-136.
- White, J.D., S.W. Running, R. Nemani, R.E. Keane, & K.C. Ryan. 1997. Measurement and remote sensing of LAI in Rocky Mountain montane ecosystems. *Canadian Journal of Forest Research* **27**:1714-1727.

Tree Physiology

- Nutrient Cycling**
- Garten, C.T., Jr., A.B. Schwab, & T.L. Shirshac. 1998. Foliar retention of N15 tracers: implications for net canopy exchange in low- and high-elevation forest ecosystems. *Forest Ecology and Management* **103**:211-216.
- Hättenschwiler, S., & C. Körner. 1998. Biomass allocation and canopy development in spruce model ecosystems under elevated CO₂ and increased N deposition. *Oecologia* **113**:104-114.
- Kreutzer, K., C. Beier, M. Bredemeier, K. Blanck, T. Cummins, E.P. Farre, N. Lammersdorf, L. Rasmussen, A. Rothe, P.H.B. de Visser, W. Weis, T. Weiß, & Y.-J. Xu. 1998. Atmospheric deposition and soil acidification in five coniferous forest ecosystems: a comparison of the control plots of the EXMAN sites. *Forest Ecology and Management* **101**:125-142.
- Remote Sensing**
- Coops, N., A. Delahaye, & E. Pook. 1997. Estimation of eucalypt forest leaf area index on the south coast of New South Wales using Landsat MSS Data. *Australian Journal of Botany* **45**:757-769.
- Dralle, K., & M. Rudemo. 1996. Stem number estimation by kernel smoothing of aerial photos. *Canadian Journal of Forest Research* **26**:1228-1236.
- Jorge, L.A.B., & G.J. Garcia. 1997. A study of habitat fragmentation in Southeastern Brazil using remote sensing and geographic information systems (GIS). *Forest Ecology and Management* **98**:35-47.
- Peet, F.G., D.J. Morrison, & K.W. Pellow. 1997. Using a hand-held electronic laser-based survey instrument for stem mapping. *Canadian Journal of Forest Research* **27**:2104-2108.
- Running, S.W., C.O. Justice, V. Salomonson, D. Hall, J. Barker, Y.J. Kaufmann, A.H. Strahler, A.R. Huete, J.-P. Muller, V. Vanderbilt, Z.M. Wan, P. Teillet, & D. Carneggie. 1994. Terrestrial remote sensing science and algorithms planned for EOS/MODIS. *International Journal of Remote Sensing* **15**:3587-3620.
- Sachs, D.L., P. Sollins, & W.B. Cohen. 1998. Detecting landscape changes in the interior of British Columbia from 1975 to 1992 using satellite imagery. *Canadian Journal of Forest Research* **28**:23-26.
- Baldwin, V.C., Jr., K.D. Peterson, H.E. Burkhart, R.L. Amateis, & P.M. Dougherty. 1997. Equations for estimating loblolly pine branch and foliage weight and surface area distributions. *Canadian Journal of Forest Restoration* **27**:918-927.
- Dang, Q., H.A. Margolis, M.R. Coyea, M. Sy, & G.J. Collatz. 1997. Regulation of branch-level gas exchange of boreal trees: roles of shoot water potential and vapor pressure difference. *Tree Physiology* **17**:521-535.
- Eckstein, R.L., P.S. Karlsson, & M. Weih. 1998. The significance of resorption of leaf resources for shoot growth in evergreen and deciduous woody plants from a subarctic environment. *Oikos* **81**:567-575.
- Giuliana, R., F. Nerozzi, E. Magnanini, & L. Corelli-Grappadelli. 1997. Influence of environmental and plant factors on canopy photosynthesis and transpiration of apple trees. *Tree Physiology* **17**:637-645.
- Herrera, B., & B. Finegan. 1997. Substrate conditions, foliar nutrients and the distributions of two canopy tree species in a Costa Rican secondary rain forest. *Plant and Soil* **191**:259-267.
- King, D.A. 1997. The functional significance of leaf angle in *Eucalyptus*. *Australian Journal of Botany* **45**:619-639.
- Liakoura, V., M. Stefanou, Y. Manetas, C. Cholevas, & G. Karabourniotis. 1997. Trichome density and its UV-B protective potential are affected by shading and leaf position on the canopy. *Environmental and Experimental Botany* **38**:223-229.
- Mabrouk, H., A. Carbonneau, & H. Sinoquet. 1997. Canopy structure and radiation regime in grapevine. I. Spatial and angular distribution of leaf area in two canopy systems. *Vitis* **36**:119-123.
- Martin, T.A., K.J. Brown, J. Cermák, R. Ceulemans, J. Kucera, F.C. Meinzer, J.S. Rombold, D.G. Sprugel, & T.M. Hinckley. 1997. Crown conductance and tree stand transpiration in a second-growth *Abies amabilis* forest. *Canadian Journal of Forest Research* **27**:797-808.
- Meinzer, F.C., T.M. Hinckley & R. Ceulemans. 1997. Apparent responses of stomata to transpiration and humidity in a hybrid poplar canopy. *Plant, Cell and Environment* **20**:1301-1308.
- Peper, P.J., & E. G. McPherson. 1998. Comparison of five methods for estimating leaf area index of open-grown trees. *Journal of Arboriculture* **24**:98-111.
- Peper, P.J., & E. G. McPherson. 1998. Comparison of four foliar and woody biomass estimation methods applied to open-grown deciduous trees. *Journal of Arboriculture* **24**:191-200.
- Stockfors, J., & S. Linder. 1998. The effect of nutrition on the seasonal course of needle respiration in Norway spruce stands. *Trees* **12**:130-138.
- Takenaka, A., Y. Inui, & A. Osawa. 1998. Measurement of three-dimensional structure of plants with a simple device and estimation of light capture of individual leaves. *Functional Ecology* **12**:159-165.
- Tyas, J.A., P.J. Hofman, S.J.R. Underhill, & K.L. Bell. 1998. Fruit canopy position and panicle bagging affects yield & quality of 'Tai So' lychee. *Scientia Horticulturae* **72**:203-213.

