

ABSTRACT BOOK AND PROGRAM

Working Forests in the Tropics:

**Conservation through
Sustainable Management**



**February 25-26, 2002
Gainesville, Florida**

Hosted by:



**Institute of Food and Agricultural Sciences
School of Forest Resources and Conservation
- and -
The Forest Management Trust**

Project #0204

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Conference Sponsors

A special thank you to our sponsors for their generous support of this conference:

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Institute of Food and Agricultural Sciences,
Office of the Dean for Research**
- ◆ **University of Florida,
Office of International Programs**
- ◆ **University of Florida,
Office of Research and Graduate Programs**

Program Agenda

Monday, February 25, 2002

AM

8:00-9:00 **Registration and Poster Setup**

General Session (Ballroom A)

9:00-9:15 **Welcome** – *Michael V. Martin*, Vice-President for Agriculture and Natural Resources, University of Florida, IFAS.

Opening Remarks – *Daniel J. Zarin*, School of Forest Resources & Conservation, University of Florida, IFAS.

9:15-10:00 **Opening Keynote Address** – “Working Forests Will Be New Ecosystems” – *Ariel Lugo*, Director, USDA Forest Service, International Institute of Tropical Forestry. (p. 13)

10:00-10:30 **Refreshment Break**

Simultaneous Oral Sessions (10:30AM – 12:05PM)

Session I – Chainsaw Conservation (Ballroom A)

10:30-10:35 **Introduction** – *Francis “Jack” Putz*, Department of Botany, University of Florida.

10:35-11:00 “Deconstructing Forests” – *Kent Redford*, Wildlife Conservation Society. (p. 15)

11:00-11:25 “Retirement Benefits for Working Forests” – *Peter Frumhoff*, Union of Concerned Scientists. (p. 9)

11:25-11:50 “Forestry as a Tool for Tropical Forest Conservation: Opportunity or Illusion?” – *William Laurance*, Smithsonian Tropical Research Institute. (p. 11)

11:50-12:05 **Discussion**

Session II – Linking Communities and Markets (Ballroom B)

AM

10:30-10:35 **Introduction** – *Marianne Schmink*, Tropical Conservation & Development Program, University of Florida.

10:35-11:00 “Is Tropical Forest Management by Communities Sustainable?: Perspectives from Quintana Roo” – *David Bray*, Florida International University. (p. 3)

11:00-11:25 “Silviculture and Conservation of Tropical Forests in Quintana Roo, Mexico: Opportunities for Sustainable Timber Production” – *Patricia Negreros-Castillo*, Iowa State University. (p. 14)

11:25-11:50 “Collaboration and Adaptation in the Marketing of Timber by Indigenous People in Lowland Bolivia” – *Peter Cronkleton*, Center for International Forestry Research. (p. 6)

11:50-12:05 **Discussion**

Monday, February 25, 2002 (Cont.)

PM

12:05-1:30 **Lunch on your own (& Final Poster Setup)**

Simultaneous Oral Sessions (1:30PM – 5:00PM)

Session I – Chainsaw Conservation (cont.) (*Ballroom A*)

PM

- 1:30-1:45 **Discussion**
- 1:45-2:00 “The Regional Context of ‘Chainsaw Conservation’: Policy Enforcement, Road Paving and the Transformation of the Amazon Logging Sector” – *Daniel C. Nepstad*, The Woods Hole Research Center and Instituto de Pesquisa Ambiental da Amazônia. (p. 25)
- 2:00-2:15 “Limited or Unlimited Wants in the Presence of Limited Means? Inquiries into the Role of Satiation in Affecting Deforestation” – *Martin Luckert*, University of Alberta. (p. 24)
- 2:15-2:30 “Jungle Dreams / Mahogany Nightmares: Politico-Economic Challenges to Sustainable Forest Management in the Western Amazon” – *Ernesto F. Ræz-Luna*, University of British Columbia. (p. 27)
- 2:30-2:45 “Selective Logging, Forest Fragmentation and Fire Disturbance: Implications of Interaction and Synergy for Conservation” – *Mark A. Cochrane*, Michigan State University. (p. 21)
- 2:45-3:00 **Discussion**
- 3:00-3:30 **Refreshment Break** (*Rooms 233-234*)
- 3:30-3:45 “Saving the Amazon with Sustainable Enterprises: The Amazonian Phoenix Project Valuing Biodiversity, People and Social Progress” – *Antonio D. Nobre*, Instituto Nacional de Pesquisas da Amazônia. (p. 26)
- 3:45-4:00 “The Role of Silviculture in the Conservation of Tropical Forests” – *Todd S. Fredericksen*, Forest Management Trust and Proyecto BOLFOR. (p. 23)
- 4:00-4:15 “Timber Production and Plant Biodiversity Conservation in Mesoamerican Rain Forests: Experimental Results and Their Implications for Adaptive Sustainability Assessment” – *Bryan Finegan*, CATIE. (p. 22)
- 4:15-4:30 “Axing the Trees, Growing the Forest: Smallholder Timber Production in the Amazon Varzea” – *Robin R. Sears*, Columbia University. (p. 28)
- 4:30-5:00 **Discussion & Synthesis**

Monday, February 25, 2002 (Cont.)

Session II – Linking Communities and Markets (cont.) (*Ballroom B*)

PM

1:30-1:45 **Discussion**

1:45-2:00 “Culture and Nature in the Maya Forest: A Working Philosophy at El Pilar” – *Anabel Ford*, University of California. (p. 33)

2:00-2:15 “Indigenous Communities and Forest Resources in Brazil: The Cost of Conservation” – *Robert Pritchard Miller*, Agencia de Cooperação Técnica aos Programas Indigenistas e Ambientais. (p. 35)

2:15-2:30 “From Staple to Fashion Food: Açai Fruit (*Euterpe oleracea Mart.*), Commodity Markets, and Rural Development in the Amazon Estuary” – *Eduardo S. Brondizio*, Indiana University. (p. 32)

2:30-2:45 “Approaches to Sustainable Community Forestry: Perspectives from Mexico and Honduras” – *Catherine Tucker*, Indiana University. (p. 37)

2:45-3:00 **Discussion**

3:00-3:30 **Refreshment Break** (*Ballroom B*)

3:30-3:45 “Community-Based Forestry in the Brazilian Amazon: An Alternative Strategy for Reconciling Conservation and Development” – *David McGrath*, Woods Hole Research Center. (p. 34)

3:45-4:00 “Does Participatory Research Stimulate Community Natural Forest Management? Indigenous Experiences from Lowland Bolivia” – *Wendy R. Townsend*, Noel Kempff Mercado Natural History Museum. (p. 36)

4:00-4:15 “Inside the Polygon: Emerging Community Tenure Systems and Forest Resource Extraction” – *Tom Ankersen* and *Grenville Barnes*, University of Florida. (p. 31)

4:15-4:30 “Strategies to Improve Rural Livelihoods through Markets for Forest Products and Services” – *Andy White*, Forest Trends. (p. 38)

4:30-5:00 **Discussion and Synthesis**



5:00-7:00 **Poster Reception**

- Rooms 243-246 – Posters

- Room 235 – Food (*across from Ballroom*)

Tuesday, February 26, 2002

Simultaneous Oral Sessions (8:30AM – 12:05PM)

Session III – Paying for Carbon (Ballroom A)

AM

- 8:30-8:35 **Introduction** – *Janaki Alavalapati*, School of Forest Resources & Conservation, University of Florida, IFAS.
- 8:35-9:05 “Making Working Forests a Reality: How Much Can We Expect from the Kyoto Protocol” – *Joyotee Smith*, Center for International Forestry Research. (p. 16)
- 9:05-9:35 “Carbon Finance and Sustainable Forestry in Practice” – *David Cassells*, The World Bank (p. 4)
- 9:35-10:05 “Carbon Sequestration Potential through Forestry Activities in Tropical Mexico” – *Bernardus H.J. de Jong*, College of Southern Border. (p. 7)
- 10:05-10:35 **Refreshment Break** (Rooms 233-234)
- 10:35-10:50 “Cost and Potential of Carbon Mitigation in Tropical Forestry” – *Willy R. Makundi*, Lawrence Berkeley National Laboratory. (p. 43)
- 10:50-11:05 “Funding Forestry through Carbon – Case Studies from Across the Tropics” – *Louise Aukland*, EcoSecurities Ltd. (p. 41)
- 11:05-11:20 “From Global Governance to Local Realities: Capturing Carbon Through Conservation” – *Emily G. K. Boyd*, University of East Anglia. (p. 42)
- 11:20-11:35 “Climate Stability through Forest Sequestration Activities” – *Mark van Soestbergen*, International Carbon Bank and Exchange. (p. 44)
- 11:35-12:05 **Discussion & Synthesis**

Session IV – Certification (Ballroom B)

AM

- 8:30-8:35 **Introduction** – *Joshua Dickinson III*, The Forest Management Trust.
- 8:35-9:05 “Opportunities and Challenges in Tropical Forest Certification” – *Heiko Liedeker*, Forest Stewardship Council. (p. 12)
- 9:05-9:35 “When is the FSC Not Enough? Challenges and Lessons in the Certification of Tropical Working Forests” – *Michael E. Conroy*, Ford Foundation. (p. 5)
- 9:35-10:05 “Reduced Impact Logging in Old-Growth Tropical Humid Forests: The Necessary Evil” – *John Forgach*, A2R Fondos Ambientales. (p. 8)
- 10:05-10:35 **Refreshment Break** (Ballroom B)
- 10:35-11:05 “Sustainable Management: The Business/Economic Side” – *Thomas Wilson*, International Specialties, Inc. (p. 17)
- 11:05-11:20 “Conservation with Certified Timber: The Experience of Programme for Belize” – *Erin O. Sills*, North Carolina State University. (p. 48)

Tuesday, February 26, 2002 (Cont.)

11:20-11:35 “Developing Principles, Criteria, Indicators and Verifiers for Forest Management Units: Tools for Defining, Evaluating and Communicating the Ecological Sustainability of Forest Management in Costa Rica and Nicaragua” – *Kathleen McGinley*, CATIE. (p. 47)

11:35-12:05 **Discussion & Synthesis**



PM

12:05-1:30 **Lunch on your own**

12:30-1:15 **Special Lunchtime Presentation** (*Ballroom B*)

“Working Forests in Acre, Brazil: An Experiment in Sustainable Development” – *Mr. Carlos Vicente*, Executive Secretary of Forests and Extractivism for the State of Acre, Brazil.



General Session (*Ballroom A*)

1:30-2:45 **Panel Discussion:** Is Sustainable Forest Management an Effective Strategy for Conservation and Development in the Tropics?

2:45-3:15 **Refreshment Break (& Final Poster Removal)**

3:15-4:00 **Closing Keynote Address** – “Conventional Wisdom and a Pro-Poor Forest Agenda” – *David Kaimowitz*, Director General, Center for International Forestry Research. (p. 10)

Poster Session Directory

Topic 1 – Tropical Land Use and Land-Cover Change

Poster
Number

- 1** **Measuring and Monitoring Carbon for Forest-Based Projects: Experience from Pilot Projects -- *Sandra Brown***, Winrock International, Arlington, VA (p. 51)
- 2** **Using Lidar to Identify Structural Differences between Primary and Secondary Tropical Rainforests -- *Charles C. Cowden and John F. Weishampel***, University of Central Florida, Orlando, FL, USA (p. 52)
- 3** **Economic Impacts of Fire in the Amazon -- *Maria del Carmen Vera Diaz***, Instituto de Pesquisa Ambiental da Amazônia - IPAM, Belem, PA, Brazil; *Daniel C. Nepstad*, IPAM and Woods Hole Research Center - WHRC, Woods Hole, MA, USA; *Ronaldo Seroa da Motta and Mário Jorge Cardoso de Mendonça*, Instituto de Pesquisa Econômica Aplicada -IPEA, Rio de Janeiro, RJ, Brazil (p. 53)
- 4** **Long-term Monitoring of Natural and Anthropogenic Change in a Neotropical Rainforest Using Remote Sensing Imagery -- *Jonathan Greenberg***, Center for Spatial Technologies and Remote Sensing (CSTARS), University of California, Davis, Davis, CA, USA (p. 54)
- 5** **Natural Regeneration in an Atlantic Forest Fragment Located in Rio de Janeiro State, Brazil -- *José Américo de Mello Filho***, Depto. Engenharia Rural - Universidade Federal de Santa Maria, RS and UFRJ, CCMN, Rio de Janeiro, RJ, Brazil. ; *Jorge Paladino Corrêa de Lima*, USDA Forest Service, Athens, Ga, USA and Universidade Federal Rural do Rio de Janeiro/ENCE, Rio de Janeiro, Brazil. (p. 55)
- 6** **Impact of Aspect and Urban Matrix in the Structure and Composition of the Vegetation in the Limestone Hills of Puerto Rico -- *J. Lugo-Perez and Alberto Sabat***, University of Puerto Rico, San Juan, PR, USA (p. 56)
- 7** **Effects of Livestock on Structure and Composition of Floodplain Forests in the Lower Amazon, Brazil -- *Pervaze A. Sheikh***, Consultant for Congressional Research Service, Washington D.C., USA and Instituto de Pesquisa Ambiental da Amazônia, Belém, PA, Brazil; *Azinilson Aquino*, Instituto de Pesquisa Ambiental da Amazônia, Belém, PA, Brazil (p. 57)
- 8** **Tropical Lowland Rainforest Loss and Bird Diversity: A Case Study from Southeast Asia -- *Navjot S. Sodhi***, National University of Singapore, Singapore, Republic of Singapore (p. 58)
- 9** **Forest Cover Change in a Western Honduras Community: Accessibility and Protection as Determinants of Landscape Transformation -- *J. Southworth, H. Nagendra and C. Tucker***, CIPEC, Indiana University, Bloomington, IN, USA (p. 59)

Poster
Number

- 10 The Role of Land Tenure on the Occurrence of Accidental Fires in the Amazon Region: Case Studies from the National Forest of Tapajós, Pará, Brazil -- *M. Angélica Toniolo and Eduardo S. Brondízio***, Indiana University, Bloomington, IN, USA (p. 60)
- 11 Reforestation Activities for Watershed Restoration in Nicaragua -- *Sarah Workman***, University of Florida, Gainesville, FL, USA; *Carlos Rodriguez*, IITF/USDA Forest Service, Puerto Rico; *Richard Chavez*, Yale University, New Haven, CT, USA (p. 61)

Topic 2 – Tropical Forestry for Timber Production

Poster
Number

- 12 Spatial and Temporal Distribution of Selective Logging in Eastern Amazon Using Visual Interpretation Analysis of Satellite Images -- *Ane A. C. Alencar***, Instituto de Pesquisa Ambiental da Amazônia - IPAM, Belem, PA, Brazil; *Daniel C. Nepstad*, IPAM and Woods Hole Research Center - WHRC, Woods Hole, MA, USA; *Sanae Hayashi*, Faculdade de Ciências Agrárias do Pará - FCAP, Belém, PA, Brazil (p. 65)
- 13 Liana Loads and Post-Logging Liana Densities after Liana Cutting in a Lowland Forest in Bolivia -- *Diana Alvira and Francis Putz***, University of Florida, Gainesville, FL, USA; *Todd S. Fredericksen*, Proyecto BOLFOR, Santa Cruz, Bolivia (p. 66)
- 14 Short and Long-term Effects of Selective Logging on Timber Tree Regeneration in French Guiana -- *Christopher Baraloto***, University of Michigan, Ann Arbor, MI, USA (p. 67)
- 15 Fire Vulnerability of Bolivian Sub-humid Forests Subjected to Different Silvicultural Treatments -- *Geoffrey M. Blate***, University of Florida, Gainesville, FL, USA (p. 68)
- 16 Conservation in the Service of Economics?: Financial Benefits of Skid Trail Planning to Reduce Future Crop Tree Damage -- *Frederick Boltz***, School of Forest Resources and Conservation, University of Florida, Gainesville, FL, USA; *Roberto Quevedo S.*, La Chonta, Ltda., Santa Cruz, Bolivia (p. 69)
- 17 Financial Returns under Uncertainty for Conventional and Reduced-Impact Logging in Permanent Production Forests of the Brazilian Amazon -- *Frederick Boltz and Douglas R. Carter***, School of Forest Resources and Conservation, University of Florida, Gainesville, FL, USA; *Thomas P. Holmes*, Southern Research Station, USDA Forest Service, Research Triangle Park, NC, USA; *Rodrigo Pereira, Jr.*, Fundação Floresta Tropical, Belém, Pará, Brazil (p. 70)

Poster
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- 18 The Secondary Forests of Tropical America; Perspectives for Their Sustainable Management -- *G. De las Salas*, IUFRO Working Group 1.07.00 Colombia (p. 71)**
- 19 Effect of Silvicultural Thinning on the Regeneration of Commercially Valuable Trees in Strip Cuts in the Peruvian Amazon -- *Chris Dolanc and David L. Gorchov*, Dept. of Botany, Miami University, Oxford, OH 45056; *Fernando Cornejo*, Proyecto Castanales, Puerto Maldonado, Peru (p. 72)**
- 20 Recovery of Faunal Diversity Following Clear-Cutting and Selective Logging in Tropical Forest Landscapes -- *Robert R. Dunn*, Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT, USA (p. 73)**
- 21 Impacts of Pre-Logging Liana Cutting on Logging Gap Regeneration of Lianas in the Eastern Brazilian Amazon -- *Jeffrey J. Gerwing and Christopher Uhl*, Pennsylvania State University, University Park, PA (p. 74)**
- 22 Historical Wood Production and the Potential of *Prioria copaifera* (cativo) Forests in Darien, Panama -- *William T. Grauel*, College of Natural Resources and Environment, University of Florida, Gainesville, Florida (p. 75)**
- 23 Sustained-yield Production of Bigleaf Mahogany (*Swietenia macrophylla*) in Acre, Brazil: Testing Forest Conservation's Ability to Pay -- *James E. Grogan*, Instituto do Homem e Meio Ambiente da Amazônia, Belém, Pará, Brazil / Yale School of Forestry & Environmental Studies, New Haven, CT, USA; *Eirivelthon Lima, Edson Vidal, Adalberto Veríssimo and Paulo Barreto*, Instituto do Homem e Meio Ambiente da Amazônia, Belém, Pará, Brazil (p. 76)**
- 24 Management of a 12-15 Year-Old Secondary Forest in Southwest Costa Rica -- *Sean P. Healey*, University of Washington, Seattle, WA, USA (p. 77)**
- 25 Dispersal of Anemocorous and Autocorous Seeds During the Dry Season in Logged Areas in a Bolivian Tropical Dry Forest -- *Bonifacio Mostacedo, Marcela Pereira and Todd S. Fredericksen*, BOLFOR Project, Santa Cruz de la Sierra, Santa Cruz, Bolivia (p. 78)**
- 26 Long-term Silvicultural Research Project in Bolivian Tropical Forests -- *Marielos Peña-Claros, Todd Fredericksen, Lincoln Quevedo, William Pariona, Juan Carlos Licona and Claudio Leños*, BOLFOR, Santa Cruz, Bolivia; *F. E. Putz*, University of Florida, Gainesville, FL, USA; *Dan Zarin*, The Forest Management Trust, Gainesville, FL, USA (p. 79)**
- 27 Review of USAID's Natural Forest Management Programs in Latin America and the Caribbean -- *Douglas J. Pool, Thomas C. Catterson, Vicente A. Molinos and Alan C. Randall*, International Resources Group, Washington, D.C. (p. 80)**

Poster
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- 28 Certified Timber from a Non-Certified Sawmill: Reflections on an Amazonian Logging Company -- *Carlos E. Rittl***, National Institute for Amazonian Research, Manaus, AM, Brazil; *William F. Laurance*, Smithsonian Tropical Research Institute, Balboa, Republic of Panama (p. 81)
- 29 Small Clandestine Sawmills and the Deadlock of Predatory Logging in Amazonia -- *Sergio L M Rivero***, Universidade Federal de Rondonia, Porto Velho, Rondonia, Brazil; *Daniel C Nepstad*, The Woods Hole Research Center, Woods Hole, MA, USA and Instituto de Pesquisa Ambiental da Amazonia, Belém, Pará, Brazil; *Ane Alencar*, Instituto de Pesquisa Ambiental da Amazonia, Belém, Pará, Brazil (p. 82)
- 30 Incorporating Tree Life History Information into Forest Management Plans in the Eastern Amazon -- *Mark Schulze***, The Pennsylvania State University, University Park, PA, USA; *Edson Vidal*, Institute of People and the Environment (IMAZON), Belem, Para, Brasil (p. 83)
- 31 Debt-for-Nature Swaps and the Tropical Forest Conservation Act, Implications for Preserving Forests in Developing Countries -- *Pervaze A. Sheikh and Betsy A. Cody***, Congressional Research Service, Washington D.C., USA (p. 84)
- 32 Patch Clear Cutting to Regenerate Mahogany (*Swietenia macrophylla* King) and Sustain Forest Value in the Mayan Ejidos of Mexico -- *Laura K. Snook and Patricia Negreros-Castillo***, CIFOR, Bogor, Indonesia; Iowa State University, Ames, Iowa (p. 85)

Topic 3 – Community Forestry in the Tropics

Poster
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- 33 Community-Based Conservation and the Future of the Tropical Forest -- *Peter Atembe***, The Environment and Rural Development Foundation (ERuDeF) ; *Ousseynou Ndoye and Eyebe Antoine*, Center for International Forestry Research (CIFOR) (p. 89)
- 34 Management of Lokta (*Daphne spp.*) in Nepal's Community Forests -- *A. L. Hammett***, Virginia Polytechnic Institute, VA, USA; *Brian Becker*, University of Florida, FL, USA (p. 90)
- 35 Effects of Thinning on Community Forests and Forest User Groups -- *Narayan Dhital***, Wageningen University, Wageningen, The Netherlands (p. 91)
- 36 Participatory Resource Mapping in Maya Communities of Quintana Roo, Mexico -- *Edward A. Ellis***, University of Florida, Gainesville FL, USA; *Christopher T. Beck and Carmen Cruz Cáceres*, Universidad de Quintana Roo, Chetumal, Quintana Roo, MX (p. 92)

Poster
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- 37 Resident Perspectives of Community-Based Ecotourism as a Tool for Development and Mobilization: A Case Study in the Dominican Republic --** *Amanda Holmes*, University of Florida, Gainesville, FL USA (p. 93)
- 38 Social Institutions, Indigenous Knowledge and Tropical Forest Conservation in Southeast Nigeria --** *Uwem E. Ite*, Lancaster University, Lancaster, UK (p. 94)
- 39 Tropical Forest Conservation and Indigenous Land Rights on Southeastern Nicaragua's Agricultural Frontier --** *Gerald R. Mueller*, University of Florida, Gainesville, FL. (p. 95)
- 40 Community Forestry: Bridging Conservation and Uses (Empirical Experiences of Nepal) --** *Shankar Paudel*, Tropical Forestry, Wageningen University, The Netherlands (p. 96)
- 41 Critical Aspects Of The Camu-Camu Industry --** *James Penn*, University of Florida, Gainesville, FL, USA (p. 97)
- 42 Local Community Participation to Support Sustainable Forest Management --** *Keith D. Porter*, Forestry Department, Kingston, Jamaica (p. 98)
- 43 Conflicts and Lawsuits over Forest Tenure in Bolivia --** *Byron Real*, University of Florida, Gainesville, FL, USA (p. 99)
- 44 Case Study: Biodiversity Conservation and Management in the Campo-Ma'an Area, Cameroon --** *Jacqueline M. J. van de Pol*, ALTERRA Green World Research, Wageningen, the Netherlands (p. 100)
- 45 Forest Resources with Economic Potential in Extractive Reserve Chico Mendes, Acre, Brazil --** *Lúcia H. O. Wadt, Evandro Orfanó Figueiredo, Rita de Cássia A. Pereira and Nádia W. V. Pereira*, Embrapa Acre, Rio Branco, Acre, Brazil (p. 101)
- 46 Commercialization of Community Forests in Tropical Nepal: Application to the Asian Region and Abroad --** *Edward L. Webb, Ram N. Sah and Ambika P. Gautam*, The Center for the Study of Rural Populations and Forest Resources (RUPAFOR), The Asian Institute of Technology, Bangkok, THAILAND (p. 102)

Topic 4 – Non-Timber Forest Products

Poster
Number

- 47 Conservation, Management and Population Dynamics of the Harvested Palm, *Chamaedorea radicalis*, in El Cielo Biosphere Reserve, Mexico --** *Bryan A. Endress and David L. Gorchov*, Miami University, Oxford, OH, USA (p. 105)
- 48 Forgotten Fruits: The Role of Abandoned Home Gardens in a Belizean Riparian Forest --** *P. C. Kangas*, University of Maryland, College Park, MD (p. 106)

Poster
Number

- 49** **Variations in Floristic Composition of Morichal Communities in El Tigre River (Anzoátegui State, Venezuela) -- *Carolina Peña; Elizabeth Gordon and Lenys Polanco***, Universidad Central de Venezuela, Caracas, Venezuela; *Jesús Segovia*, Petróleos de Venezuela, San Tomé, Venezuela. (p. 107)
- 50** **Proyecto Aguaje -- *James Penn***, University of Florida, Gainesville, FL, USA (p. 108)
- 51** **The Commercial Harvest of “Breu” Resin from Burseraceae Trees in the Eastern Brazilian Amazon and the Role of *Sternocoelus* Weevils in its Formation -- *Campbell Plowden and Christopher Uhl***, The Pennsylvania State University, University Park, PA, USA; *Francisco de Assis Oliveira*, Faculdade de Ciências Agrícolas do Pará, Belém, Para, Brazil (p. 109)
- 52** **Characterization of Adult Brazil Nut Trees in Extractive Reserve Chico Mendes, Acre, Brazil -- *Lúcia H. O. Wadt***, Embrapa Acre, Rio Branco, Acre, Brazil; *Karen A. Kainer*, University of Florida, Gainesville, Florida, USA; *Daisy Gomes Silva*, Universidade Federal do Acre, Rio Branco, Acre, Brazil (p. 110)

Invited Speakers Abstracts

- Listed alphabetically by presenting author.
- Presenting author appears in **bold**.

Is Tropical Forest Management by Communities Sustainable?: Perspectives from Quintana Roo, Mexico

David Barton Bray

Florida International University, Miami, FL, USA

Patricia Negreros-Castillo

Iowa State U., Ames, IA, USA

Alejandro Guevara Sanginés

Universidad Iberoamericana, México City, Mexico

Juan Manuel Torres-Rojo

Centro De Investigación y Docencia Económica, México City, Mexico

Hans Vester

Colegio de la Frontera Sur, Chetumal, QR, México

Recent research on the sustainable management of tropical forests has suggested that it is an oxymoron. It has been argued by Rice and others that sustainable management has failed because returns to investment are always going to be lower than those earned from conventional logging or other land uses. The nature of tropical forest diversity and the special treatments required to assure regeneration of high-value species like mahogany (*swietenia macrophylla*) seem to make the costs of sustainable tropical forest management prohibitively high. This may or may not be true for private enterprises, but what about tropical forest logging operations conducted by communities on their own lands? This paper will present the conceptual framework and early data for a research project designed to test the proposition that tropical forest management by communities may be sustainable. An ongoing interdisciplinary research project conducted by a team of ecologists, economists, and anthropologists is focusing on the community of Laguna Kaná, a Mayan community in central Quintana Roo, Mexico. Laguna Kaná has been managing 10,000 ha of semi-humid tropical forest for mahogany and lesser-known tropical species for 16 years under a management plan, after a 25-year history of apparently unsustainable logging by outside contractors. However, the community does not only conduct logging operations on its lands, but extracts multiple timber and non-timber forest products in a diversified enterprise. A community may also apply very different discount rates that include intergenerational valuation of the forestlands. Thus, it may be that communities find tropical forest management profitable even if private enterprises don't.

David Barton Bray, Florida International University, Department of Environmental Studies, Miami, FL 33199, Phone: 305-348-6236, Fax: 305-348-6137, Email: brayd@fiu.edu

Carbon Finance and Sustainable Forestry in Practice

David Cassells and Kenneth Newcombe

The World Bank, Washington, DC

With the final agreement in Marrakesh in November 2001 on the regulatory framework for implementation of the Kyoto Protocol the stage is set for investments in the developing countries to achieve greenhouse gas emissions reductions through afforestation and reforestation activities in developing countries. The World Bank is already pioneering such investments under its Prototype Carbon Fund in Brazil and Romania, and as part of the implementation for its proposed new Forest Sector Strategy is exploring a Prototype Sequestration Fund to undertake emissions reductions investments in a large range of land use and forestry activities in developing countries that would contribute to sustainable development, biodiversity conservation, land degradation mitigation as well as climate change mitigation.

David S. Cassells, Senior Environmental Specialist, Forest Resources, The World Bank, Environment Department, 1818 H Street, NW, Washington, DC, 20433, Phone: (202) 473-1376, Fax: (202) 522-1142, Email: Dcassells@Worldbank.Org

When is the FSC Not Enough? Challenges and Lessons in the Certification of Tropical Working Forests

Michael E. Conroy

Ford Foundation, New York NY

Certification according to the principles and criteria of the Forest Stewardship Council has become a powerful new tool for encouraging and rewarding higher levels of social and environmental responsibility in sustainable forest management in both tropical forests and temperate and boreal forests. But the vast majority of the forests certified to date have been in temperate and boreal zones. What explanation can we give for the relative slowness of certification in tropical working forests?

This paper will explore, first, lessons learned worldwide in the development of the global certification movement. It will turn, then, to a series of hypotheses about the relatively slow development of certification in tropical forests, including a) the relatively low importance of “branding” in markets for tropical forest products, b) the challenge of outright illegal logging for tropical forest markets, c) fundamental problems of aggregation, scale, and species composition vis-à-vis markets in the global North, and d) the distinct challenges of community-scale forest product processing and marketing.

The paper will then review a number of creative options that have appeared in recent years for meeting those challenges, including a) the rapid growth of certified processing in China, b) innovative examples for management of the full certified value chain, and c) new marketing tools and opportunities. It will conclude with analyses of some cases where FSC certification, by itself, will not be sufficient for the transformation of tropical working forests; and it will indicate what complementary policies and programs may be necessary.

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Collaboration and Adaptation in the Marketing of Timber by Indigenous People in Lowland Bolivia

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For decades, technical assistance agencies have promoted forest management as a strategy for generating income and strengthening the land claims of indigenous people in Bolivia's eastern lowlands. While the sale of timber continues to be an attractive option for indigenous communities, it has been difficult for local groups to establish viable projects and maintain control over their forest resources. Currently, indigenous groups must follow technical and organizational guidelines established by Bolivian forestry legislation for developing management plans, and need to negotiate with neighbors, political authorities and potential buyers to assure that management rules are respected and to gain approval for timber sales. Successfully implementing a management plan to sell timber requires that the indigenous people collaborate with a diverse range of stakeholders within and around their communities, groups that sometimes have divergent or even conflicting interests. Furthermore, the long-term survival of such projects likely depends on the development of mechanisms that will allow management practices to adapt to changing socio-economic, political and environmental conditions. Forest management plans are unlikely to generate income for indigenous people or protect resources in indigenous territories if local groups cannot reach collaborative agreements with other stakeholders or adapt their management system to changing conditions.

To examine the role played by collaborative and adaptive processes in indigenous forest management, this paper will draw examples from Guarayo communities that are working with BOLFOR's Community Forestry Unit and CIFOR's Adaptive Collaborative Management program to establish timber management projects.

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Carbon Sequestration Potential through Forestry Activities in Tropical Mexico

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The United Nations Framework Convention on Climate Change (UN-FCCC), allows for market-based mechanisms to trade in greenhouse gas emission (GHG) reductions between Annex 1 countries and non-Annex 1 countries, known as the Clean Development Mechanism (CDM). Under a possible future carbon offset trading program, countries would be most likely to pay for GHG reductions in another country where the cost is lower.

Evidence from the *Scolet Té* project in Chiapas, Mexico indicates that carbon mitigation through forestry and agroforestry can be carried out at relatively low costs. Various land-use systems are considered viable, with local adjustments in terms of preferred species, planting arrangements, and rotation times. The carbon sequestration potential of these systems varies highly between systems and ecological regions and depends mainly on tree planting densities and growth potential.

The mitigation potential of an area of around 600,000 ha in southern Mexico was estimated at $38 * 10^6$ MgC for under \$US 15 MgC⁻¹, of which $32 * 10^6$ MgC by means of sustainable forest management. The choice of a baseline rate of biomass loss in the "business-as-usual" scenario remains a critical issue to estimate the carbon sequestration potential of forestry. The main sources of uncertainties observed in the calculations of the GHG-offset potential were related to: (i) classification of LU/LC types; (ii) estimation of C-stocks within each LU/LC type; (iii) historical evidence of LU/LC changes and related GHG fluxes applied in baselines; and (iv) simulation techniques used to calculate future baseline and project C-fluxes.

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Reduced Impact Logging in Old Growth Tropical Humid Forests: The “Necessary Evil”

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Even bankers hurt when they see and hear those giant Amazon trees come crashing down. It is little consolation that the chainsaw crews are well trained in directional-felling techniques and that the logs are pulled out with sophisticated skidders and harvested through state-of-the-art forest-management-plans based on computerized inventories made by specialized GPS assisted botanists.

It matters little to the canopy dwellers, bugs, birds, primates, frogs, butterflies, orchids and other extraordinary living beings that we haven't yet even discovered, who are being destroyed as their habitat is chopped-off and left to rot on the ground, that we are operating under FSC-certified conditions. In fact one always wonders if it really makes any sense to impact (to any degree) an old growth delicate ecosystem in order to destroy 90% of its Biodiversity (the canopy) and harvest only 10% (the hard fiber)? Certified or not, does this activity make any sense at all?

The long answer is that we are not yet sure (and might never be), the short answer is: yes, it makes sense from environmental, economic and social points of view. In this presentation, I review the case of the Brazilian Amazon rainforest, where our learning curve for investing in certified sustainable forest management has been quite steep.

Limited price premiums for certified wood products in today's markets are at best temporary manifestations of market in-balances in supply and demand. The main drivers are not price differentials. The main driver for investing in the certified logging of old growth tropical forests is the possibility to lock-in and explore some long term capital-gain opportunities. They include known values but also many still unquantifiable values that we can only hope to benefit from if the old growth forests stands are still around when we finally can appreciate their value.

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Retirement Benefits for Working Forests

Peter C. Frumhoff

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Global conservation priority-setting exercises have identified significant areas of the world's remaining forests as having particularly high value for the conservation of biodiversity. In the tropics and elsewhere, many high conservation value forests are threatened by current practices of legal and illegal industrial logging. These production forests constitute a tremendous but fleeting conservation opportunity. Conserving them while meeting growing demands for wood products will require three concurrent actions: greatly reducing or eliminating industrial logging operations within forests that have the greatest value for biodiversity conservation, strengthening the sustainability of forestry operations in regions of relatively lower conservation value (i.e. "chainsaw conservation"), and expanding wood supplies from well-managed plantations. Too often, these approaches have been framed as alternative, rather than complementary, conservation strategies.

This paper will address the first of these conservation strategies. I will assess the tools available to halt or prevent industrial logging in high conservation value forests and discuss the current challenges confronting their successful application on a wide geographic scale.

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Conventional Wisdom and a Pro-Poor Forest Agenda

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One influential group of foresters believes that to sustainably manage a forest for commercial timber production requires large-scale operations and detailed forest management plans prepared by professionals. They tend to view people engaged in small-scale forestry activities in natural forests as threats to forest resources, particularly if they are not active participants in social forestry projects. Similarly, many of them support strict regulation of a wide variety of forest-related activities. To improve forest management they generally promote reforming the forest concession, trade and tax policies, stricter enforcement of forestry laws, and forest certification. This presentation will question some of the assumptions underlying these views. While acknowledging the importance of improving the management of large-scale logging operations, it will argue that there are strong reasons to believe small-scale forestry activities are often a more equitable and sustainable option. In addition, it will show that many of the forest policy reforms currently in fashion are not likely to greatly improve forest management, and in some cases may make things worse.

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Forestry as a Tool for Tropical Forest Conservation: Opportunity or Illusion?

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Efforts to promote reduced-impact logging (RIL) must be tempered by a realistic perception of the tropical timber industry. I will focus on the environmental risks and realities of tropical logging, and highlight some challenges involved in implementing RIL on a large scale.

Most commercial logging operations in the tropics are poorly managed, leading to excessive environmental damage. Moreover, labyrinths of logging roads greatly increase physical accessibility to frontier forests, increasing forest invasions, deforestation, and overhunting—and to date no practical mechanism exists to halt post-logging invasions. Illegal logging is common, and endemic bribery along with inadequate training, infrastructure, and institutional support for forestry officers greatly impedes enforcement activities. Far too often, logging operations in developing nations are controlled by a few powerful clans or individuals, with the economic benefits becoming concentrated in the hands of a few.

Daunting challenges must be overcome before RIL can be applied on a large scale. Because it is less profitable than typical logging and requires special training, external subsidies are needed to promote RIL. Market demand for eco-certified timber is growing in Europe and North America but not in Asia, which is an increasingly dominant consumer of tropical timber. Although RIL techniques are well established, realistic means to undertake effective large-scale implementation are critically lacking. Non-governmental organizations could play an important role in promoting RIL, monitoring illegal logging, and publicizing harvest operations that cause excessive environmental damage.

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Opportunities and Challenges in Tropical Forest Certification

Heiko Liedeker

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Over the past 9 years FSC has received unprecedented attention. FSC's national working groups in 29 countries, 25 million hectares of certified forest operations in 50 countries and its members in 60 countries worldwide have proven that development of environmentally appropriate, socially beneficial and economically viable management of forest resources is feasible, practical and achievable.

The presentation will discuss how the unique collaboration of stakeholders in FSC built awareness throughout the global commodities sector, how it linked the global political debate with concrete achievements on the ground and how its stakeholder dialogue together with pilot projects led to significant reforms in the forest sector in several countries around the world.

FSC needs to extend its outreach in various areas of the forest sector especially in more complex environments where regulatory frameworks, management competence, stakeholder participation and balance are less developed and where market conditions are less supportive. The presentation will examine barriers to forest certification and strategies to support stakeholder participation, capacity building and forest management projects in regions and countries where market driven forest certification has so far proven less attractive.

In addition FSC needs to become involved in new areas of the global forestry debate. Within the global forest sector immediate areas include the debate on illegal logging, the certification of carbon storage under the CDM and the certification of biodiversity. The presentation will discuss how FSC can engage in the broader debate on forest conservation and develop applications and services in support of environmentally appropriate, socially beneficial forest stewardship.

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Working Forests Will Be New Ecosystems

Ariel E. Lugo

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A new ecosystem is one whose species composition or array of species importance values is new in the biosphere. New ecosystems develop all the time due to environmental change and they will increase in abundance in the future. I describe the characteristics of new Caribbean forests where humans have used landscapes for millennia. Small size, diverse topography and ecological systems, long history of human influence, and high population densities make Caribbean islands particularly useful as case studies of trends in land use and land cover change. In Puerto Rico, these trends are leading to increased built-up areas, environmental surprises, and increased dependence on external subsidies. Changes over the past 50 yr also include a reversal in deforestation, an increase in forest patch size, and formation of new ecosystems. These changes are the response of the biota to novel environmental conditions that humans are introducing. Humans can imitate nature while solving many environmental problems by explicitly accepting and designing new species combinations that can recycle waste, absorb disturbance events, protect soil, accelerate succession, or buffer human activity. Accepting and designing new ecosystems requires treating all biodiversity as equally valuable and eliminating biases based on origin, type, or bureaucratic designations of species. Tropical landscape management requires understanding and application of natural resilience mechanisms of ecosystems, greater use of ecological engineering approaches to infrastructure development, enforcement of zoning laws, enlightened economic development policies, and an understanding and agreement of a conservation vision among all sectors of society.

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Silviculture and Conservation of Tropical Forests in Quintana Roo, Mexico: Opportunities for Sustainable Timber Production

Patricia Negreros-Castillo

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In Quintana Roo, Mexico most forested land is owned through a community land ownership system called "ejidos". The forests of Quintana Roo are part of the Maya forest region (Belize, Guatemala and Mexico) and currently represent the largest continuous block of tropical forest in Mexico. Historically, local inhabitants, mostly of Mayan descent, have made their livelihood from agriculture, hunting, and gathering from these forests. Their traditional knowledge and skills have been very effective for utilizing the forests for these purposes and at the same time preserving the forests until recently. Recently, however, they have been obtaining income from marketing of valuable timber species, such as mahogany (*Swietenia macrophylla*). Because the people lack traditional knowledge and scientific methods to sustainably use the forests for timber production, there are problems with high-grading. To ensure that indigenous people continue to be the guardians of the tropical forests of Quintana Roo, they need to gain access to scientific information on managing their forests, particularly the information that has been generated in the last decade. This information should be presented to them in such a way that it becomes part of their traditional knowledge and skills, so they can then manage the forests for timber production in an effective and sustainable way. This paper analyzes the important role that the Maya people of Quintana Roo could continue to play in preserving the forests, reviews the most recent relevant silvicultural research and explores some ideas on how this scientific knowledge can become accessible to them.

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Deconstructing Forests

Kent H. Redford

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Raging debates about rates and causes of deforestation and forest degradation in the tropics obscure some fundamental confusion about what is meant by the term “forest.” The etymological roots of this term are varied and have resulted in a confusion that is more than academic. Proponents of one position or another draw selectively from the myriad definitions of “forest” in order to create arguments, and interpret data in ways that advance their positions. In order to illuminate this situation we present a typology of forests that includes many of the different definitions being used. This typology distinguishes forests on the basis of their predominant or intended use: biodiversity forests; extraction forests; ecosystem service forests; and agroforests. We also recognize that many forests may fit into more than one of these categories, and that the distinctions are sometime blurred, but nevertheless believe that by using a classification system like this one, more progress will be made towards protecting the real forests of concern.

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Making Working Forests a Reality: How Much Can We Expect from the Kyoto Protocol?

Joyotee Smith

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The debate about including forests in the Kyoto Protocol has focused on whether forests would make genuine contributions to emission reduction. This paper focuses on an issue that has largely been relegated to a back seat: what will Kyoto do for forests and forest people? Synthesizing insights from the forestry literature and from pilot carbon projects, it concludes that Kyoto's potential contribution remains highly uncertain, even though agreement on the core elements of the Kyoto Protocol have been reached. The paper focuses on two of the causes of uncertainty. It discusses uncertainties about the price of carbon under various scenarios and evaluates their implications for the competitiveness of various types of planted forests, such as fast growing industrial plantations and community plantations. It then discusses uncertainties about the way in which the sustainable development clause of the Clean Development Mechanism will be implemented and assesses the environmental and social implications of a "laissez faire" approach to sustainable development versus a "proactive" approach. Among the issues discussed are the potential impact of CDM supported plantations on timber harvesting from natural forests. It then briefly assesses the contribution Kyoto could make if other forestry activities were included in future commitment periods. It concludes by arguing that Kyoto sends a powerful signal about the willingness of the international community to pay for forest environmental services. Investment in proactive efforts to increase collateral benefits and to reduce risks could therefore reap dividends in future by stimulating mechanisms to support other environmental services.

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Sustainable Management: The Business/Economic Side

Thomas E. Wilson

International Specialties, Inc.

Many of the early proponents of certification (of sustainability), have attempted to induce producers into using and meeting the criteria of their schemes by making promises of large “Green Premiums”. In short they have told producers that if they would become certified they could obtain substantially higher prices for their certified products. Premiums of 25 – 50% have been mentioned. These “Green Premium” prices would more than offset the producer’s cost of becoming certified. However the realities in the North American commercial market place have shown otherwise. While in some niche markets there may be some customers willing to pay substantially higher prices, for certified products compared to non-certified products, the main commercial market place has not shown this tendency. Certified suppliers have many hurdles to overcome to be financially successful. This is especially true of those certified under schemes, which both increase their initial costs and require them to spread their harvests over many different species, most not currently commercially accepted. These hurdles, combined with the lack of the promised “Green Premium” have challenged many producers and forcing some to curtail or cease operations. With these challenges one must ask what allows certified producers to be profitable? They must run their operations efficiently, making use of newer technologies to both lower costs and increase utilization. They must also be inventive to be able to develop process capabilities that increase the value of the material. They must market their products to achieve maximum appreciation of their material. We’ll cover these aspects in detail.

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Oral Topic 1

Chainsaw Conservation

- Listed alphabetically by presenting author.
- Presenting author appears in **bold**.

Selective Logging, Forest Fragmentation and Fire Disturbance: Implications of Interaction and Synergy for Conservation

Mark A. Cochrane, David L. Skole, Eraldo A.T. Matricardi, Christopher Barber and Walter Chomentowski

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Working forests are premised upon sustainable management, however, ecosystems are mandated by disturbance. Therefore, conservation and management of forests requires knowledge of past, present and, to the extent possible, future disturbances. Tropical forests are increasingly impacted by degrading activities as well as outright deforestation. Landscapes have been transformed from continuous tracts of unbroken forest into mosaics of pastures, agricultural plots and forest fragments that have often been subjected to varying degrees of increased disturbance from sun, wind, fire and logging operations. Multitemporal case studies from within the Brazilian Amazon are used to illustrate the linkages and synergy between forest fragmentation, selective logging and forest fire. A geographic information system is then used to quantitatively and spatially relate disturbance across the landscape so that spatially articulated disturbance regimes can be mapped. These maps provide both knowledge of the current state of existing forests as well as the likely future of given parcels of forest. Preliminary results have shown that forest fragmentation and forest fire are directly linked with fires becoming edge effects that penetrate kilometers into standing forests. Selective logging also exacerbates fire probability but with larger effects at larger distances from forest edges. In typical anthropogenic landscapes, fragmentation effects, fire and logging can involve nearly all of the remaining forests and pose special challenges for sustainable management of these resources.

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Timber Production and Plant Biodiversity Conservation in Mesoamerican Rain Forests: Experimental Results and Their Implications for Adaptive Sustainability Assessment

Bryan Finegan, Diego Delgado and Marlen Camacho

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Nelson Zamora

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Progress towards sustainable forest management in the neotropics will eventually require greater emphasis on monitoring and an adaptive approach, for which baseline data on management effects on fundamentally important plant community characteristics are still required. In permanent sample plots (PSPs) during the first decade following intervention, lowland rain forest at two Costa Rican sites appeared resilient and productive, although natural mortality rates rose following silvicultural treatment at one site. Managed stands had floristic diversity similar to comparable undisturbed forests in both under- and overstoreys, suggesting that the ecological processes which maintain diversity continue to operate, compensating for the immediate random species loss from PSPs produced by logging and treatment. The diversity and abundance of lianas were reduced, however, and population sizes and structures of some non-commercial tree species were drastically modified by silvicultural treatment. Model simulations indicate that diversity could be maintained over the long term in production forests. Outcome indicators of floristic change, necessary for adaptive management, can be costly to evaluate, and these case studies indicate that structural indicators are poor surrogates for floristic ones. Modified permanent sample plot protocols, in combination with a focal species approach, are suggested for monitoring. Focal species would have priority if the robustness of floristic diversity under typical mesoamerican management regimes is confirmed by further work. Policy and institutional mechanisms to make monitoring possible are badly needed, and attributes of forest types - limited area, unusual characteristics and degree of threat - and management operations - type and intensity of intervention - should also be used in setting priorities for monitoring.

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The Role of Silviculture in the Conservation of Tropical Forests

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Minimizing the deleterious environmental impact of management activities, including those from logging and additional silvicultural treatments, is the conservation goal in tropical forests managed for timber production. While it is always beneficial to minimize unnecessary damage and interventions, more intensive silviculture should not be discouraged in tropical forests where it is appropriate, especially because the regeneration of many commercially-valuable timber species may depend on fairly intensive silviculture. Timber production forests where these species are not sustainably managed may be more susceptible to conversion to other more lucrative land uses. Furthermore, indirect or secondary impacts of over-hunting, timber theft, wildfires, colonization, and conversion that result from or the increased accessibility of logged areas is probably more threatening than the direct impacts of silvicultural interventions. Conservation of many tropical forests may well depend more on the implementation of successful silviculture (practices controlling forest stand establishment, composition and growth) than by minimizing the impacts of these interventions.

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Limited or Unlimited Wants in the Presence of Limited Means? Inquiries Into the Role of Satiation in Affecting Deforestation

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A number of recent studies suggest that, contrary to popular belief, intensified agricultural or forest management will not necessarily reduce deforestation. Instead, of this “win-win” situation, we may see increased output per hectare, accompanied by expanded deforestation. Although there are numerous factors cited as causes of this result, the focus of this paper is on the underlying preferences of those making resource use decisions. Economic scarcity is frequently defined as “unlimited wants in the presence of limited means”. This presentation considers the first part of this quote by investigating concepts and causes of satiation.

In the presentation, satiation is defined in terms of internal and external effects on utility (i.e. satisfaction received by resource users), and conditions are developed to describe situations where satiation may or may not be found. Then, empirical evidence is investigated regarding satiation in case studies involving aboriginal peoples and natural resource use. Despite conditions that would support the potential for satiation, findings indicate that wants tend to be unlimited. The implication for deforestation is that there is potentially yet another reason to believe that intensified agricultural or forest management will not reduce deforestation. People may tend to want more forest products or convert more forest land to agriculture, even under circumstances where we may expect them not to.

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The Regional Context of ‘Chainsaw Conservation’: Policy Enforcement, Road Paving and the Transformation of the Amazon Logging Sector

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Only five out of two thousand Amazon sawmills have been awarded certification for forest management systems. More than three fourths of Amazon mills are associated with illegal timber harvest operations. In the absence of top-down enforcement of existing forest policies that require reduced impact forest management, the prospect of bottom-up chainsaw conservation to conserve large areas of Amazon forest against conversion to cattle pasture and cropland will be diminished by: (1) an abundant supply of inexpensive timber on the market, (2) the inability of certified and legal timber companies and communities to protect their forest holdings from illegal operators, and (3) rural violence against legal companies and communities. The need for greater enforcement of existing forest policies, and for frontier governance generally, is elevated by the paving of all-weather highways into central and western Amazonia, regions that have been largely inaccessible to market-oriented production. In expeditions along the Transamazon highway in east-central Amazonia, the Cuiabá-Santarém highway in central Amazonia, and the Transoceanic highway across the Peruvian Andes, interviews of mill operators and property-holders in twelve emerging logging centers indicated that highway paving would provide these regions with rapid entry into large domestic markets for Amazon timber, particularly in Brazil. Most sawmill owners cited federal regulations as one of their largest costs (e.g. US\$20,000 for forest management planning), although indirect evidence suggested that most mill owners continued to operate illegally. Two legal logging companies had received death threats. Without effective regulation of the expanding logging frontier, the success of chainsaw conservation will be limited.

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Saving the Amazon with Sustainable Enterprises: The Amazonian Phoenix Project Valuing Biodiversity People and Social Progress

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We have designed a concept for an industry that produces ecological wood products using fiber from secondary tree species grown on previously deforested land. We propose that this concept in industrial ecology will evolve into a sustainable business on degraded lands along the southern rim of the Brazilian Amazon, competing with selective logging in native forests. In our concept model, remaining native forest becomes seed orchards, degraded lands become intensive wood production areas and sawmills are converted from nomadic and ephemeral existence into sustainable industrial structures.

The lack of alternative employment opportunities in this region of the Amazon is a fundamental driving force for deforestation and destructive logging. Preliminary evidence indicates that the proposed eco-product concept could meet the need for a locally based, employment-intensive industry. The proposed business opportunity makes use of fast growing tree species that invade deforested areas, and slow growing hardwood that can be consociated with short cycle pioneer trees.

The fiber from these secondary plants has been demonstrated to be useful as a primary component for wood composite products that could range from building materials to finished retail items. We expect that a detailed examination of our end-to-end concept will demonstrate that market opportunities generated by this eco-industry could attract significant venture capital, generate considerable employment opportunities for people who would otherwise cut virgin forest to survive, and contribute to a stronger and more sustainable Brazilian economy.

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Jungle Dreams / Mahogany Nightmares: Politico-economic Challenges to Sustainable Forest Management in the Western Amazon

Ernesto F. Ráez-Luna

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Peru contains the 5th largest extension of closed tropical forests in the world. Amazonian forests cover 60% of Peru's territory. For decades, Peruvian leaders have dreamt of conquering the jungle and turning it into a food basket for the country. Instead, the Peruvian Amazon has remained an extractive periphery. Selective logging and lumber production (chiefly of big-leafed mahogany, *Swietenia macrophylla*) are keystone economic activities in this region.

The timber industry is full of century-old problems. As much as 90% of timber is illegally logged. About 55% of round wood is lost during primary transformation. Seventy five percent of timber exports are minimally-processed sawn wood. From 1991 to 1999, Peru's mahogany exports to the USA experienced a twenty-fold increase. The ongoing mahogany fever seriously threatens the few remaining stands of the species in Peru.

A new forest law intends to reorganize the timber sector, protect mahogany, and promote sustainable forest management (SFM). The law is strongly opposed by timber industrials, and strongly supported by conservationists. In spite of its technical virtues, the law fails to address the politico-economic historical structures that produce and reproduce the illnesses of the timber sector. This is also a key failure in much of the international debate on SFM.

Historical structures operate at multiple scales. In Peru, they include nation-level center-periphery inequalities in economic exchange and political leverage, region-level semi-slavery relations of production between timber patrons and indigenous labor, and community-level gender and clan inequities. I discuss those structures, their impact on SFM, and offer a framework for solutions.

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Axing the Trees, Growing the Forest: Smallholder Timber Production in the Amazon Varzea

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Smallholder farmers in Amazonia are often portrayed as ax-wielding rainforest destroyers when in truth many are practicing forest management. We describe the timber production systems of smallholder farmers and operations of sawmill owners in areas of periodically inundated forests (varzea) in Amazonia from Macapá, Brazil, to Iquitos, Peru. Through employing local knowledge and production technologies, smallholder farmers on the varzea supply a significant portion of timber to local, regional, and even international markets. Their role in the timber industry is often either overlooked or frowned upon, but can be likened to the role of small private landowners in the United States as providing a significant portion of timber to the industry.

With recognition of farmers' intimate knowledge of natural processes such as natural regeneration and of the autecology of critical species, we describe local silvicultural practices, present production data, and characterize the managed forests in terms of species richness, forest structure, and management intensity. We present the specific case of *Calycophyllum spruceanum* as a valuable non-traditional timber species managed in a diversity of production systems in the varzea environment. We show that ax-wielding forest managers in the Amazon varzea not only meet conditions for conservation and sustainable development but thrive on the "consequences" of timber management and extraction: maintenance of species-rich production forests, reduction of forest conversion, evolution of local knowledge and extraction technologies, and expansion of the timber market to include non-traditional species.

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Oral Topic 2

Linking Communities

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Inside the Polygon: Emerging Community Tenure Systems and Forest Resource Extraction

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In this paper we focus on communities that are subjected to land tenure rules that emanate from the national level as well as those that operate within the customary setting of the territory. Community tenure systems have generally focused on defining the outside boundary of the territory and on issuing a land title to the holding group. In this paper, we make the case that it is essential to look inside this polygon if we are to promote sustainable extraction of forest resources.

Given the external and internal pressures that are squeezing these communities, can land tenure systems adapt so as to facilitate sustainable conservation and development? We examine indigenous land tenure systems in Mexico (ejidos), Peru and Brazil (extractive reserves) and show that these systems are often a contradictory mix of western law and indigenous custom.

We explore several extraction scenarios (timber and non-timber) that demand resource and tenure information inside the polygon. In each case we suggest how this could be managed within a community cadastre that builds on participatory mapping techniques and local maintenance of the cadastral information.

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From Staple to Fashion Food: Açai Fruit (*Euterpe oleracea* Mart.), Commodity Markets, and Rural Development in the Amazon Estuary

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Produced in the floodplain environment, Açai fruit (*Euterpe oleracea* Mart.) has become the main economic activity for a large number of estuarine towns during the last thirty years. This paper looks at the growth of the açai fruit economy as a regional urban staple food, and, more recently, within the national and international "fashion food" markets. The focus on a production system -- as a synthesis of multi-level social, economic, and environmental relations -- serves as a venue to discuss the linkages among development history, local livelihood, forest resources, and regional, national, and international markets. This work is based on a combination of ethnographic, inventory, archive, and remote sensing data. The paper overviews the development phases of the açai economy with emphasis on a decade long price comparison with other regional agro-pastoral products and the intensification of the production system. Paper's discussion covers: First, the role of the regional history in shaping the contemporary social landscape of the estuary and the persisting invisibility of local actors reflecting a history of social hierarchy defining agrarian structure and labor classes. Second, it looks at the mismatch among views of regional development. Agriculture intensification theory is discussed in the context of development models and agroforestry systems. Third, it looks at the heterogeneity and differential trajectories of change across communities in the Amazon estuary with emphasis on the role of land tenure, access to resources, and markets. Whereas market growth has created new opportunities, it tends to reproduce historical inequalities against local small-scale producers.

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Culture And Nature In The Maya Forest: A Working Philosophy At El Pilar

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Contemporary communities of the Maya forest have pioneered lands and adapted to environmental conditions that have a long and dynamic tradition stretching back millennia to the ancient Maya civilization. While recent community land use patterns have emerged under different conditions, the same natural and physical resources shaped links that depend on a complex interwoven alliance between culture and nature. Regardless of contemporary political boundaries, the region shares a common past, is united by the related present, and stands threatened by an ominous future. Current strategies for survival are unsustainable, and the accelerated deterioration of cultural and natural resources could be creating a situation of irreversible damage at every scale. Without clear appreciation of the alternatives, this situation will persist. The El Pilar Program unites an unique interdisciplinary research and development team that relies on an integrated science approach to understanding one of the world's most biodiverse regions: the Maya forest. The program dovetails with regional and local development activities of the regional resources Maya forest. Focused effort at El Pilar are promoting a model for investigation and conservation built on a strong research base, local and international community education awareness, and a participatory management design.

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Community-Based Forestry in the Brazilian Amazon: An Alternative Strategy for Reconciling Conservation and Development

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The potential of community-based timber management as a strategy for reconciling development and conservation objectives for tropical forests has been hotly debated. The approach has been questioned on three overlapping grounds: 1) the economic viability of forest management, 2) the impacts of forest management on biodiversity, and 3) the organizational capacity of communities to sustainably manage forest resources. Many community-based forest management projects in the tropics involving timber extraction and processing have been plagued by problems. Even where the resource base was adequate, the large scale, technological complexity and organizational demands of the enterprise frequently exceeded the individual and collective abilities of the local organizations that were supposed to manage them.

Here we report progress on an alternative strategy for developing community-based forest industries now under way in the Tapajós-Arapiuns Extractive Reserve of the state of Pará, Brasil. This strategy involves four main elements: 1) emphasis on organizational development and skills acquisition, 2) management focused on small selective harvest of annual growth rather than liquidation of all merchantable stock, 3) small scale, simple tools and productive process for making furniture, and 4) incremental process of implementation geared to increase the scale and technical and organizational complexity of the enterprise as group capacity to manage forests and produce and market furniture develops. Preliminary results indicate that this strategy has the potential to address problems encountered in many earlier initiatives. The critical challenges are those facing any business: insuring overall efficiency, product quality, reliability of supply and access to appropriate markets.

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Indigenous Communities and Forest Resources in Brazil: The Cost of Conservation

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In Brazil, and especially the Amazon Basin, indigenous reserves occupy large tracts of tropical forest and savanna/forest ecosystems, and will play an increasingly important role in the conservation of biodiversity. Many indigenous communities are moving from traditional, non-monetary subsistence economies to full participation in national economies through the sale of crafts, extractive forest products, agricultural products, or through wage labor. During this economic transition the temptation to liquidate timber resources is great, unless alternative sources of income are available. However, for indigenous groups with little economic or managerial expertise, exploitation of timber can be disastrous from both a social and ecological point of view.

This paper examines some of the issues surrounding timber resources on indigenous lands, as well as the cost of creating and supporting alternative economic opportunities for two groups, the Parakanã of Pará State and the Waimiri Atroari of Amazonas/Roraima. As part of mitigation for social and environmental impacts caused by hydroelectric projects on tribal lands, these groups are benefitted by aid programs which include health care, education and support for production. In the case of the Parakanã, this support involves the sale of agricultural and extractive forest products, and to a lesser degree, crafts. Recently, the Parakanã have also begun to collect and market seeds of timber trees, principally mahogany. The principal source of income for the Waimiri Atroari is the sale of crafts, which generated approximately US\$ 40,000 in the year 2000. On a yearly basis, these aid programs for the Parakanã and Waimiri Atroari require expenditures on the order of \$1000 per individual of each tribe. This value permits an idea of the costs associated with providing support for forest dwellers, not only in terms of health care and education, but also for the development, transport, and marketing of their products.

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Does Participatory Research Stimulate Community Natural Forest Management?: Indigenous Experiences from Lowland Bolivia

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Bolivian natural forest management needs to reflect community processes and participatory research is an effective strategy to achieve that goal in indigenous territories. Despite the fact that more than 3 million hectares of natural forest has been claimed as indigenous, indigenous forest management experiences are limited. The political and social tools used to promote sustainable management by the timber industry need to be re-designed for promoting sustainable production from indigenous territories. Recent experience has shown that participatory research can be an important tool for stimulating indigenous people in the sustainable use of their natural resources.

From 1997 to 2001, CIDOB (The Confederation of Indigenous Peoples of Bolivia) implemented a project financed by DFID (British International Cooperation Agency) which focused on strengthening indigenous participation in research and management. The project supported 20 small participatory research projects, conceived and carried out by indigenous researchers, guided by academic co-researchers and focused on traditional resource use and land management practices. Support was awarded by merit based on originality of the research idea.

These experiences demonstrate that participatory research can stimulate curiosity, self-esteem, and community participation, as well as document local knowledge. The traditional elaboration of various commercial products was researched and this has stimulated commercialization of the same. At least one community has had some success with selling their non timber forest products. Other projects adapted scientific censusing techniques to local conditions and community participation. The participatory research experience has provided valuable lessons for achieving integrated natural forest management in Bolivian indigenous territories.

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Approaches to Sustainable Community Forestry: Perspectives from Mexico and Honduras

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Achieving sustainable forest management poses many challenges for nations that aim for economic development while also protecting their natural resources. Community forestry has been promoted as a means to combine community development with sustainable forest management practices. Not only does community forestry promise benefits to local populations, it also can reduce government costs for forest monitoring and management when communities take on these responsibilities. In theory, communities that gain income from forests will adopt sustainable management practices in order to maintain the resource base. Yet policy initiatives and programs to promote community forestry have encountered numerous obstacles to success, and many communities have encountered difficulties in finding markets or selling forest products profitably while maintaining sustainable harvesting. This study discusses case studies from Mexico and Honduras, with a focus on two communities that are committed to managing their common property forests wisely. One community has limited commercial activities to resin-tapping, while the other has chosen to market value-added timber products. Both communities have encountered dilemmas, from external obstacles and contradictions to internal tensions. The paper explores socioeconomic, historical and cultural dimensions that contribute to these communities' successes and shortcomings in forest management, and their relationships to the broader economic and policy contexts. In the process the discussion examines the challenge of sustainable forestry and its broader implications for the role of the state and community autonomy in natural resource management.

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Strategies to Improve Rural Livelihoods through Markets for Forest Products and Services

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In this paper, we argue that global challenges of meeting growing forest product and service demands, and forest conservation can be met while *also* reducing rural poverty. Forestry plays an important role in livelihoods for the rural poor, and commercial forest markets present a valuable development opportunity for them. Many factors presently limit forest market participation by local people but major changes and innovations in markets, resources and governance are re-shaping the forest sector.

We conclude that to take advantage of market opportunities and raise incomes significantly, local producers must improve their market position by managing livelihood risks by managing a “portfolio” of products in different income/risk categories, and maintaining the capacity to switch products as markets change. Phased market development over time is usually necessary, so that producer capacity has time to develop, and strategic business partnerships can benefit both private industry and local forest producers. We also recommend securing forest ownership and access rights of local people to expand local business opportunities. Reducing the excessive regulatory burden on local forest producers is necessary for them to participate profitably in legal forest markets. Forest market policies that discriminate against poor producers must be reformed significantly to realize potentials for local participation. Active involvement of local producers in forest policy negotiations will result in more practical, realistic and lower-cost laws, regulations and development plans.

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Oral Topic 3

Paying for Carbon

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Funding Forestry through Carbon – Case Studies from across the Tropics

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The paper will present a number of forestry projects from the tropics where carbon constitutes an additional income-generating stream for various forestry based activities. Using examples from across the tropics, some of the key issues in the carbon project cycle will be illustrated, including the setting of baselines, the quantification of offsets and carbon credit accounting. This will be done for a range of activity types including reduced impact logging and the sustainable management of a forest unit, integrated conservation and rural development, afforestation and forest rehabilitation.

Using the case studies, the presenter will demonstrate how different funding mechanisms can be used to meet the needs and objectives of both the project developer and the investor.

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From Global Governance to Local Realities: Capturing Carbon through Conservation. A Participatory Evaluation of the Noel Kempff Climate Action Project, Bolivia

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In the wake of the Kyoto Protocol of the UN Framework Convention on Climate Change a strong interest has emerged on the role of forests as sinks for greenhouse gases. In the light of uncertainties surrounding co-benefits of global mitigation with the localised importance of forests, forest management and the communities dependent on them the Noel Kempff Climate Action Project in Bolivia was assessed during five months PhD fieldwork culminating in a multi-stakeholder participatory evaluation workshop (2001). The paper suggests key factors contributing to the Project's impact on local institutional arrangements and access to common property resources includes trust and transparency between actors, opportunity for adaptation, context specific development and enabling legislation.

The paper contextualises the Project in the Bajo Paraguá zone of Bolivia illustrating how multiple conservation and mitigation objectives have contributed to complex inter-linkages between local institutional arrangements, community dynamics and management regimes. The author suggests parallels can be drawn between the project's compensation approach and initially limited community participation with traditional Conservation and Development projects. However, she argues that local actors do not recognise this as an indicator of "project failure," but rather as a process of change, resulting in an adaptive learning experience, strengthening capacity and collaboration between outsiders and insiders.

Concluding, the paper advocates that the communities are agents of change, adapting and exploiting benefits largely through institutional change, planning, representation and participation. These changes have impacted community dynamics, and despite incidences of conflict local stakeholders have chosen to engage in dialogue consolidating internal management regimes.

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Cost and Potential of Carbon Mitigation in Tropical Forestry

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This paper analyzes specific activities in selected tropical countries involving carbon sequestration and GHG emission reduction with an objective of estimating the cost and potential for mitigation in tropical forestry. The analysis is based on studies carried in Brazil, Mexico, Tanzania, India, Indonesia, Philippines and China using a common methodology (COMAP) to estimate the cost and potential for carbon mitigation. The approach requires the projection of baseline and mitigation land-use scenarios. It allows for the estimation of monetary benefit per t C by using the data on carbon sequestration, emission reduction and non-carbon costs and benefits. The residual cost provides a measure of the 'at-cost' value of carbon in tropical forests in the services global climate change mitigation.

Preliminary results show that about half the cumulative mitigation potential of 6.2 Gt C between 2000 and 2030 in the seven countries (about 223 Mt C/yr) could be realized at a negative cost, the next 2 Gt C being achieved at a cost not exceeding \$ 20 per tC, with the remainder costing less than \$100 per t C. Negative cost potential indicates that non-carbon revenue is sufficient to offset direct costs of these options. The achievable potential is likely to be smaller, however, due to market, institutional, and socio-cultural barriers that can delay or prevent the implementation of the analyzed options. The actual value of carbon in tropical forests will depend on the prevailing conditions in the forthcoming market for carbon credits.

Keywords: carbon mitigation potential, cost per tC, forestation, forest protection, tropical forestry, carbon trading

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Climate Stability through Forest Sequestration Activities

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Worries over the impact of increased carbon in the atmosphere are driving the world forestry in a new direction. After about a decade of deliberation, sequestration activities are now being recognized as a legitimate vehicle to harvest carbon dioxide emissions from industrial activities. The Kyoto Protocol and other mechanisms are creating methods in which an emitter can pay for reductions achieved by another, and count those reductions as his/her own. The quantity of reductions expected to be realized through greenhouse gas (GHG) emissions trade is about 500 million t/C per year, with over 10% permitted in forest based carbon sinks.

This presents an enormous opportunity and novel challenges to tropical forest communities. In particular, issues such as ensuring project's goals while keeping costs low and the implementation practical are central. To facilitate this process, the International Carbon Bank and Exchange (ICBE) has created a virtual framework in which a variety of participants can fulfill their role to enable a greenhouse gas transaction in an efficient manner. In this paper, I will demonstrate how forestland owners can use this system to generate carbon projects and participate in carbon emissions trading and learn how reductions are verified and mapped to their exact location. I will make this example using tropical forest projects, which are in progress.

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Oral Topic 4 Certification

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Developing Principles, Criteria, Indicators and Verifiers for Forest Management Units: Tools for Defining, Evaluating and Communicating the Ecological Sustainability of Forest Management in Costa Rica and Nicaragua

Kathleen McGinley and Bryan Finegan

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The Costa Rican Standards and Procedures for Sustainable Forest Management and Certification (CNCF 1999) and the Nicaraguan proposal of principles, criteria and indicators for sustainable forest management (PC&I) (INAFOR 2000) are examples of national level efforts to establish guidelines to define, evaluate and communicate sustainable forest management (SFM) in the neotropics. Both proposals focus primarily on the fulfillment of sound forest practices with comparatively little emphasis on adaptive management and the assessment of management impacts and outcomes.

CATIE's C&IEcoAdapt project: Ecological Criteria and Indicators for Adaptive Forest Management was initiated to propose standards for the evaluation of SFM that encompass elements of adaptive management for Costa Rica and Nicaragua, to contribute to the process of testing and validation of existing national forest management standards in the neotropics, and to advance the understanding and experience with processes for developing national level standards (e.g. sets of PC&I) for the evaluation of sustainable natural tropical forest management using existing or generic C&I sets as a starting point.

The basic research process encompassed three phases of evaluation (in-office, desk and field) of the initial or 'starting point' set of elements taken from existing national standards and the CIFOR generic C&I template (predominantly focused on evaluating forest management outcomes) and involved multi-disciplinary, international groups of experts in forest ecology, management and policy. The paper discusses the process and results of CATIE's C&IEcoAdapt project, underscoring the development of national standards for forest management as part of national conservation/sustainable management strategies and ultimately, facilitating forest certification at the forest management unit and national level in Costa Rica and Nicaragua.

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Conservation with Certified Timber: The Experience of Programme for Belize

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Certified timber production has been undertaken by the non-profit organization Programme for Belize (PfB) as part of its mission is "to link conservation of tropical forest with the development of sustainable land uses that leave the forest and its environmental values intact." Out of a 95,000 hectare reserve in northwestern Belize, PfB designated 17,800 hectares of subtropical moist forest for timber extraction. Between 1997 and 1999, PfB harvested 420,200 board feet from 800 hectares. Both Woodmark (Soil Association) and Smartwood (Rainforest Alliance) certified the timber harvest, allowing PfB to export certified lumber. In addition to certification, PfB had the advantages of secure tenure, an existing road network, and the possibility of sharing infrastructure costs with other activities such as ecotourism. However, a financial analysis demonstrates that timber extraction was not profitable. Given the current cost structure and prices, only extraction of mahogany (*Swietenia macrophylla*) generates significant profits. Reasons for this lack of profitability include some particular to PfB, such as the experimental nature and research objectives of the operations, and the costs of contracting and monitoring agents to extract, transport, and mill the timber. Other reasons are inherent to certified timber production in this region, including reduced timber volumes due to previous logging, higher costs relative to commercial loggers operating under less rigorous and poorly enforced standards, and the difficulty of obtaining a premium price for certified wood from all but the best known species.

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Poster Topic 1 Tropical Land Use and Land-Cover Change

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Measuring and Monitoring Carbon for Forest-Based Projects: Experience from Pilot Projects

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There are many pilot forestry projects that are under some stage of implementation, and much experience has been gained from them with respect to measuring, monitoring, and accounting for their carbon benefits. For forestry projects, not all pools need measuring—a selective accounting system can be used that includes all pools expected to decrease and choice of pools expected to increase as a result of the project. Such a system allows for trade-offs between expected carbon benefits, costs, and desired precision, while maintaining the integrity of the net carbon benefits. Techniques and methods for sampling design and for accurately and precisely measuring individual carbon pools in forestry projects exist, are based on commonly accepted principles of forest inventory, soil sampling, and ecological surveys, and have been well tested in many part of the world. Experience with several forestry projects in tropical countries have shown that with the use of these techniques carbon pools can readily be estimated to be within less than $\pm 10\%$ of the mean at a modest cost. To date, there is little experience with measuring the changes in carbon stocks over time, but use of the correct design and sufficient numbers of permanent plots, it is expected that precision levels will be maintained at less than 10% of the mean.

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Using Lidar to Identify Structural Differences between Primary and Secondary Tropical Rainforests

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Remote sensing is an invaluable tool for estimating forest cover over vast or inaccessible areas; such techniques have been applied to measure various biophysical attributes of forest canopies including height, stand volume, and aboveground biomass. The development of large footprint lidar (light detection and ranging) has allowed accurate mapping of canopy structure of closed canopies with high leaf area indices (LAI). Analysis of lidar return waveforms has yielded various structural descriptions such as canopy surface height, height profiles, and canopy volume. Field research has shown primary and secondary tropical rainforests to be both structurally and floristically discrete; therefore, remotely sensed canopy characteristics may be able to distinguish primary forests from secondary forests. Secondary forests act as nutrient sinks, and primary forests are potential sources but remain relatively at equilibrium under natural disturbance regimes (gap-phase dynamics). Thus the ability to discern rainforest types is integral in developing accurate estimates of global carbon dynamics and local nutrient cycling. For this study, lidar data were collected from primary and secondary tropical rainforests at La Selva Biological Station in Costa Rica in March 1998 for the Vegetation Canopy Lidar (VCL) mission. Using height, fractal dimension, and semi-variance techniques on this lidar transect data, we assessed the ability to distinguish between primary and secondary tropical rainforests.

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Economic Impacts of Fire in the Amazon

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Fire usage is a deeply rooted cultural practice in the Brazilian Amazon. Every year, towards the end of the dry season, farmers and landholders burn their lands to transform forest areas into agricultural and grazing lands. Within this context, fire is one of the principal elements in the agricultural expansion of the region. Paradoxically, when out of control, fire also causes losses to rural property owners by burning areas that were not supposed to be burned and generating externalities to society. This risk of uncontrolled fire stimulates property owners to reduce investments in their properties, perpetuating the dominance of extensive cattle ranching and slash and burn agriculture at the expense of agroforestry systems and sustainable forest management. Fire damage valuation is complex and ignored by the economic system, which considers, exclusively, the benefits obtained from using this agricultural practice. Our main objective is to evaluate the economic and environmental impacts of fire in Amazonia, for society as a whole and for rural property owners. The impacts include burned grassland, forest, plantations, lost fences, CO₂ emissions and respiratory diseases. Physical and monetary quantification of fire losses in Amazonia is done using the environmental economics theoretical-methodological framework. Fire and smoke damages to rural property owners and negative externalities to society are identified. Preliminary results indicate that the losses caused by fire in the Amazon can represent 3% of the region's GDP. These estimates constitute a valuable tool in the discussion and elaboration of public policies related to accidental fire prevention and control.

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Long-term Monitoring of Natural and Anthropogenic Change in a Neotropical Rainforest Using Remote Sensing Imagery

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Yasuní National Park is the largest park in Ecuador and spans nearly 1 million hectares of pristine lowland rainforest, floodplain forest and swamp communities. However, rapid colonization and deforestation is occurring along two major oil access roads built through the park. The ability to understand and manage deforestation requires a multidisciplinary approach combining forest successional dynamics, human economics and wide-scale monitoring of present and past forest conditions. Satellite-based remote sensing is an excellent tool to provide much of the information required to adequately monitor and predict colonization of these forests. Here, we present initial results from 35 years of remote sensing data over the park, quantifying both deforestation rates along the two roads as well as relevant forest parameters including turnover rate and successional stage. These data will ultimately be integrated into a model to determine the future conditions of the forest under current and proposed conditions, as well as examining the feasibility of realistic, alternative management and land use practices.

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Natural Regeneration in an Atlantic Forest Fragment Located in Rio de Janeiro State, Brazil

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In this study, the fragments of native tropical forest covering were considered inside of the limits of the National Forest Mario Xavier. The Mario Xavier National Forest is located in Seropédica County, state of Rio de Janeiro, Brazil, and was created in 1986 with an area of 493 ha. It has the most important native forest fragment in Seropédica, covering an area of about 60 ha, and is a residual part of Brazil's Atlantic Forest.

The aim of this research was to show the expansion of native forest through natural regeneration in this tropical forest fragment, using geoprocessing technology with a field survey.

Using aerial photo interpretation, the native forest covering was quantified and mapped in five different moments, encompassing a period of 36 years. A sequence of images, obtained at different ages, between 1964 and 2000, showed that in the Mario Xavier National Forest, 34.2 hectares of natural expansion of native forest have occurred over the 36-year period, corresponding to an annual increase of native vegetation cover of 0.95 ha/year.

Expansion of native forest through natural regeneration relies mainly on naturally dispersed seed. To identify the more important species in the Mario Xavier National Forest natural regeneration process, a field survey was developed. *Erythroxylum pulchrum*_A.St.-Hill, *Casearia sylvestris* Sw., *Casearia inaequilatera*_Camb., *Anadenanthera colubrina* (Vell.) Brenan, *Piptadenia gonoacantha* (Mart.), *Inga marginata* Willd., *Tabebuia cassinoides* DC. and *Genipa americana* were identified among others species.

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Impact of Aspect and Urban Matrix in the Structure and Composition of the Vegetation in the Limestone Hills of Puerto Rico

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Urban centers may affect the plant composition and structure in limestone hills. I compared the vegetation composition and structure of limestone hills slopes with different matrix (urban or secondary forest) and aspect (northwest or southeast). I selected twelve limestone hill slopes in Puerto Rico. Four different conditions of matrix and aspect were chosen: urban (U) northwest (NW) and southeast (SE), and secondary forest (F) northwest (NW) and southeast (SE). Plants were grouped in three categories of basal area (ba) to evaluate the effect of conditions on different plant sizes. For small plants ($0.03\text{-}30.00\text{cm}^2$ ba), diversity of the community is influenced by matrix and aspect. Southeast small plant community showed similar diversity values for both matrixes. However, F-NW had the highest diversity and U-NW had the lowest diversity among all conditions. Southeast aspects have higher species richness than NW, but no differences between densities were found. Diversity and species richness for medium-sized plants ($30.1\text{-}315.0\text{cm}^2$ ba) were higher in plant communities adjacent to urban matrixes, but not between aspects. No difference was found in plant density among conditions. Large plants ($> 315.1\text{cm}^2$ ba) diversity, species richness and density were not different between conditions. Species composition in the small-sized category showed more similarity among communities with the same matrix. Species composition in the medium-sized category grouped the communities by aspect and matrix. Aspects and matrixes have an influence on the plant community structure and composition on limestone hill slopes, but the influence of matrix and aspect varies among plant size classes.

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Effects of Livestock on Structure and Composition of Floodplain Forests in the Lower Amazon, Brazil

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In the Lower Amazon, introduced cattle and water buffalo freely range within floodplain forests at densities ranging from 10 - 15 animals/ha. Heavy livestock activity in floodplain forests has caused concern that woody regeneration may be inhibited by livestock and causing forests to be converted to grasslands. We inventoried 21 floodplain forest stands to see if livestock activity was related to forest structure, woody stem species composition, and soil properties. Each forest was assigned a level of livestock activity (heavy, moderate or light) based on the density of pug marks found in each inventoried plot. In each forest, we counted and measured saplings, seedlings and adult woody stems in three randomly placed 1000m² plots. In addition, we measured soil bulk density, soil compaction and light penetration in forest plots. We found that forests with heavy livestock activity had significantly less seedlings, saplings, and basal area compared to forests with light activity ($p < 0.05$). Forests with moderate livestock activity had significantly higher diversity and seedling density than forests with heavy activity ($p < 0.05$). Soil and light properties were also positively related to livestock activity. Ranching is expanding on the Amazon floodplain. In the future, most floodplain forests will be exposed to heavy livestock activity. If soil compaction and trampling by livestock is decreasing seedling and sapling density, light penetration may increase and give a competitive growing advantage to native grasses in the forest understory. If woody regeneration continues to be suppressed, forest may eventually be converted to grasslands.

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Tropical Lowland Rainforest Loss and Bird Diversity: A Case Study from Southeast Asia

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There has been unprecedented loss of tropical lowland rainforests in Southeast Asia. This trend is continuing despite the fact that Southeast Asia is one of the mega-biodiversity regions of our planet. I studied the effects of tropical lowland rainforest loss on bird diversity in Singapore. Singapore is an island state and is one of the most densely populated areas of our planet. Since mid 1800s, forest loss in Singapore has been extensive with only 5% of the native forest cover currently remaining. As a consequence, Singapore has lost 67% of its forest-dependent avifauna. Comparisons with larger forests in Peninsular Malaysia show that the bird communities are depauperate in Singaporean forest patches. Artificial nest experiments also reveal possibly very high predation in the forest patches. Studies from Singapore show heavy and irreversible loss of avian diversity following forest loss. Countries in Southeast Asia should reconsider their heavy deforestation practices. It may be essential to protect large tracts of lowland rainforests for the long-term viability of avian communities.

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Forest Cover Change in a Western Honduras Community: Accessibility and Protection as Determinants of Landscape Transformation

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This study addresses the issues of trajectories of forest cover change and their relationship to the social and biophysical trajectories of the landscape in Western Honduras. This region presents a complex mosaic of land cover change processes that involve multiple human and environmental dimensions. Remote sensing imagery of 1987, 1991 and 1996 were used to examine land cover change and landscape fragmentation with regard to elevation, and distance from roads. Changes in landscape pattern can be related to increasing pressure on the land, and concurrent shifts in land use. Through the 1990s export coffee production has expanded in the region, resulting in clearings of forest on steeper slopes and higher elevations. We also examine the effectiveness of park boundaries in deterring deforestation within this study region for Celaque National Park. Over time, there is increased deforestation in the buffer region, while the park boundary and core region appear to be maintaining forest cover. Forest plot level vegetation analyses were used to link the ground based and satellite data to evaluate changes in forest cover over the larger study area. A community level analysis within this larger study area shows the importance of land tenure, with higher rates of deforestation and lower rates of reforestation in communal versus private forest. This research highlights the importance of multi-disciplinary analysis in linking the spatial patterns of land cover change to the processes driving land use change within this complex, dynamic landscape.

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The Role of Land Tenure on the Occurrence of Accidental Fires in the Amazon Region: Case Studies from the National Forest of Tapajós, Pará, Brazil

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During the dry season of 1997, the Brazilian Amazon region experienced fires on a vast scale. Logging, cattle ranching, and agriculture have impoverished and fragmented significant portions of the forest and increased the unwanted spread of fires beyond their intended limits.

The main question addressed in this research is whether variation in property regimes affects the incidence and spread of accidental fires. Property regimes produce different incentives for land use with implications for the spatial and temporal patterns of deforestation. Distinct landscape patterns create differential conditions for the spread of accidental fires. To fully understand the relationships between land tenure, land-use systems, landscape structure, and incentives, it is important to consider how the specific rules devised within a given tenure regime shape farmers' decisions about land use and fire management at the local level, and to what degree, these rules depend on higher level decision-making processes.

Working forests are embedded in institutional landscapes and this paper will discuss the conceptual approach to this topic. The paper presents a research design to capture these relationships and presents preliminary results. Archive research, field surveys, and analysis of remotely sensed data are used. The paper explores important aspects of sampling within different land tenure systems, the main variables that allow capturing these aspects, and how these aspects relate to land use/land cover.

This is a particularly relevant study area because the governmental property overlaps common and private properties, which is representative of numerous conservation units throughout Latin America.

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Reforestation Activities for Watershed Restoration in Nicaragua

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The torrential rains of Hurricane Mitch in October 1998 caused great damage to the infrastructure and natural resources of Nicaragua. Hurricane effects most heavily impacted the Departments of Chinandega, Leon, Esteli, Nuevo Segovia, and Madriz. The area around Casitas in the Maribios volcanic chain and steep-slope zones in departments farther north suffered severe landslides that resulted in stream channel scouring and massive sediment/debris deposition. Much of the disaster can be linked to the combination of slope steepness, previous deforestation with lack of soil conservation in farming systems, and grazing practices. Maintenance of perennial tree cover in the landscape is one of the best watershed management practices possible. The USDA Hurricane Mitch Restoration Project was active in 2000 and 2001. Reforestation efforts focused on establishment of perennial vegetation on sloping lands and along upper reaches of stream courses as well as restoration of tree cover on agricultural lands and riparian areas damaged by floods. From July-September 2000, USDA directly sponsored communities planting 40,000 fruit tree seedlings and 350,000 forestry seedlings across the western half of Nicaragua with NGO/PVO partner groups. Efforts in 2001 focused on projects with small grants to NGOs, demonstrations, and training events. Concentrated technical assistance to the National Tree Seed Center for tree seed collection and storage helped assure quality germplasm for partner groups and other reforestation efforts in country. Additional USDA support for the forestry sector included technical training and assistance in nursery production, agroforestry, forest products certification, forest policy, and GIS/remote sensing applications for forest management.

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Poster Topic 2 Tropical Forestry for Timber Production

- Listed alphabetically by presenting author.
- Presenting author appears in **bold**.

Spatial and Temporal Distribution of Selective Logging in Eastern Amazon Using Visual Interpretation Analysis of Satellite Images

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There are uncertainties related to the area annually affected by selective logging in the Amazon. Methods that include measurements of satellite images and interviews have been used to quantify the area annually affected by logging in this region, producing results that vary from 1500km² up to 15000km². In this study, an alternative method is presented to assess the extent of logged area using visual interpretation of digital images. This method consists of multi-date analysis of selective logging scars on 4 coregistered Landsat TM scenes of 32,340 km², during a 7 year period. The study area is located between the cities of Paragominas and Tailândia, two important logging centers in the eastern Amazon. The images used were path/row 223/62 from June 1993 and 1995, August 1999 and 2000. The purpose of this study is to quantify the logging area per year, to map the use of logging areas after the logging activity and to identify the temporal and spatial distribution of the logging areas. Preliminary results indicated that an average area of 2,600km² per year was affected by logging in 1999 and 2000. In this old logging frontier, 82 % of the area logged was abandoned to forest regrowth from 1993 to 1999, while 12% of the logged area was deforested and 6% logged again. This method is suitable for identifying areas of recent and intensive logging in the Amazon, and is a fast and simple tool for monitoring this activity in the region.

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Liana Loads and Post-Logging Liana Densities after Liana Cutting in a Lowland Forest in Bolivia

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Liana infestations are a problem in many forest management areas because lianas decrease rates of tree growth, damage tree boles, and inhibit regeneration. We described "liana sheds" of canopy trees and quantified liana regeneration in felling gaps after selective logging in a liana-rich moist lowland forest in Amazonian Bolivia. Of 80 individual trees >10 cm in DBH representing 11 commercial species, 90% had at least one liana >2 cm diameter. Infested trees with lianas hosted an average of 14 lianas ($\pm 14.9 = \pm 1\text{sd.}$; range: 1 to 68 lianas). The mean area of the crown affected with lianas was 35% (± 29.7). Of the trees colonized by lianas, 90 % had lianas within the crowns and 10 % had lianas only on their boles. Crown position and crown quality were not correlated with liana infestation, but a higher than average proportion of slightly curved trees were liana-laden. There was a weak positive correlation between crown size area and degree of liana infestation. Liana shed area was a function of crown area. Most lianas on trees were rooted below their crown (90%), the number of lianas decreased with increasing distance from the crown edge, but lianas colonized trees as far as 8 m from the edge of their crown.

Liana regeneration in felling gaps after selective logging was mainly by sprouting of fallen stems. Pre-logging liana cutting reduced liana density and post-logging liana proliferation in logging gaps.

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Short and Long-term Effects of Selective Logging on Timber Tree Regeneration in French Guiana

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Timber tree regeneration is an important component of any sustainable management strategy that includes selective logging. I have investigated how logging damage influences patterns of regeneration after selective logging in French Guiana.

In a before-after survey of logging damage at 220 sampling points, I characterized post-logging microhabitats based on differences in physical parameters. Skid trails had increased light availability and soil compaction; and sites where trees were cut had more open canopy and less compacted soil. However, in a site logged twelve years earlier (264 sampling points), I found only slight differences among post-logging microhabitats. Skid trails still received more light than understory sites, but not as much as actual canopy gaps. And no soil characteristic differed between post-logging microhabitats and undisturbed understory. Significantly, I found no relationship between harvest intensity (basal area removed of 0 - 42m²) and damage to the physical environment.

In an experiment simulating soil disturbances characteristic of recently-logged microhabitats, two large-seeded and a very-small-seeded pioneer species exhibited little reduction in survival in response to compacted and bare soils, while other small-seeded non-pioneers failed to establish seedlings. In contrast, survivorship from seed differed only slightly among post-logging microhabitats in forest logged twelve years earlier.

These results suggest that small-seeded timber tree species lacking a seed bank may experience reduced seedling establishment immediately after logging, especially in microhabitats with soil disturbances. However, if seed sources are ensured and dispersal syndromes remain intact, then these results predict little long-term effects of logging damage on seedling establishment in French Guianan rainforest.

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Fire Vulnerability of Bolivian Sub-humid Forests Subjected to Different Silvicultural Treatments

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Fire, an increasingly important disturbance in tropical forests, threatens the potential to manage these forests for a number of key objectives including sustained timber yields. The risk of severely damaging fires may be particularly high in forests that require intensive management to achieve sustained yields. Such management is probably necessary in Bolivian sub-humid forests to enhance the currently inadequate regeneration, recruitment and growth of commercial species. If intensive silviculture – which disturbs the soil and creates large canopy openings – is necessary to sustain commercial timber yields, an important tradeoff may be greater vulnerability to fire because of increased fuel loads and faster dry down rates. I tested this hypothesis in La Chonta, a Bolivian timber concession situated in a sub-humid forest.

To assess whether flammability varied significantly across the range of microsites created by different management intensities, I first established a relationship between vegetative cover and fuel dry down rates during the dry season. Because this relationship was relatively weak, I tested whether the litter layer could carry fire under the same range of microsites. Despite significant differences in the area burned across this range, fire carried in nearly all cover conditions indicating that most of La Chonta is vulnerable to fire. These results suggest that intensifying management for silvicultural objectives will not significantly increase fire susceptibility in this forest. It may, however, increase fire severity. Moreover, because forests like La Chonta are highly flammable, silvicultural objectives may be undermined unless accompanied by efforts to prevent and control fires.

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Conservation in the Service of Economics?: Financial Benefits of Skid Trail Planning to Reduce Future Crop Tree Damage

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Research comparing planned and unplanned logging operations in Brazil, Guyana, and Suriname has shown that the increased costs of skid trail planning are compensated by financial gains from greater skidding efficiency. Moreover, studies throughout the tropics have demonstrated that damage to the residual forest is significantly reduced in planned versus unplanned operations. Of further interest is whether the financial benefits of protecting future crop trees outweigh the increased cost of skid trail planning to avoid these trees. We undertake a simple analysis of operations conducted in the forestry concession of La Chonta in Guarayos, Santa Cruz, Bolivia to examine this question. The analysis is based upon cost and damage data from La Chonta and estimates of improved planning costs extrapolated from planned logging studies in Brazil. Our conservative estimates indicate that the present value of financial benefits gained in improved future crop tree conservation may be expected to exceed planning expenses. FCT protection plus the cost reductions that result from greater skidding efficiency within a planned forest infrastructure should provide adequate incentive for the adoption of this forest-conserving practice by Bolivia's forest concessionaires.

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Financial Returns under Uncertainty for Conventional and Reduced-Impact Logging in Permanent Production Forests of the Brazilian Amazon

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Reduced-impact logging (RIL) techniques are designed to improve the efficiency of timber harvesting while mitigating its adverse impacts on the forest ecosystem. Research on RIL in select tropical forest regions has demonstrated clear ecological benefits relative to conventional logging (CL) practices, however, the financial competitiveness of RIL is less conclusive. We conduct a comparative analysis of financial returns to one and two cutting-cycle harvests for representative RIL and CL operations of the eastern Amazon. Uncertainties of forest productivity and market conditions and observed variability in harvest efficiency and are introduced in a stochastic simulation of future biological and financial returns to the alternative logging systems. Despite the perceived investment risks, RIL harvesting operations generate competitive or superior returns relative to CL for a wide range of discount rates due to gains in harvest efficiency and forest conservation.

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The Secondary Forests of Tropical America; Perspectives for Their Sustainable Management

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IUFRO Working Group 1.07.00 Colombia

Failure to recognize the advantages of tropical secondary forests reflects certain generalized perceptions, notably: the forest does not produce commercial timber; trees are very small or they do not have marketable value; their floristics represents an obstacle to develop modern industrial processes; natural regeneration of traditional timber species is often inadequate; the recuperation process of already degraded forest sites is quite expensive. These considerations overlook the formidable potential of secondary forests as producers of goods and services.

The need for a new ethic to properly manage tropical forests is essential. The following elements are necessary: absence of corruption, stable policies, open and transparent processes to allocate resources, dedicated forest personnel and accessible information. An optimistic view of sustainable forest management must emphasize: i) resilience instead of fragility, ii) available technology, iii) use of global commitments and iv) long-term and pertinent research.

Keywords: Forest conservation, Secondary forests, tropical America, Forest management, Forest Ecology,

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Effect of Silvicultural Thinning on the Regeneration of Commercially Valuable Trees in Strip Cuts in the Peruvian Amazon

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High-grade logging practices in Amazon rain forests often result in reduced commercial value, damaged trees, and soil compaction. An alternative, the Palcazu Forest Management System, purports to avoid these problems by clear-cutting the forest in narrow strips. Strips are allowed to regenerate naturally and are expected to be re-harvested in 30-40 years. We've found the early regeneration is dominated by pioneer species of low commercial value, indicating the system may not be sustainable. To test whether silvicultural thinning promotes the growth of commercially valuable hardwoods, in 1996 we girdled pioneer trees of the Melastomataceae and *Alchornea* < 10 m tall and all *Cecropia* in 2 strips that were cleared in 1989 in lowland rain forest in Jenaro Herrera, Peru. Advance regeneration and stump sprouts throughout the strips have been measured regularly (1989-2000), as have new trees (>2m) recruiting on selected plots. Survival of commercial trees was high in both thinned and control portions of both strips. Growth increment (1996-2000) was significantly greater in thinned portions of strip 1 for commercially valuable stump sprouts and advance regeneration. Thinning significantly increased growth increment (1996-2000) of commercially valuable advance regeneration (in strip 1), recruits in (strip 2) and stump sprouts (in both strips). New recruitment (1996-2000) of non-pioneer taxa was not significantly higher in thinned portions of strip 1, but twice as great in thinned portions of strip 2. These findings suggest that silvicultural manipulation enhances the sustainability of strip-cutting by encouraging growth and recruitment of commercially valuable taxa.

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Recovery of Faunal Diversity Following Clear-Cutting and Selective Logging in Tropical Forest Landscapes

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Chainsaws rip through most of the tropical forests of the world as I write. This action is often viewed as irreconcilable with conservation of biodiversity, however, this is not necessarily so. As tropical forests regenerate following clearance, animal communities can recover their diversity relatively quickly, but this depends on how forests are cleared. Using a review and meta-analysis of published literature and a case study from the Northern Bolivian Amazon, my research explores the factors that affect the recovery of animal communities following forest clearance. I focus in particular on the relative recovery rates from clear-cutting vs. selective logging. Differences in the recovery of rate of animal communities between selectively logged and clear-cut sites appear to depend complexly on the scale of study and the metric by which biodiversity is measured.

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Impacts of Pre-Logging Liana Cutting on Logging Gap Regeneration of Lianas in the Eastern Brazilian Amazon

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The cutting of all lianas prior to logging is a reduced-impact logging technique that is predicted to reduce liana proliferation in logging gaps. This study compared liana abundance and species composition in gaps created during typical and reduced-impact logging in the eastern Brazilian Amazon. Logging treatments were conducted in side-by-side 100 ha plots. Shortly following logging, 50-m² plots were located in the approximate centers of four small (single treefall) and four large (multiple treefall) gaps in each logging area. Six years following logging, there were ca. 40% fewer climbing lianas in reduced-impact gaps than in typical logging gaps. In both logging areas large gaps had higher liana densities and a higher proportion of lianas recruiting from seed than small gaps where sprouts from cut or fallen lianas were more common. The mean number of liana species encountered per plot varied little among treatments, however, increased species evenness in the reduced-impact logging gaps resulted in them having significantly higher diversity overall (Fisher's α). Indices of quantitative species similarity showed that among all possible pairs of logging treatment and gap size, large gaps in the two logging treatments were most alike in terms of species composition and relative abundance. This similarity resulted from the presence of several species that regenerated new climbing stems almost exclusively from seed in large gaps. The results of this study suggest that pre-logging liana cutting can significantly reduce post-logging liana proliferation in gaps, with no discernible negative impact on the species diversity of regenerating lianas.

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Historical Wood Production and the Potential of *Prioria copaifera* (cativo) Forests in Darien, Panama

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Eastern Panama is one of the most diverse and species-rich areas in Central America. Darien National Park contains five Holdridge life-zones including swamp forests dominated by *Prioria copaifera* (cativo).

Cativo has historically supplied up to 95% of the raw material for the domestic plywood industry in Panama. Although the original area of cativo forest decreased from 60,000 ha to 15,000 ha in recent decades, cativo extraction still provides a major source of income to local communities adjacent to Darien National Park. In contrast to species-rich tropical lowland forests, wetland forests dominated by cativo contain few other tree species. This homogeneity, combined with abundant regeneration and reasonable growth rates, has allowed some cativo-dominated forests to persist despite four decades of exploitation.

Although few harvestable trees remain in degraded riverine cativo forests, they still contain 19 to 42 m³ ha⁻¹ of wood in trees > 60 cm dbh. These forests could provide sustained wood production given that they also contain 150 – 175 m³ ha⁻¹ of wood in trees between 40-60 cm dbh. Unfortunately, careless and unplanned historical exploitation has left these residual forests with few well-formed individuals. Intact inland swamps, in contrast, contain up to 190 m³ ha⁻¹ in harvestable trees and are the focus of current mechanized extraction,

Promotion of improved cativo management in areas adjacent to Darien National Park can be viewed as a biodiversity conservation tool. Providing income through sustainable wood extraction activities to local communities should reduce pressure to exploit the natural resources in the park.

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Sustained-yield Production of Bigleaf Mahogany (*Swietenia macrophylla*) in Acre, Brazil: Testing Forest Conservation's Ability to Pay

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After three decades of bigleaf mahogany's predatory extraction across its vast Brazilian range, the logging frontier for tropical America's most valuable timber species is approaching the western Amazonian state of Acre. There, primitive transportation infrastructure, a fragile local timber economy, mahogany's low landscape-scale density, and the federal moratorium on new logging licenses for mahogany since 1996 have prevented its wholesale removal. But with the Pacific highway via Peru nearing completion, pressure builds for extraction of a resource often called "green gold". The state government of Acre's Secretariat of Forestry & Extractivism (SEFE) and the Belém-based Institute of the Amazonian Environment (IMAZON) have recently initiated an experimental management project on privately owned land to answer the following questions: Are sustained-yield production systems for mahogany and associated high-value timber species technically feasible at industrial scales? Can income generated from managed forests compete with other land-use options? Management prescriptions are derived from a life history study of mahogany in southeast Pará underway since 1995, with silvicultural interventions designed to enrich original stockings of adult trees. Forest structure and composition will be retained essentially intact, safeguarding capacity to generate other goods and services (e.g., non-timber forest products, biodiversity, watershed protection). The project's overall objective is to develop a management protocol for mahogany and associated species that provides both for conservation and profit, and which could be implemented at both industrial and community scales. We describe technical, ecological, financial, institutional, and legal constraints and opportunities associated with logging bigleaf mahogany sustainably in western Amazonia.

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Management of a 12-15 Year-Old Secondary Forest in Southwest Costa Rica

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Inventory of a forest growing on an abandoned field on Costa Rica's Osa Peninsula revealed abundant natural regeneration of potentially valuable, long-lived trees. The canopy of this forest was dominated by short-lived, fast-growing species such as *Trichospermum galeotii* (Tiliaceae) and *Ochroma pyramidale* (Bombacaceae). However, almost no regeneration of these dominant species was established in the understory, suggesting a shift in stand dominance upon the senescence of the current dominant cohort. Silvicultural treatments were applied to 21 experimental plots to explore the possibility of accelerating the growth of desirable species currently in the understory. Treatments included thinning, vine removal, thinning plus vine removal, and no action. Treatments were evaluated by their effects on seedlings of *Brosimum utile* (Moraceae), a tree with commercial potential that is dominant in nearby mature forests. None of the treatments, which required approximately 3 worker-days ha⁻¹, significantly affected mean seedling height growth (32.9 cm) or new seedling establishment (143 ha⁻¹) over a twelve-month study period. It was therefore concluded that at this early stage of the forest's development, costly measures to promote natural regeneration would be ineffective and economically unfavorable.

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Dispersal of Anemocorous and Autocorous Seeds During the Dry Season in Logged Areas in a Bolivian Tropical Dry Forest

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The influence of gaps created by dry-season logging on the temporal distribution of wind- and gravity-dispersed vine and tree species was studied in a Bolivian dry forest. Three areas were selected (large logging gaps, small logging gaps, and undisturbed forest) for the location of seed traps. The number of seeds trapped was counted monthly for each species from May-September, 1998. The abundance of seeds and the richness of species producing them increased significantly during the end of the dry season. Approximately 50% of tree and vine species dispersed seeds throughout the dry season, while the remainder had shorter dispersal periods. Wind-dispersed species had longer seed dispersal intervals than gravity-dispersed species. In general, species richness and seed abundance of wind-dispersed species increased at the end of the dry season, while that of gravity-dispersed species peaked during the middle of the dry season. While the seed abundance of some species increased in gaps compared to undisturbed areas, seed abundance did not vary by gap size. The effect of logging gaps on the dynamics of animal-dispersed seeds also deserves study.

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Long-term Silvicultural Research Project in Bolivian Tropical Forests

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Silvicultural treatments applied in Bolivian forests are restricted to diameter-cutting limit and some pre-harvest vine cutting. Silvicultural treatments are needed to guarantee the long-term productivity of forests managed for timber. A long-term silvicultural research project is being established to evaluate the sustainability and cost-effectiveness of various silvicultural treatments, and to study their effect on stand dynamics, biodiversity and forest ecosystem function. Plots of 20 – 30 ha are being established in concession areas located in different forest types (tropical humid forest, tropical dry forests and Amazonian wet forests). Four different silvicultural treatments varying in intensity are applied to the plots, so that there are 3 – 5 replicates per treatment per forest type. All trees with a diameter at breast height (DBH) > 40 cm are measured, mapped and tagged. Trees 10 – 40 cm are sampled in subplots. Silvicultural treatments applied include vine cutting (on commercial and future crop trees –FCT), marking and liberation of FCT from overtopping, timber stand improvement, and soil scarification. Plots have already been established in the tropical humid forest site. There are about 100 tree species, from which 8-10 are currently being harvested for timber. Preliminary data from the site suggest that several of the harvested species require large disturbances for establishment and that silvicultural treatments may be necessary to promote tree growth and improve stand quality. For example, about 60 % of the trees have some level of liana infestation and about 60 % of the trees have a regular to bad stem quality for timber extraction.

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Review of USAID's Natural Forest Management Programs in Latin America and the Caribbean

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Forestry activities have long been part of USAID's thrust in Latin America and the Caribbean. In the past most of these efforts were directed at tree planting, reforestation and agroforestry activities aimed at appropriate land-use solutions for small holders on marginal lands or for restoring degraded lands. Currently, effective management of natural resources is featured as one of the goals that can contribute to the economic growth and agriculture pillar of USAID's increasingly focused approach to the development challenge.

In the latter half of the 1980s, USAID initiated several projects focusing on natural forest management (BOSCOSA and FORESTA in Costa Rica and the Forestry Private Enterprise Initiative in Ecuador). Subsequently, USAID has undertaken similar projects and programs in seven countries of the region (BOLFOR in Bolivia, support for reduced impact logging and forest sector diagnostic studies in Brazil, MAYAFOR in Guatemala, Central Selva Resources Management and BIOFOR in Peru, SUBIR in Ecuador and the Forestry Development Project in Honduras).

This assessment is not an evaluation of the USAID program. Rather, it was a concerted effort, using consultations with those most directly involved, to identify what it takes to achieve real results in natural forest management programs. The findings attempt to avoid minutiae, focusing instead on recurrent themes that the team's interactions and observations suggest are the most meaningful for program success. These findings are organized along the analytical framework inherent to the internal make-up of the team and its specializations—policy and institutional development, forest management technologies, forest business and market development, and social and community development. The assessment team recognizes that in many cases these themes are linked; they have been separated here for ease of analysis, interpretation, and response.

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Certified Timber from a Non-Certified Sawmill: Reflections on an Amazonian Logging Company

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The status of environmentally and socially sound certified forests has changed the international timber market. Certification of primary forests is enthusiastically supported by environmentalists. Demand on tropical timber is significantly increasing, and so are the areas of certified forests. These trends indicate the necessity of a deep reflection on the certification process.

Certification is applied to forestry management practices only. However, other aspects, directly linked to forest management, should also be considered within the certification process.

Precious Woods Amazon, the first certified company in Brazilian Amazon, has accelerated its operation, and is already harvesting areas that should be logged only in 2011. A new area was also acquired for future harvesting. This is a consequence of low productivity of the sawmill (e.g., in October, 2000, only 11% of the harvest was processed into saleable products), among other factors.

Consequences for the forest have been huge. Schedule of harvesting was accelerated, increasing the annual area to be logged. Roads and trails cannot be opened with the necessary lack of time to receive heavy traffic (about one year), and need to be frequently repaired. Logging must be conducted in dry and also in rainy seasons. Pools of mud can be easily found in loading areas, trails and roads, ultimately polluting streams.

Tropical forestry certification should necessarily be associated with certification of sawmill, or chain of custody. Otherwise, it will not ensure good, long term forest management.

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Small Clandestine Sawmills and the Deadlock of Predatory Logging in Amazonia

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Thirty million m³ of timber are harvested each year from forests of the Brazilian Amazon. Much of this timber volume (40 to 70%) is harvested by small mills with only 1 bandsaw with low levels of capital investment and harvesting practice that avoid the investment and operational costs of management plans. With this market share, and cost structure, small mills play a crucial role in price formation and in the competition for logging resources, undermining the prospects for forest certification and reduced-impact logging. They are numerous, more mobile, and more difficult for enforcement agencies to regulate than large mills. Small mills can also influence the decision of other types of loggers (medium and even large) about the type of extraction strategy they employ. This situation can be represented in a game theory approach as a *deadlock* in which the agents have little or no incentive to adopt reduced impact harvesting strategies and other forest management planning. This *deadlock* perpetuates predatory logging practices in the region.

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Incorporating Tree Life History Information into Forest Management Plans in the Eastern Amazon

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Under any definition of sustainability, forest management must maintain viable populations of timber species. Reduced Impact Logging, the current Amazonian alternative to predatory logging, does not guarantee that this most basic criterion is met. Even under RIL, shifts in species composition and regeneration failure of important timber species appear likely.

We studied seven timber tree species, selected to represent a range of life history characters, at five sites in the eastern Amazon. Population dynamics were studied in both undisturbed and logged stands. The two emergent species with dense wood (*Tabebuia impetiginosa*, *Hymenaea courbaril*) were the most vulnerable to logging disturbance. Shade intolerant seedlings, size class distributions highly skewed towards large adults, and poor colonization of logging gaps make populations of these species unlikely to rebound from logging. High natural densities and balanced size class distributions of the shade tolerant species (*Manilkara huberi*, *Astronium lecointei*) render their populations more resilient under logging pressure. However, populations of shade-tolerant species were characterized by a large percentage of trees exhibiting low annual diameter growth; proposed rotation lengths of 30-40 years may be overly optimistic. Light-demanding species with light wood (*Simarouba amara*, *Cordia goeldiana*, *Parkia pendula*) showed high potential for successful gap colonization from seed when local seed sources were present.

Variation in timber species life history characteristics lead to varied responses to logging disturbance that may have profound economic and ecological implications. We discuss the potential to employ knowledge of tree population ecology in fine-tuning the harvesting and silvicultural methods of reduced impact logging.

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Debt-for-Nature Swaps and the Tropical Forest Conservation Act, Implications for Preserving Forests in Developing Countries

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Extensive foreign debt and degrading natural resources in developing nations led to the creation of debt-for-nature initiatives that reduced debt obligations and generated funds for the environment. These initiatives typically involved re-structuring, reducing, or buying a portion of outstanding debt of a developing country with a percentage of proceeds being used to support conservation programs within the debtor country. The United States has extended the utility of debt-for-nature transactions with the passage of the Tropical Forest Conservation Act. This act enables the U.S. to re-structure debt of eligible developing countries in exchange for funds earmarked for conserving tropical forests within the debtor country. A history of debt-for-nature transactions and implications for preserving tropical forests under the guidelines of the Tropical Forest Conservation Act are discussed. In conclusion, questions linking policy mechanisms between debt-for-nature and carbon credit transactions are posed.

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Patch Clear Cutting to Regenerate Mahogany (*Swietenia macrophylla* King) and Sustain Forest Value in the Mayan Ejidos of Mexico

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Mahogany (*Swietenia macrophylla* King) is the most valuable timber species in the tropical forests which provide livelihoods to 62 communities in Quintana Roo. Mahogany has regenerated naturally after catastrophic disturbances (typically, hurricanes followed by fire); but favorable regeneration conditions are not produced by selective logging. Silvicultural techniques must be applied to ensure mahogany regeneration and prevent this species from being extirpated from logged forests. Three different techniques (complete felling, machine clearing, and slashing and burning) were used to clear 5000 m² patch clearcuts in community forest reserves. Mahogany seedlings were planted in each patch, as well as on control plots under the forest canopy; on half the patches seedlings were cleaned. Five years later, only 5% of seedlings planted under the canopy survived. Survival was highest (47%) on slashed and burned and machine-cleared patchcuts, and lower on felled patchcuts (31%). Cleaning did not significantly affect survival. Seedling growth was highest on slashed and burned clearings (373 cm) as compared to machine-cleared (306 cm) or felled (269 cm) clearings (which were not significantly different), while the few surviving seedlings planted under the forest canopy had grown only 14 cm. Cleaning significantly affected seedling growth only on felled clearings, where resprouting had produced a high density of competing vegetation. Slashing and burning techniques used by local farmers to clear “milpas”, which are sown with crops for a year or two and then abandoned to fallow, provide the best local setting for regenerating mahogany; planting seedlings under the forest canopy is a waste.

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Poster Topic 3 Community Forestry in the Tropics

- Listed alphabetically by presenting author.
- Presenting author appears in **bold**.

Community-Based Conservation and the Future of the Tropical Forest

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Community-based conservation (CBC) is a term, which refers to conservation initiatives involving the local people as an integral part of the conservation activities. The most important aspect of these programs is that the local communities participate in the conception, planning, and management process. These programs emerged as an alternative to past habits that often kept out rural people from conservation efforts concerning their own well being.

This new approach aims at making the rural people an integral part of the process of natural resources conservation. Despite the socio-economic problems such as poverty, rapid population growth, land tenure problems, economic crisis, environmental degradation, developing countries especially in Africa, and particularly rural forest-dependent people, are making great efforts in conserving their natural resources. Due to difficult living situations in the rural communities especially in developing countries, the implementation of CBCs may not be as successful as intended.

Our work was conducted in the tropical forest of the southwest and montane forest of the northwest provinces of Cameroon. The demise that faces the future of conservation programs is due to conflict between the economic needs of the rural forest resources users and the implementation of conservation programs. Focusgroups and targeted persons were interviewed concerning their basic socio-economic priorities with respect to natural resources conservation activities.

The study showed that if certain obstacles to natural resources conservation initiatives, are not addressed, CBC programs may not attain their objectives.

Key words: Community-based, Local participation, Indigenous knowledge, Benefit sharing, Forest users, Integrated, Bottom-top

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Management of Lokta (*Daphne spp.*) in Nepal's Community Forests

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The making of handmade paper is an ancient tradition that has significant cultural and economic importance to many people that live in the hills of Nepal. Made from the inner bark fibers of Lokta (*Daphne spp.*) since the first millennium, handmade paper production has been promoted as a sustainable income generation activity for marginalized farmers. However, Lokta, a slow growing understory plant, suffered as a result of both the degradation of Nepal's forest cover and intensive cutting to satisfy international market demands for the paper. This resulted in the closure of factories during the 1990's that were unable to meet their raw material requirements. Today there is renewed interest in the sustainable production of handmade paper by organizations promoting enterprise based conservation and development. Opportunities exist within the context of Nepal's Community Forestry Program for the sustainable management of Lokta. Granted usufruct by the program, some communities are beginning to develop Community Forest Management Plans that include the management of the Lokta in their forests. However, conflicting policies and weak enforcement of government regulations threaten recent advancements. Strengths and weakness of market, institutional and management possibilities available are presented based upon reflection of work experience in the program from 1997 to 2000.

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Effects of Thinning on Community Forests and Forest User Groups

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The study project entitled “ Effect of Thinning Operation on Community Forest (CF) and Forest User Group (FUG)” was carried out in four FUGs in Kabhre District, a middle hill district of central Nepal, which have established and maintained a timber processing enterprise, Chaubas Bhumlu Community Sawmill (CBCS), in their village for the last four years.

The objectives of this study were to document the existing thinning practice in study area, and to assess the effect of thinning on CFs and FUGs.

To collect the information regarding CFs, a forest inventory was carried out. To collect information about FUGs, a structured questionnaire survey was conducted. Direct observation was also considered a data collection tool. Qualitative and quantitative techniques were used to analyze the data collected.

Year-round twenty-employment opportunities with the FUGs and CBCS are generated by the thinning operation. As a result, a substantial amount of money is being circulated in the village economy due to this activity. Out-migration of the labor force has been lowered and the supply of fuel wood has increased.

Regeneration status of CF blocks thinned in 1996 is the best. Stocking also is good but it is too early to reach conclusions regarding growth rate, since no previous data are available. Continuous inventory of the plots established during this study might provide the best information about the effect of thinning on growth rate and regeneration.

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Participatory Resource Mapping in Maya Communities of Quintana Roo, Mexico

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Participatory resource mapping in tropical regions is an effective tool for gathering ecological and socio-economic information about natural resource use. Resource maps can aid in understanding the relationships between agriculture, forests, people, policies and markets. These maps, once communities create them, provide residents a means to develop strategies for sustainable land use and to communicate information with non-residents. An interdisciplinary research team in collaboration with members of two Mayan communities in the south-eastern Mexican state of Quintana Roo guided the mapping process presented here. The process entailed workshops, semi-structured interviews, and transect walks combined with Geographical Information Systems (GIS). LANDSAT 7 ETM composite satellite imagery was used for the base map and important features, landmarks, boundaries, and forest resources were drawn on transparencies overlaying the base map. Transect walks with community members were also conducted to survey resources and to identify features of social and cultural importance within the territory. We used Global Positioning System (GPS) receivers to geographically reference resource use, vegetation types, and points of interest. In addition, we collected vegetation ground-truthing points to produce land use/land cover classifications using remote sensing techniques. The work was conducted in both Spanish and Yucatec Maya languages to better integrate the richness of indigenous knowledge and expertise. The participatory resource mapping process provided the communities with both informative reports on resource use and management as well as maps spatially representing resources and points of social and cultural interest from their own perspectives in their own terms.

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Resident Perspectives of Community-Based Ecotourism as a Tool for Development and Mobilization: A Case Study in the Dominican Republic

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Ecotourism is a budding field of research that is being lauded as the panacea for ecologically sound, economically profitable, and community based development. Numerous positive and negative effects may occur in the economic, social, political and psychological realm. My study analyzes the impacts according to the criteria of the community members themselves, specifically focusing on the community's social structure and the role of women.

The Samaná peninsula, specifically regarding El Salto del Limon (the Waterfall of Limon) most resembles veritable ecotourism in the Dominican Republic because the project incorporates collaborative management and participatory planning techniques; it economically benefits the community members; and it focuses on conservation and restoration of the natural landscape through action and education. A unique situation here is that the majority of the businesses are locally owned and operated. Also, the community members have politically mobilized themselves through grassroots organizations. My data disaggregates the informants by sex, age and occupation to more fully understand ecotourism's distinct impacts on the individual community members.

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Social Institutions, Indigenous Knowledge and Tropical Forest Conservation in Southeast Nigeria

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The success and failure of tropical forest conservation in West Africa can be explained to a large extent by social institutions backed by local communities' utilization of their rich ecological knowledge during the process of forest resource exploitation. I present evidence from southeast Nigeria and reject the proposition that small farmers behave irrationally in relation to agricultural land use and environmental degradation. The evidence indicates the rationality of the farmers' decision-making process. The detailed knowledge by small farmers of the vegetation types, soil characteristics, market opportunities and associated problems significantly influence agricultural practices, with negative implications for tropical forest loss and conservation. Such knowledge can be a two-edged sword: it can be used in sustainable agricultural land use practices and at the same time, it could contribute to environmental degradation. A case is made for the need to understand the contextual causes of forest loss from the household perspective. This understanding is considered as an important component of, and a significant input for, the success of forest conservation planning and implementation in developing countries.

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Tropical Forest Conservation and Indigenous Land Rights on Southeastern Nicaragua's Agricultural Frontier

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Southeastern Nicaragua contains one of the largest intact blocks of lowland tropical rainforest in Central America, and has been identified as a key component in the proposed Mesoamerican Biological Corridor. Yet despite the official designation of protected natural areas in the region over ten years ago, actual management efforts in the Indio-Maiz Biological Reserve and the larger Southeastern Nicaragua Biosphere Reserve have been limited and largely unsuccessful. A strong invasion of agricultural settlers into the protected areas has accelerated, along with the minimally-regulated extraction of wildlife and timber products. In addition to these chronic threats to southeastern Nicaragua's forests, a new coast-to-coast transportation corridor is being proposed that would dissect the biosphere reserve, and could spark an unprecedented wave of settlement and deforestation.

Protected natural area management in southeastern Nicaragua has been hindered by a failure to incorporate participation by coastal residents, including the Rama Indians and Creoles. A key challenge to forest conservation in southeastern Nicaragua lies in the region's highly unstable land tenure situation. A growing body of literature demonstrates that successful collaboration between conservationists and indigenous or other local peoples lies in the mutual support for local people's land rights.

Efforts are needed to stabilize the land tenure situation in southeastern Nicaragua, and to reevaluate the conservation strategies being applied in the region. This poster will provide an overview of the status of conservation efforts along southeastern Nicaragua's agricultural frontier, and will present the results of a participatory mapping project with the Rama Indians.

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Community Forestry: Bridging Conservation and Uses (Empirical Experiences of Nepal)

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Community Forestry, a user based strategy for forest conservation, has already proven itself as a promising way to halt deforestation and to accelerate rural and community development in Nepal. Since 1978, under statutory obligation, the state has formally commenced community forestry programmes as a trial in very limited areas of the hill districts. Within a very short time frame, positive results required authorities to re-evaluate their classical model of conservation thinking, which aspired to create government forests as “isolated conservation islands”.

Empirical results of community forestry and the restoration of the democracy in 1991 ousted the past model of forest conservation completely and enriched the community forestry programme more judicially, financially and politically, resulting in country-wide implementation.

As per data available until July 1998, 6,317 community forest user groups organized and have taken over the management of 419,262 hectare of forests in 64 districts, and 672,211 households are participating in community forestry throughout Nepal. Accounts of many user groups in recent years show that in general, there is a gradual shift of user groups from subsistence towards monetized market economy. Studies have further indicated that forest area and crown cover are also increasing in several districts of Nepal.

Community forestry is a prominent strategy to bridge conservation and use of forests in Nepal

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Critical Aspects Of The Camu-Camu Industry

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Camu-camu (*Myrciaria dubia*) is a small tree native to wetlands of the Amazon basin. It is especially abundant in Peruvian Amazonia. The high vitamin C content of the fruit has generated interest in exporting camu-camu products from Amazonia to the more developed countries. The government of Peru has been promoting this new export industry, as well as the planting of camu-camu in rural areas. Development organizations and private industry are now actively involved with camu-camu projects and enterprises.

In Peru, there is much enthusiasm over this native species because it is believed that it will provide a needed and sustainable economic boost for the region. However, many questions about the ecological and economic viability of the camu-camu export industry need to be answered in order to understand the effects of the business on the region's forests and rural communities. For the same reasons, camu-camu planting projects must be evaluated. This presentation examines the distribution of *M. dubia* in the wild and the critical aspects of the camu-camu industry. It will also answer some of the questions surrounding this potential economic boom for Amazonian communities.

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Local Community Participation to Support Sustainable Forest Management

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The management of Jamaica's forest reserves has, until recently, been the sole preserve of government. Communities have not been involved in the planning for forest management or conservation and gained few benefits from local forests except for temporary employment during infrequent tree planting and harvesting operations. While the Forestry Department is mandated to manage and protect the country's forest reserves, it has recognised that the participation of local communities in this task can only enhance its own efforts. In return, it is envisaged communities will be able to derive sustainable economic and environmental benefits from planned forest use.

Giving local communities a say in how the forest estate is managed is a key strategy in Jamaica's National Forest Management and Conservation Plan (2001). Jamaica's Forest Act provides for the formation of local forest management committees although their specific functions and organisation are not defined.

In September 2000, the Forestry Department took the first steps to establishing local forest management committees. While community based approaches to sustainable forest management vary from country to country, they all take into account local social, cultural and economic conditions which may affect an individual's decisions regarding forest land use. Hence the definition and elaboration of the committee's operation has been a collaborative process with groups and individuals who wish to serve on the committee.

This paper documents the background to forest management in Jamaica, the present policy, the progress to date to engage local communities in forest management and the challenges which lie ahead.

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Conflicts and Lawsuits over Forest Tenure in Bolivia

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Land and resource tenure conflicts represent the dominant issue in the effort to consolidate communally owned land in Bolivia, much of it within the Bolivian forest estate. As a direct result of legal changes on these forested lands in the last five years, the overlapping social and economic interests of different forest stakeholders have collided

These collisions have resulted in several lawsuits over control of Bolivian forests. In addition to litigation, political pressure to reform land and resource tenure laws have also been brought by peasant unions at the national level. This poster will analyze the most relevant of these lawsuits and their impact on the land tenure and forest resources of Bolivia.

The litigation and political conflicts are divided in three categories:

- Overlap of Communal Origin Lands (TCO's) with forest concessions
- Overlap of TCO's with private ownership
- Constitutional claims over land tenure
- Political confrontation between government and colonists

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Case Study: Biodiversity Conservation and Management in the Campo-Ma'an Area, Cameroon

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The Campo-Ma'an area is situated in southwest Cameroon bordering Equatorial Guinea and the Atlantic Ocean. The area (7,000 km²) is covered by evergreen tropical rainforest and is divided in several land use zones. In January 2000 the National Park Campo-Ma'an was established. Additionally the area includes five logging concessions, two agro-industrial plantations and an agro-forestry zone with community forest possibilities. Approximately 60,000 persons inhabit the area outside the national park.

The Campo-Ma'an Project (part of the Global Environmental Facility Program funded by the World Bank) is charged with the management and conservation of the biodiversity in the national park and its surrounding area. When the project started in 1999, local people and other stakeholders regarded the project as a threat to their activities. The most important goal for the project is to synchronize the different expectations of all stakeholders and assure a good cohabitation, in order to insure long-term conservation of the biodiversity. This is to be achieved by creating win-win situations.

The poster shows four examples of project activities that should lead to win-win situations for both conservationists and other stakeholders.

1. Support for development of management plans for logging concessions and negotiation with concession holders to achieve wood certification.
2. Organization of villagers in committees and joint preparation of management plans for community forests.
3. Research for cost-effective bio-monitoring methods to be carried out by ministry delegates and forest guards.
4. Organization and training of villagers in development and exploitation of interesting places for eco-tourism.

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Forest Resources with Economic Potential in Extractive Reserve Chico Mendes, Acre, Brazil

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The 1250 residents in Extractive Reserve Chico Mendes live principally off of rubber and Brazil nut extraction. However, this extractive system is economically precarious, and may have contributed to observed increases in rural poverty and exodus. Therefore, product diversification has been advocated as an alternative, searching for forest species and products with potential for sustainable management such as fruits, essential oils, seeds, and medicinal and artisan plants.

The objective of this study is to identify potential species through forest and ethnobotanical inventories. All individuals ≥ 5 cm were evaluated in 67 plots of 2500 m² which were located in a 1,747 ha study area. The ethnobotanical inventory was carried out with two families each living on approximately 300 ha landholdings, applying surveys to all family members and through on-site plant collections.

Of the most abundant species, açai (*Euterpe precatoria*) was identified as demonstrating the most promise. Approximately 70 other useful species were identified, categorized as food (24%), medicinal (51%), artisan (7%) fragrances (5%), and other (13%). Of these, prominent species included *Tanaecium nocturnum* (*cipó vick*), *Humirianthera ampla* (*surucuína*), *Aniba* spp. (*canelão*), *Uncaria guianensis* (*unha de gato*), *Piper ottonoides* (*João brandinho*) and *Astrocaryum* spp. (*mumuru*).

It is hoped that this study, identifying potential forest resources for sustainable management, serves as a first step for ultimately reaching competitive markets.

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Commercialization of Community Forests in Tropical Nepal: Application to the Asian Region and Abroad

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The tropical lowland forests of Nepal (the Terai) are dominated by the commercially valuable species *Shorea robusta* (Dipterocarpaceae), locally named Sal. Commercial timber exploitation of Sal forests was historically controlled by His Majesty's Government of Nepal. However, with the recent emergence of community forestry as the most prioritized program of the Ministry of Forests, local user groups can now be the beneficiaries of commercial forestry operations. Although the community forestry strategy in Nepal is a global leader in terms of having a legislative foundation that formalizes the national strategy, numerous barriers exist to effective implementation and maintenance of a sustainable, viable, and equitable commercial forestry system in the Terai. This paper traces the history of forest management and the emergence of the community forestry paradigm in Nepal and the Terai. We draw on the advanced nature of community forestry policy and the wealth of experiences in Nepal to provide examples of successful commercial community forests, in both the tropical Terai and the subtropical / temperate Middle Hills. We also present a series of findings from our research and that of others, which may be broadly applicable to the promotion of market-oriented community forests in other countries grappling with such a strategy. These findings include the importance of decentralization of authority, land tenure, community characteristics, and forest management.

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Poster Topic 4

Non-Timber Forest Products

- Listed alphabetically by presenting author.
- Presenting author appears in **bold**.

Conservation, Management and Population Dynamics of the Harvested Palm, *Chamaedorea radicalis*, in El Cielo Biosphere Reserve, Mexico

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Assessing the sustainability of NTFP extraction requires an understanding of both ecological and socio-economic dimensions of resource extraction. Leaves from the understory palm, *Chamaedorea radicalis*, are harvested from Mexican forests and exported for floral greenery. The objectives of this study were to 1) assess current harvest pressures, 2) examine the effect of alternative harvest schedules and livestock browsing on palm demography, and 3) explore social factors affecting the harvest of *C. radicalis* leaves in the El Cielo Biosphere Reserve, Tamaulipas, Mexico. Demographic data (survival, growth, reproduction, seed germination) was obtained from transects and permanent plots established to examine the effects of leaf removal and burro browsing on palm demography. Palm collectors (*palmilleros*) were interviewed to ascertain harvesting practices and factors influencing palm harvesting. During 1999-2000, *palmilleros* sold an average of 51,420 leaves/month. We estimate that 90% of adult palms have had leaves removed during the past two years, and 81% of adult leaves produced are harvested. Demographic data were used to parameterize stage transition matrices, which indicated that browsing has a much greater effect than leaf harvest on population dynamics. While leaf removal reduced survival and reproduction, populations were projected to remain stable ($\lambda=1.0$). However, a one-time browse by burros reduced λ to 0.96 while twice-a-year browsing resulted in $\lambda=0.82$. Leaf harvest intensity by communities is attributed to an un-diversified resource base, leaf sales based on quantity, and lack of competition between middlemen. These factors also inhibit the development of community conservation and management strategies.

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Forgotten Fruits: The Role of Abandoned Home Gardens in a Belizean Riparian Forest

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In 1961 Hurricane Hattie caused widespread damage in the coastal areas of Belize. Along the Sittee River in central Belize, this hurricane destroyed all of the homes on the lower portion of the river, which were evacuated and never rebuilt. However, some planted species from the dooryard gardens associated with these homes survived the hurricane and have maintained themselves as local forest species recolonized the site. The purpose of this presentation is to describe the riparian forest that has emerged through natural succession with inputs from the abandoned dooryard gardens and from the surrounding wildland species pool. Planted fruit-bearing trees in the riparian forest include such species as mango (*Mangifera indica*), craboo (*Ternstroemia tepezapote*), breadfruit (*Antocarpus altilis*), and calabash (*Calabash cujete*). Although these fruit trees are represented by only a relatively few individuals, they often have large diameters and, thus, contribute significantly to the total basal area of the forest. This unique plant community is discussed in relation to model forests being designed throughout the Tropics to provide non-timber forest products as a sustainable development/conservation option.

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Variations in Floristic Composition of Morichal Communities in El Tigre River (Anzoátegui State, Venezuela)

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The Morichales are ecosystems where a floristic association between Moriche palm (*Mauritia flexuosa* L.) and other woody species take place. Such communities have a forest physiognomy related, in turn, with water drainage axis or permanent water courses. Floristic and physiognomic composition of Moriche communities along the upper basin of El Tigre river were characterized in 8 different 0.1 ha plots. In each plot all individuals above a 2m height were registered and the floristic composition, height, coverage and number of individuals of the present species was determined. In the forest three further strata were distinguished, lower (2-5 m), middle (5-10 m) and upper (>10 m), including woody climbers, epiphytes and emergent species. A total of 28 tree species were found. *M. flexuosa* density decreased and other tree species density increased along the river showing that the Morichal forest is being replaced by an evergreen forest along the river. Besides *M. flexuosa* other tree species found along the river are *Virola surinamensis*, *Inga acuminata*, *Protium neglectum*, *Cupania americana* and *Coccoloba latifolia*.

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Proyecto Aguaje

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The aguaje palm (*Mauritia flexuosa* L. F.) Is the most economically important palm in Peru's largest region of Loreto. The unsustainable exploitation of the palm's fruit, called aguaje, has negative impacts on the region's forests, fauna, and people. The traditional view of aguaje conservation has concentrated in protecting productive aguaje palms in the wild. This study analyzes a different approach, where the aguaje palm was planted in an agroforestry project with small farmers in their fields, in the buffer zone of the Reserva Comunal Tamshiyacu-Tahuayo, located in the northeastern Peruvian Amazon.

Mauritia flexuosa is a massive, single-stemmed palm that is widely distributed throughout lowland Amazonia and especially abundant in Peru. *M. Flexuosa* occurs most often in virtually monotypic stands in permanently flooded backswamp habitats. These palm swamps cover more than four million hectares in Peru. In the wild, aguaje palms can grow to a height of over 30 meters. Because the physical nature of the palm's trunk makes it almost impossible to climb, they are felled in order to harvest the large bunches of fruit. It is a dioecious species; only the females bear fruit. As a result, alarming numbers of female aguaje palms are cut yearly to provide for market needs, and the fruit bearing palms are now extinct in swamps located even in relatively isolated areas. Because of these ecological and socio-economic realities, Proyecto Aguaje initiated an extension project that assists farmers with the cultivation of the palms in their swidden-fallow agroforestry systems. This strategy allows families to own and sustainably harvest aguaje on their agricultural lands, while decreasing the harvest pressure on this keystone species in the wild.

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The Commercial Harvest of “Breu” Resin from Burseraceae Trees in the Eastern Brazilian Amazon and the Role of *Sternocoelus* Weevils in its Formation

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Many Brazilian Amazon forest dwellers collect and sell resins from various Burseraceae trees known as. “breu.” A study conducted with Tembé Indians in the eastern Brazilian Amazon revealed initial harvests averaged 0.8 kg resin/tree. Resin flow is stimulated by bark-boring *Sternocoelus* weevil larvae that develop in resin lumps on the bark. Resin amounts were highest on large and dead trees. Follow-up harvests showed previously infected trees yielded more resin than uncolonized trees. A regression harvest model predicts resin accumulation will rebuild to initial harvest amounts four years after harvest.

As resin-yielding Burseraceae tree density varies from 1 to 50 trees/ha in different Amazon forests, this study predicts one collector could harvest 1 to 19 kg of resin/day. Sun-dried resin lost 17% of its weight prior to sale so these yields would generate average harvesting revenues of \$0.21 to \$3.94/day. This weight loss was mostly due to essential oil volatilization, but resin drying that permitted stingless bee resin removal lost 10% more weight than fully-screened samples.

Tembé harvests of several tons of resin/year may have depleted resin supplies and *Sternocoelus* weevil populations near villages. Managing harvests could avoid local depletions, but current harvests can probably be maintained in the large Tembé forest reserve. This study suggests researchers and communities interested in the harvest of resin and medicinal plants should further explore connections between plant defensive compounds and insects that provoke their production. Such agents might better be thought of and potentially managed as beneficial insects rather than pests.

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Characterization of Adult Brazil Nut Trees in Extractive Reserve Chico Mendes, Acre, Brazil

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Brazil nut (*Bertholletia excelsa*) is an emergent canopy species occurring on non-flooded lands (*terra firme*) in the Amazon basin. Its seeds or nuts, which are collected in the wild and sold on the international market, are an important income source for extractive families living throughout the species range. Seed collection appears to be ecologically sustainable as recent comparative studies demonstrate no negative impact on population structure. Still, technologies for improving production are needed to enhance the economic sustainability of extractive reserves.

The objective of this preliminary study, executed in a 465-ha Brazil nut-rich forest within Extractive Reserve Chico Mendes, was to examine factors affecting Brazil nut productivity, focusing on effects of vine loads on adults. Only trees ≥ 30 cm DBH were considered adults and included in the analysis given that no tree below this cutoff produced fruit. For each tree, DBH was measured, and GPS coordinates and categorical data on vine load, nut production, and crown form and position were collected. Densities and diameter distributions were calculated for the stand.

Adult Brazil nut densities were 1.01 individuals ha⁻¹. Mean population DBH was 99 cm, and 90% of individuals were between 47.6 and 150.2 cm. The number of trees with vines was high (60.3%), and almost half of these were considered to have heavy loads. Preliminary statistical analyses indicate that heavy vine loads negatively affect nut production.

Traditional knowledge indicates that vine cutting favors Brazil nut production. Future research focusing on silvicultural treatments for reducing vine competition is recommended.

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