

Tropical Resources Institute

TRI NEWS

No. 4
Fall 1987/88

Message from the Director

Centennial celebrations of the birth of famous people have always seemed a strange cultural ritual. The ritual serves as a means for present generations to excuse themselves for all the bad things they did to an older generation, yet the present still gets to turn all the ritual posturing to its own self righteous utility. It is a practice not unlike European colonial powers carrying the sword and the bible so they could do very well economically, while feeling good because they preached the gospels. Still, there is some value in the ritual, if by invoking the past we can get a better understanding of where we stand and how we most need to alter our behavior if we hope to come even close to the grand hopes that our ancestors held for us. Be that as it may, in the case of Aldo Leopold I make an exception. This year, 1987, is the one-hundred year anniversary of Leopold's birth in Iowa.

Leopold, who was a Yale graduate, was a forester who ran counter to much of the prevailing forestry wisdom of his time. Further, he helped to establish wildlife ecology and game management as subjects of professional study and practice. He identified wilderness as a legitimate resource and produced a set of essays that were published after his death in 1948. Leopold, who died while fighting a fire on a neighbor's forest land, did not expect much impact from his essays. Yet, his one short essay on

Contents

Message from the Director	1
Research Profiles	
<i>Catherine Radford</i>	3
<i>Nora Devoe</i>	4
Cooperators	6
Cooperator Notes	7
TRI Notes	9
Literature	12

the land ethic has done more to inspire the American wilderness and environmental movement than all of the coffee table nature books stacked higher than the highest mountain.

Amidst all the hoopla that will accompany the celebration of Leopold's birth, it seems wise to reflect upon how important a single, determined person with an innovative perspective can be. When we begin to despair at resolving our local and our global social and environmental problems it is important to recognize how important a few well chosen words can be.

" And, as with the present American economy, there will need to be some hard moral choices made once people adjust to the fact that life rides on more than wishes and rhetoric."

Beneath the conventional words that Leopold used there was a highly revolutionary message — if we judge the land, resources or ourselves by economic factors alone we and the land are bound to ultimately perish. The black Monday (19 October, 1987) crash of the U.S. Stock Market seems a fitting test of all the theories that greed alone and the ensuing trickle down from the rich would simply not work, even for the paper rich. We are all members of a national and world community and our personal rights must be balanced by our equal adherence to obligation . . . to what we owe one another and the future.

Leopold reminded us that "an ethic, ecologically, is a limitation on freedom of action in the struggle for existence. An ethic, philosophically, is a differentiation of social from anti-social conduct . . . all ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts". To live in a harmonious community, the individual members must forego the satisfaction of certain personal desires in order to serve the collective good. As one reads the "ethic" you begin to realize how pre-industrial is the vision that Leopold is suggesting. He then takes our relationships to

our fellow human beings a next step, the land ethic, "changes the role of *homo sapiens* from conquerer of the land community to plain member and citizen of it. It implies respect for the community as such". And here Leopold re-discovers the ancient wisdom of Buddhism which encourages us to see the interrelatedness of all forms to one another, with no one member more important than another. Indeed, E.F. Schumacher in *Small is Beautiful* has a chapter on "Buddhist economics" as an antidote to the materialism of most western policies of 'development'.

Leopold's musings on a small abandoned farm in the driftless area of Wisconsin may not have much to do with all the present concern about biotechnology, international gold flows, miracle trees, biodiversity, deforestation, re-distribution systems, agroforestry, community forestry and the latest forms of technology transfer. Yet, to replay some of the ideas I shared with you in the last newsletter, at some point supply-side forestry and ecosystem management will need to find the ethical means to live with ourselves, as we are, not as we might like to imagine we might like to be. And, as with the present American economy, there will need to be some hard moral choices made once people adjust to the fact that life rides on more than wishes and rhetoric.

Leopold thought that the depression and emergence from the Second World War had us evolving toward a land ethic. All that mankind needed to do was "quit thinking about decent land use as solely an economic problem. Examine each question in terms of what is ethically and esthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise". It is crucial to remind ourselves that he included humanity as a natural part of that biotic community. Such hopes seem almost quaint in our sophisticated age of computer models. Yet, Leopold reminds us of something we hope to hide from in the rich effluvia of the mathematical model's output - - the practice of the art and science of resource management is ultimately the exercise of an ethical obligation we have for one another and our equals in the ecological community. Our professional practice begins and ends not in high tech, but entangled in an ancient set of ethical choices. Buddha's wisdom is as important as a new technology.

- William R. Burch, Jr.

RESEARCH PROFILES

Use, Knowledge, and Values of Animals Among the Embera Indians of Panama.

Catherine Radford, Ph.D. Candidate
Yale School of Forestry and Environmental Studies

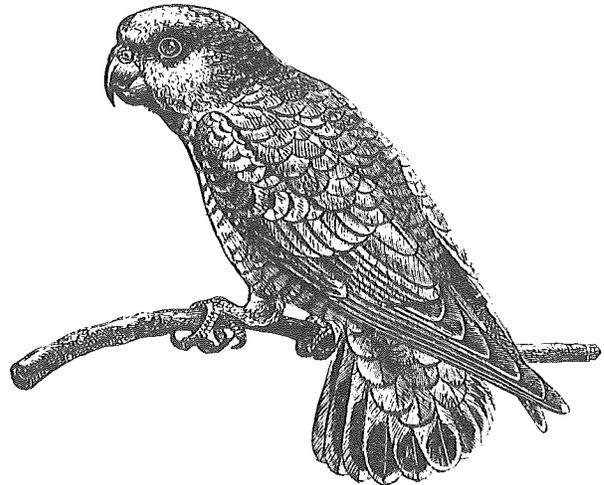
Introduction

The accelerating rate of extinction of species has led to world-wide concern for protecting wildlife habitat. Yet the best of intentions and the most carefully formulated management plans often run afoul of unforeseen social and political factors. Animals which appeal to educated city dwellers, such as the wolf, are considered pests by many who inhabit the animal's range, because of either damage of livestock or competition for game animals such as deer. Assessing the attitudes of the various actors, then becomes essential to developing a management plan for a given wildlife conflict. This is important as well in managing non-endangered species such as fish, game, and fur-bearing animals which are the basis for multi-million dollar industries.

Many countries outside the United States lack information as well as the resources to manage wildlife and preserve the habitats. In cases where national parks are set aside, they often cannot be protected from the growing population's need for land and food.

In particular, the problems of indigenous peoples, long economically and politically marginalized, are becoming more widely known, as they are increasingly called upon to bear the burden of exclusion from traditional subsistence resources, whether through creation of reserves or encroachment of colonists. Many traditional people believe that the problems that caused the shrinking resources base are not of their making, and that in fact their way of life represents a sustainable alternative to the consumptive and polluting industrial economy.

In many areas of Latin America indigenous populations have been until recently left alone to follow traditional subsistence patterns. The continued survival (until threatened by outsiders) of the Amazon rain forest and other areas of Indian habitation has posed the question to researchers not whether the Indians manage their resource base, but how they manage it. Because each habitat is different and people differ (from other people and from themselves over time) in their responses to environmental factors, no judgement can be made that will apply broadly unless it is supported by studies of each tribe in the area of interest. This project focuses on a lowland tropical



rainforest people, the Embera Indians (also known as the Choco) of Darien Province, Republic of Panama, in order to determine as accurately as possible their attitudes toward animals in the context of natural resource management.

Study Site

The principal study site was Manene, an Embera village of approximately 250 inhabitants on the Balsas River, near the Colombian border. This village is located in the Darien National Park, an international Biosphere Reserve and World Heritage Site. The area is exceptionally rich in game and is also a center of traditional culture. I made trips to four other rivers in the Darien for comparison.

Data

Ethnographic data were collected on uses of and interaction with animals: game and non-game wildlife, domestic animals and pets. The second level of analysis concerns knowledge of animals' biology and ecology; the Embera taxonomic system and linguistic features pertaining to the natural world; and ethnoecological concepts and principles of natural resource management. The third type of data reveals values of animals, for example as food, companions, pests, medicine, or mythical personages, with emphasis on the philosophical meanings these have for individuals and the society as a whole.

Methods

The methods used were participant observation and unstructured interviews. Paid informants were not used in order to avoid both bias in the study and jealousy and disruption in the community. I made an effort to include men, women, and children, and a wide range of ages, educational levels, and other factors. Documenting individuals differences in beliefs and practices was an important facet of data collection. I strove to reduce bias in a number of ways and devised a system for weighing the relative accuracy of observations.

Conclusion

Now that the fieldwork has been completed, the next steps will be to analyze the data and write the dissertation.

There are three areas of potential application of the results of this project, both locally in the Darien and in a broader sense. These are: resolving natural resources conflicts; wildlife conservation and park management, with emphasis on the Darien National Park and its role as part of UNESCO's Man and the Biosphere Program; and gaining an understanding of the knowledge and wildlife management techniques that indigenous peoples have to offer.

Acknowledgements

Principal support for this research came from Doherty Foundation for Latin American Studies at Princeton University, with supplemental funding from the Tropical Resources Institute, the Yale Council on Latin American Studies, and the G.R. Dodge Foundation.

Towards Improving Natural Regeneration Silviculture in the Humid Tropics: The Effects of Light Exposure Level on the Growth of Tropical Tree Species *El Verde, Puerto Rico and Barro Colorado Nature Monument, Panama*

Nora Devoe, Ph.D. candidate

The need to conserve and to rationalize the use of tropical moist forests is clear and urgent. One and perhaps the best hope for conservation in the tropics is the profitable management of natural forests which may surround strict nature reserves or stand alone to provide the multiple benefits of forest cover. If investment in forest management is made more competitive with alternative land uses, the requisite economic incentive to conserve natural forests will be strengthened. Research in natural regeneration has a major role to play in widening the margin between the value of management and the value of benefits derived from them.

Many tropical timbers require a break in the canopy at one or more stages of their life cycles in order to grow to maturity. Measurements of the size and frequency of natural canopy openings, usually treefall gaps, confirm the sufficiency of gap areas for forest regeneration. Treefall gaps initially vary tremendously in size, orientation, populations surviving the treefall, proximity to particular seed sources, and many other parameters which may influence subsequent colonization. So many variables and such a large species pool are potentially involved that some investigators have concluded that gap colonization is largely if not purely fortuitous.

However, gap size is one characteristic that has been linked repeatedly to species composition. The studies at

El Verde and in the Barro Colorado Nature Monument advance the premise that this is so primarily because gap size and orientation determine shade and shadow patterns which establish levels of light and heat affecting seedlings. If it is true that size of opening influences species composition principally through levels of light and heat, this can be proved by examining recruitment and growth across a range of microclimates. The value of such a conclusion is that if we understand the mechanism by which changing size of forest opening influences species composition, we have gone a long way toward refining the forester's prime tool, artificial canopy opening, to improve stocking and composition of treated stands. If we improve stocking and composition, we increase economic value and hence, conservation potential.

The investigation at El Verde, Puerto Rico contains two experiments which are run concurrently on the same plots. The plots are two equal-area openings in the tabonuco forest. The openings were cut in degraded secondary stands that had first been censused and mapped to provide a record of the location of each of the original stems taller than two feet. This data provide for comparisons of forest structure and composition before and after treatment. The algorithm of Brown and Merrit (1970) was used to determine the width of the cut strips as a function of location, height of the encircling forest, slope and

aspect. The openings were sized to include the full range of microclimatic conditions from the forest edge to fully exposed in the plot centers with direct sunlight from 8 am to 6 pm.

Exposure levels within the openings and in the surrounding forest were established on the ground through measurements of total irradiance with pyranometers and in units of photosynthetic photon flux density with quantum sensors. A program of environmental monitoring includes light, soil moisture and temperature at two depths, air temperature and relative humidity.

In one experiment equal levels of seedlings of each of five tree species were produced in a nursery and then planted at a 3 x 3 meter spacing within the gaps into the surrounding forest. The five species occur naturally together and include valuable timber species and species thought to compete with the timber trees [*Daryodes excelsa*, (tabonuco); *Sloanea berteriana*, *Cacao motillo*; *Guarea guidonia*, (guaraguo); *Schefflera morototoni*, (yagrumo macho), and *Cecropia peltata*, (yagrumo hembra)]. These species span the range of shade tolerance from highly tolerant to shade-intolerant, from primary forest species to pioneers. Competition is standardized by uniform spacing and weeding. The survival and growth (height, dry matter production) of the seedlings will be compared intra- and inter-specifically to determine which microclimatic conditions favor which species and how the species respond as a cohort. This experiment was established in the spring of 1987. Mortality two months after out-planting was 11 percent. The second set of counts and height measurements is now being taken.

The experiment is a split-plot design. Exposure is the main treatment represented at four levels. Species constitute the splits or subplots. The physical nature of the experiment is such that the location of the main treatments cannot be randomized. Since similar exposure values are found in proximity to each other, the associated error terms may not be independent. The replication of the complete experiment provides the strip as the unit of independent replication. The analysis of variance will follow the models of Montgomery (1976:294) and Gomez and Gomez (1984:341). Block and cluster techniques and multivariate regression will be used to assess the effects of the environmental variables on species and aggregate plant response. Application of this experiment is in the improvement of stocking and composition of managed natural forest.

In the second experiment, one-meter square plots were laid east/west across the openings and into the surrounding forest. The plots were initially cleared of all living vegetation (but not litter) and are now being monitored to observe which species enter which microclimates, at what

rates, in what sequences and with what results. The experiment will contribute to our knowledge of natural successional processes. The application of these results is in the evaluation of the biological and economic efficiency of these processes to restock cleared sites.

In the investigation in the Barro Colorado Nature Monument, the plots are twenty openings in the forest ranging from 40m² to 400m², most of the size range of natural treefall gaps. This range includes opening sizes most likely to occur under natural forest processes and also those most likely to result from timber extraction under forest management. The complete range of microclimates from the understory to fully-exposed are included. Half of the plots were cleared completely, as in the El Verde study, and in the other half the understory and boles only were removed. The experiment tests the effects of exposure level, gap size and understory vegetation on the survival and growth of planted seedlings.

In this experiment, the canopy photography and video analysis system developed by Dr. Alan P. Smith at the Smithsonian Tropical Research Institute will be used to measure the light climates of the planted seedlings. Other environmental monitoring will include soil temperature at two depths, soil moisture, air temperature and relative humidity.

Seven hundred seedlings of each of five study species were produced. The five species are ecological associates and include the most valuable commercial timbers in Panama. They also span the range of shade tolerance. Included are *Prioria copaifera*, (cativo); *Anacardium excelsum*, (espave); *Terminalia amazonica*, (amarillo); *Cordia alliodora*, (laurel); and *Cecropia peltata*, (guarumo). In September 1987, this was planted at 3 x 3 m spacing within the gaps and under the canopy of the surrounding forest. The survival and growth of the seedlings will be compared intra- and inter-specifically, along the lines of El Verde study.

Funding for the research in Puerto Rico is provided by Oak Ridge Associated Universities and the Yale Tropical Resources Institute. The University of Puerto Rico's Center for Energy and Environment Research, the U.S. Forest Service Institute of Tropical Forestry and the Caribbean National Forest are cooperators in the study. Work in Panama is supported by a cooperative research agreement between Yale University School of Forestry and Environmental Studies and the U.S.D.A. Office of International Cooperation and Development for the U.S. Agency for International Development. The Smithsonian Tropical Research Institute hosts the project. Additional support has been received from the Yale Tropical Resources Institute and the Panama Canal Commission.

COOPERATORS

The Universidad Nacional Agraria La Molina - Lima, Peru

The university was officially recognized in 1960. However, it has a long tradition in agrarian sciences as it was formerly a National Agriculture School which was established in 1902. As an academic center, the university has achieved international recognition in education and research.

The university has faculties of agronomy, agricultural engineering, biology, chemistry, economy, food industry, fisheries, mathematics, meteorology, nutrition, soils and statistics as well as a Regional Institute for Development and a Research Institute.

The Faculty of Forestry Sciences

The Faculty was created in 1974 under an agreement with the Farm and Agriculture Organization. There are two departments within the Faculty: Forestry Management and Forestry Industries. Both departments are equipped with laboratories and other research facilities and work in cooperation with the Masters Program of the Graduate School.

In 1983, a specialized masters program was established with assistance from the Canadian International Development Agency. This program incorporates three areas of specialization in which students can major: conservation of forest resources, forestry management, and forestry industries. The program has been recognized as one of the best graduate programs in tropical rain forest conservation and management in Latin America.

Research Facilities

The Faculty of Forestry Sciences has laboratories for silviculture, photo interpretation, plant anatomy, pulp and paper research, wood preservation, and has available a greenhouse and a herbarium. Other facilities include: a library with extensive material on forestry and natural resources in Peru; and a Data Center for Conservation which provides scientific information about flora and fauna and the ecosystems of Peru.

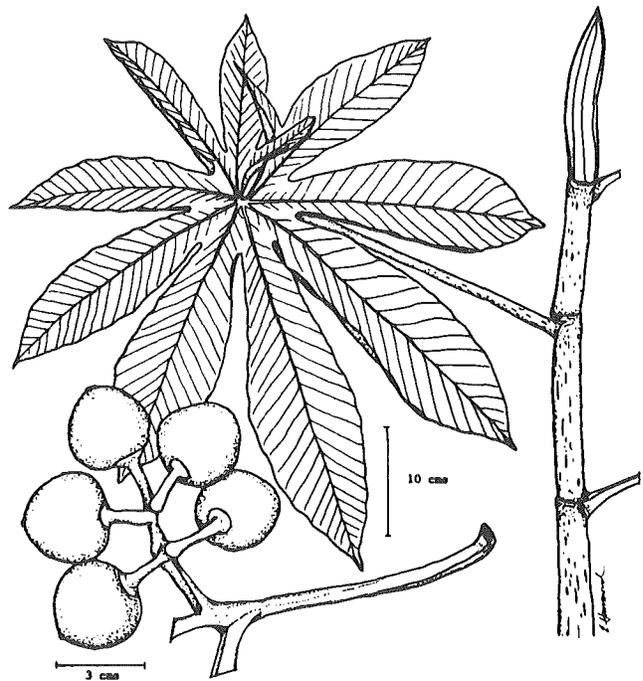
The university has three regional institutes located in different geographical regions. The government of Peru has given the university 5000 hectares of natural forest lands to establish the Model Unit for Management and Forest Products as well as an experimental forest.

Cooperating Agencies

The university and the Faculty of Forestry Sciences are working in close cooperation with: the Canadian Agency for International Development; Colorado University, International Development Research Center in Canada; Nature Conservancy International; the Swiss Government and the World Bank.

Research programs

Research areas include: use of secondary forest in the tropical rain forest (biological, technical and socio-economic research); use and management of Amazonian Natural Forest; a permanent inventory of natural resources. Areas currently being developed include: agroforestry, taxonomy, botany, rural development and wildland management. For more information about La Molina, please contact: Dean Jose Dance, Universidad Nacional Agraria La Molina, Facultad de Ciencias Forestales, Apartado Postal 456, Lima, Peru.



Pourouma cecropiaefolia Mart.

COOPERATOR NOTES

The **Conservation Trust of Puerto Rico** is completing the restoration of a manor house built in 1847 at Estancia Buena Vista in Ponce. A series of raceways or channels totaling 2,600 feet, a coffee mill, a corn mill, a coffee drying house, and a corn warehouse which doubled as a shelter during the hurricane season have been restored. Along with coffee and corn, pineapples of an historic variety called "pan de azucar" (sugar bread), plantain, and bananas are being cultivated at the 80-acre site, the remnant of what originally had been a prosperous 500-acre plantation. An interpretive program is currently being drawn up for this site, which is scheduled to be opened to the public during the summer.

The **Island Resources Foundation (IRF)** is providing technical assistance to the Caribbean Conservation Association (CCA) and selected Eastern Caribbean islands for the development of country environmental profiles. These profiles help to ensure that environmental issues are addressed in planning development projects. In addition, an IRF research team led by Dr. Mary Lou Coulston completed a pilot experimental seagrass transplantation project on the south shore of St. Croix. Dr. Coulston also carried out a three-month biological monitoring program for the Red Point sewer outfall area of St. Thomas. For more details about these projects as well as other IRF activities, contact Dr. Edward Towle at IRF's office at Red Hook Box 33, St. Thomas, U.S.V.I. 00802 (809)775-6225.

The **International Union for Conservation of Nature and Natural Resources (IUCN)** has appointed Dr. Martin Holdgate as its new Director General. Dr. Holdgate will begin his appointment in April 1988 following the General Assembly of IUCN in San Jose, Costa Rica in February.

The papers from the September 1986 conference on "Management of the Forests of Tropical America: Prospects and Technologies" have been published by the **International Society of Tropical Foresters (ISTF)**. The 32 papers concentrate on natural forest management, plantations, social forestry, and extension. To obtain a copy of this publication, please write ISTF, 5400 Grosvenor Lane, Bethesda, Maryland 20814 USA.

The **First International Congress of Ethnobiology**, sponsored by the Nucleo de Ethnobiologia of the **Museu Paraense Emilio Goeldi** in Balem, Para, Brazil will be held from July 19 to 24, 1988. The six-day Congress will be divided into three parts: 1) ethnobiological research, 2) interdisciplinary discussions organized around geographic and area studies and 3) presentations of applied ethnobiological projects and discussions about potential research.

To receive more information about the congress, please contact Dr. Darrell Addison Posey, Nucleo de Ethnobiologia, Museu Paraense Emilio Goeldi - CNPq, Caixa Postal 599, 66.040 Belem, Para, Brazil. Telephone: (091)228-2341 ext. 65.

The **National Zoological Park of the Smithsonian Institution** will hold a conference on "Culture: The Missing Element in Conservation" on April 8 and 9, 1988 in Washington, D.C. Two general areas - "Human Dimensions of Conservation Problems" and "Culture as an Element of Conservation Solutions" will be discussed. Additional information can be obtained from Katy Moran, Office of Public Affairs, National Zoo, Smithsonian Institution, Washington, D.C. 20008.

The **Virgin Islands Resource Management Cooperative (VIRMC)** is sponsoring Dr. Caroline S. Rogers' coordination and preparation of a synthesis and summary report of research and resource management information on terrestrial and marine resources in the Virgin Islands National Park and Biosphere Reserve. The report will be used to identify future research needs and to recommend management alternatives and options for ecosystems within the park and biosphere reserve. This publication is intended for scientists and protected-area managers in the Caribbean. Other projects include a study of Buck Island Fisheries off St. Croix, a long-term vegetation monitoring project on St. John, and research by Cindy Ginez and Carlos Ramos from the **Center for Energy and Environment Research** in Puerto Rico on the impact of heavy metals in intermittent streams within guts on St. John and on the marine ecosystems which receive runoff from these guts. Information about these and other VIRMC projects can be obtained from Dr. Caroline Rogers, Virgin Islands National Park, P.O. Box 7789, St. Thomas, U.S.V.I. 00801, USA.

The **Centre for Environmental Studies** publishes a Fuelwood Research Bulletin which summarizes projects which are being carried out at the **University of Tasmania**, Australia. The Centre is a multidisciplinary research and post-graduate teaching institution. General research fields include land use, environmental law and policy, pollution, energy, environmental thought, green politics and ecological issues. Masters and Ph.D. degrees are offered. From May 16 to 20 1988, the Centre will be hosting a conference on **Energy for Rural and Island Communities**. For more information about the conference, the Centre, its Fuelwood Research Group and Bulletin, please contact Dr. John Todd, Centre for Environmental Studies, University of Tasmania, G.P.O. Box 252C, Hobart, Tasmania, 7001, Australia.

Forthcoming projects of the **South-East Asian Rain Forest Research Programme** include: research on tropical rain forest hydrology and geomorphology at the Danum Valley Field Centre in Sabah, Malaysia and a study on soil fauna in primary and logged-over forest in Sabah. For more details about the Programme's research projects as well as a copy of their newsletter, please write Dr. Arian G. Marshall, Research Coordinator, Institute of South-east Asian Biology, c/o Department of Zoology, University of Aberdeen, Aberdeen AB9 2TN, Scotland, U.K.

The **Instituto de Investigaciones Agropecuarias** recently has published a book entitled *Suelos Volcanicos de Chile*. This publication is a summary of the actual knowledge on these soils combined with the experience accumulated in Chile over 45 years. Also included in the publication is an album which consists of ten colored soil maps and eight maps of the volcanic quaternary sediments. The book can be purchased at the La Platina Station, Casilla 439, Correo 3, Sanitago, Chile.

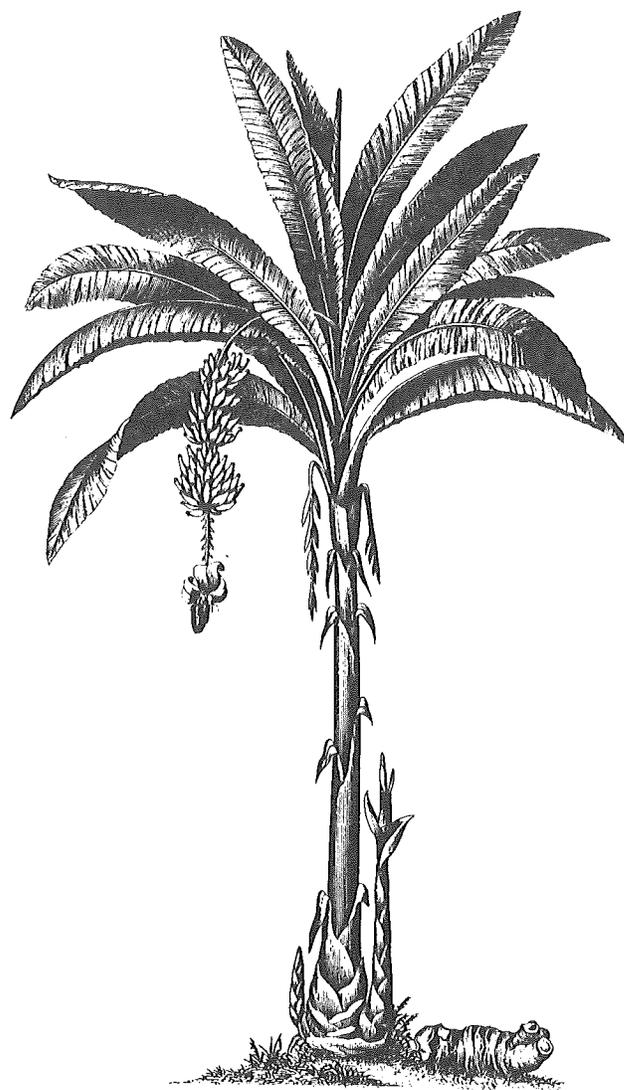
A Geographic Information System is being developed by the **U.S. Geological Survey (USGS)** to assist Commonwealth of Puerto Rico agencies with water-related issues. The GIS data base will detail the areal distribution of ground-water resources in terms of their physical, chemical and biological characteristics and their proximity to sources of contamination. The USGS has recently published: *Climatological Data for the Rice-Growing areas along the North Coast of Puerto Rico* as well as *Water Resources Data of Puerto Rico and the U.S. Virgin Islands, Water Year 1985*. More information on the GIS program and USGS reports is available from the U.S.G.S., Water Resources Division, GPO Box 4424, San Juan, PR 00936.

From July 12 to the 19th, the **Fourth Round Table Conference on Dipterocarps** will be held in Bangkok and Nakhon Ratchasima Province, Thailand. The conference will focus on natural and experimental regeneration. Registration fee is U.S. \$50. For more information contact: Mr. Parvist Chittachumnonk, Silvicultural Research Sub-division, Silvicultural Division, Royal Forest Department, Bangkok 10900, Thailand.

A new publication entitled *Lesser Antilles Park and Protected Area News*, sponsored by the **Caribbean Conservation Association** and the **Eastern Caribbean Natural Area Management Programme** is available through CCA, Savannah Lodge, The Garrison, St. Michael, Barbados.

The **International Union of Forestry Research Organizations (IUFRO)** will be holding an All Division

Conference on "Forest Products Research — Improved Utilization for Economic and Social Development" from May 15 to the 20th in Sao Paulo, Brazil. If interested in attending, contact Mr. J. Luther Utt, Unique Rewards, P.O. Box 21385, Roanoke, VA 24018, USA or if you reside in Brazil, contact Dr. Amantino de Frietas, I.P.T. Cicade Universitaria, Postal 7141, 05508, Sao Paulo, Brazil.



TRI NOTES

Faculty and Student Activities

Peggy R. King, Assistant Director of Education for TRI resigned her position this semester to relocate to Minnesota. Peggy was instrumental in establishing TRI's education program over the past three years and her valuable presence is sorely missed. Ms. Sarah T. Warren who obtained a masters degree from Yale F&ES in 1986 and who is currently pursuing a doctoral degree at the School has taken over Peggy's responsibilities.

In May, TRI Director William R. Burch Jr. participated in a symposium concerning Indochina and natural resources management at Mohonk Mountain, N.Y. This conference was the largest gathering of U.S. and Vietnamese scientists since the Vietnam War. In August, Dr. Burch served as a consultant to Winrock on their F/FRED (Forestry/Fuelwood Research and Development) training and education project. During the latter part of the month, he traveled to the U.S. Virgin Islands to work with the National Park Service on a development study. In December, Dr. Burch participated in a regional community forestry training seminar at Kasetsart University in Bangkok, Thailand. Participants from all over Asia and the Pacific attended.

Dr. Francois Mergen opened the XVI Pacific Science Congress on August 30, 1987 in Seoul, Korea. He gave a talk on the challenges faced by forest managers in the Asia Pacific region.

Dr. Ghilleen T. Prance and Dr. Michael Balick of the New York Botanical Garden Institute of Economic Botany and visiting faculty of Yale F&ES received a grant from the National Cancer Institute to collect plants that may be effective against cancer. This five-year program will involve the collection of 7,500 plants from South America's tropical rainforest region.

Michael J. Balick has recently co-authored a volume entitled *Brazilian Palms* with Claudio U.B. Pinheiro of the Empresa Maranhense de Pesquisa Agropecuaria in San Luis, Brazil. This publication appeared as Volume 17 in the series *Contributions from The New York Botanical Garden*. The monograph is a compilation and translation from the classic work on useful plants of Brazil written by Manoel Pio Correa and published as a six volume set. This translation contains updated nomenclature for all of the palm species mentioned, and for the first time makes available this information in a single volume. The work also contains 38 photographs taken of the contemporary utilization of palms.

Several masters students completed internships this summer in Puerto Rico, Costa Rica, Nepal and India. These students were supported by TRI and by a cooperating institution. Their work, as well as doctoral research supported by TRI, is detailed below.

Holly Welles worked in cooperation with the Center for Energy and Environment Research. She studied the adsorption of nutrients in a small stream, La Prieta, located in the Caribbean National Forest. Four separate field experiments were completed involving the addition of nutrients, calcium, nitrate, phosphate, and potassium one at a time to the stream for seven continuous hours. The stream was sampled prior to the nutrient addition and thereafter once every one to two hours. The data supported the hypothesis that stream sediments do absorb these nutrients. The significance of the amount of absorption by streamwater sediments and its relevance to biological activity is currently being evaluated. A report is being written and is intended for publication in early 1988.

Eric Olson did a project in conjunction with CATIE on biosphere reserves of Central America. Eric looked at three reserves, one in Costa Rica, one in Panama and one in Honduras. Two other reserves have been proposed to UNESCO and will probably be approved early in 1988 when the Man and the Biosphere Committee meets. One of the proposed reserves is in Costa Rica and the other is in Panama. Eric visited the three existing and the two proposed reserves. Through interviews, observation and a review of the management plans, an initial assessment was made on how close to "ideal" these reserves presently are. Baseline information about each reserve was collected for evaluation.

Manuel Ramirez also worked in Costa Rica this summer with the Tropical Science Center. Manuel carried out a research project on wet forest environments on the Osa Peninsula in southern Costa Rica. The research site is located in Piro, 400 kilometers southeast of San Jose. The projects general goals were: to get a better understanding of the dynamics of succession and stand growth in tropical wet forests by establishing a long-term monitoring system on stand development; and to set up the initial steps to implement a sustained-yield based forest management plan for the area in the near future. A systematic forest inventory was conducted for primary and secondary forests. A one-hectare permanent plot was established in the primary forest where all trees were mapped and data on regeneration was collected. Finally, a narrow strip

clear-cutting operation was performed to set up a permanent plot in this man-created disturbance. The final results of this project will form the cornerstone for a management plan.

Also working with the Tropical Science Center was master student Cristin Gallup. Cristin researched the relation between the Monteverde Cloud Forest Reserve and the nearby communities. The Cloud Forest, which is administered by TSC, is located in the Tiliarn mountains of northern Costa Rica. The reserve is designed to protect the ecosystem, provide research and educational opportunities, and is open to tourism which has grown dramatically over the last ten years. Cristin's research focused on providing TSC with an assessment of the Monteverde area residents' perceptions of the reserve and reserve management. She used methods of social ecology (travel time studies, time budgets, energy flows, and rates of change within the communities), observation, and interviews. The majority of work concentrated on the communities of Monteverde, Cerro Plano, Santa Elena, and La Cruz.

William Condon went to Nepal last summer where he was involved in a number of projects. While in Kathmandu, he conferred with staff of the International Centre for Integrated Mountain Development (ICIMOD), which lent considerable support to his work. William's primary task was to collect information on indigenous methods of fodder tree management used in hill farming systems. This information included local criteria for species and planting site selection and coppicing techniques. He found considerable expertise among villagers in how to manage their trees and he identified opportunities for information exchange among people from different regions, villages, and sometimes within the same hamlet. This information will contribute to developing innovations to increase the productivity of fodder trees growing between agricultural terraces and in adjacent community forests.

William also had a contract to collect plant samples and prepare herbarium specimens in what remains of the moist tropical forest in the Terai of eastern Nepal on behalf of the University of Illinois at Chicago and the National Cancer Institute of Washington, D.C.

Finally, William evaluated the forestry component of a community development program administered by Save the Children Federation in a hill district in central Nepal. He identified opportunities for improving nursery management and planting technique and for increasing the coordination among Save the Children, village user groups, and the District Forest Controller in forest management, protection and resources distribution.

Ph.D. student Elysa Hammond traveled to Peru this summer to work on a field guide to native fruit trees and to develop potential research connections between TRI and professionals involved in resource management in Peru. While in Peru, Elysa met with professionals from the Universidad Nacional Agraria, La Molina - Lima, Manu National Park and U.S.A.I.D.

Dorceta Taylor, a joint Ph.D. candidate in sociology and forestry and environmental studies, traveled to St. John in the U.S. Virgin Islands this fall to begin research on the effects of modernization on the patterns of leisure behavior. Her research will utilize the study of leisure patterns as a means of understanding the effects of modernization on aspects of the socio-cultural environment. The study will examine the past and present patterns of leisure behavior and projections of future expectations of leisure in five age groups. More specifically, it will seek to determine whether or not tourism and the establishment of a national park covering about two thirds of the island and managed by the National Park Service has affected local leisure behavior.

Laura Snook spent the summer in the Yucatan peninsula of Mexico to begin her doctoral dissertation research on stand development following disturbance in the tropical moist forests of Quintana Roo. This study will be the first to analyze stand development in a tropical forest. In Mexico, Laura is working in cooperation with the National Institute for Research on Forestry, Agriculture and Animal Husbandry and the National Institute for Research on Biotic Resources.

Doctor of Forestry candidate Mary Rowen went to Kenya this summer to do preliminary work for her dissertation research on mother-infant behavior of wild and captive populations of Grevy's zebra: factors influencing infant survival, herd demography and social organization. A captive population is currently being studied at Canyon Colorado Equid Sanctuary, New Mexico and study of a wild population will take place in Samburu/Buffalo Springs reserves in northern Kenya.

Visitors

October:

On October 1, Dr. Richard Bierregaard, scientific director for the World Wildlife Fund project on minimum critical size of ecosystems in Manaus, Brazil gave a talk about the project and met with interested students.

Yale F&ES graduate Bostjan Anko came to the School in October and gave two talks. On October 6, he presented "Multiple-Use Forestry and Community Development in the Julian Alps - Lessons for Developing Countries" and

on October 9 he talked about "Nature-based Tourism and Rural Development in Yugoslavia - Some Strategies for Developing Countries".

On October 7 and 8, TRI and the General Seminar Committee sponsored a conference on Forests, Floodplains and Farmers: Environment and Resource Use in the Peruvian Amazon. This conference, which was organized by Ph.D. student Elysa Hammond, brought in: Dr. Charles Peters, ecologist with the New York Botanical Garden; Dr. Christine Padoch, anthropologist with NYBG; Miguel Pinedo-Vasquez advisor to the Federacion Campesina de Maynas of Peru; Dr. Mario Hiraoka, Professor of Geography at Millersville University; Dr. Michael Chibnik, professor of anthropology at the University of Iowa and Wil de Jong, agroforester from Wageningen University in The Netherlands.

Dr. Alan Grainger presented a Henry S. Graves lecture on October 15 on "Creating a Future for Tropical Forests". The previous day, Dr. Grainger talked with the students in the International Resources Group on some of the problems in studying international forestry.

The Committee on Scholarly Communication with the People's Republic of China sponsored a seminar on October 19 by Professor Wu Zhonglun, President of the Chinese Society of Forestry. Dr. Wu spoke about tropical forestry in China.

Ph.D. student Daniel Nepstad presented his work in a Greeley seminar on October 20. His talk was entitled "Deep Roots and Drought: Barriers to Forest Regrowth in Abandoned Amazon Pastures".

On October 26, Dr. Gary Hartshorn visited the School and gave a presentation on "National Forest Management in the Peruvian Amazon: The Palcaza Project".

Dr. Philip Kio from the University of Ibadan, Nigeria gave a talk on October 28 entitled "Conflicts and Compromises in Tropical Forestry Management and Conservation".

The following day, Cindy Gines Sanchez spoke on "Environmental Activism and Management of El Yunque Rain Forest in Puerto Rico".

November:

On the 5th, John B. Raintree from the International Council for Research in Agroforestry presented "Frontiers of Agroforestry: Diagnosis and Design".

Dr. H.G. Nandadasa spoke on "Research on Social/Community Forestry in Sri Lanka" on the 18th and Dr. Phillip Sollins gave a talk the next day on "Biological Control of Nutrient Retention in Tropical Soils".

Courses

This fall semester, TRI is offering a course on tropical forest ecology taught by Dr. Peter Ashton from Harvard University. Dr. Ashton brought in a series of speakers to present work on topics ranging from tropical savannas to village forest systems. Also this fall, Dr. Brian Boom of NYBG taught his course on plant systematics. In the spring, Dr. Ghilleen Prance and Dr. Michael Balick from NYBG will be teaching their course on plant resources for the tropics and Dean John Gordon will be teaching a course on agroforestry. Dr. Phillip Sollins will be teaching a course on tropical soils.

Graduates

Kathy Rorison, (M.F.S. 1987) has taken a position with CARE in Haiti as Agroforestry Training Officer. She will be working to set up four extension training offices in a new region of Haiti and to institutionalize a training program. This summer, Kathy worked in Rome as an associate professional officer for FAO. In this position, she worked with Ms. Marilyn Hoskins in the community forestry unit.

Also from the class of 1987, Nina Marshall (1987) is working as an intern at CARE in N.Y., and Anne Reilly has taken a position with the New York Botanical Garden.

Jim Chamberlain (1986) has taken a position as development associate for Asia with the Nitrogen Fixing Tree Association of Hawaii. Prior to this, Jim was working at Winrock International, developing agroforestry training materials and examining rural development problems in the U.S.

Mark Dillenbeck (1986) is in Paraguay as a Peace Corps volunteer. He is working with the Instituto Agropecuario Salesiano in Coronel Oviedo.

Nancy Sheehan (1986) also has joined the Peace Corps and is stationed in the Gambia, West Africa.

Doug Henderson (1983) finished his work in the Cook Islands this spring and, in June, served as a consultant to FAO's office for Asia and the Pacific (Bangkok).

J. Kathy Parker, (Ph.D. 1980) has started her own international social ecology consulting business out of Broomall, PA.

Graduates — Please send us information on your activities. Longer research articles would also be welcomed.

Position Search -- Yale F&ES is conducting an active search this spring for a tenure track position of assistant professor in tropical ecology. For more information, please contact Dr. Christina Vogt (203)432-5076.

LITERATURE

Noted below are selected, recent additions to the TRI bibliographic database. Searches and printouts of the data-base will be available on demand. We also can provide copies of some items. We would welcome any papers or reports you could send for inclusion in this database. These publications will be listed in the next issue of TRI NEWS. If you do not have publications to send, please mail us citations of publications you judge to have special importance to tropical resources management.

BOOKS

Agroforestry in Haiti. Ashley, M. D. University of Maine, Agroforestry Outreach Research Project under USAID, 1986. 69 pp.

Comparative studies on the utilization and conservation of the natural environment by agroforestry systems. Monsoon Asia Agroforestry Joint Research Team (MAART), Laboratory of Forest Resources, Kyoto University, 1986. 453 pp.

Ecology and tropical biology. Deshmukh, I. Blackwell Scientific Publishers, 1986. 387 pp.

Evaluacion de tierras y recursos para la planeacion nacional en las zonas tropicales; Land and resource evaluation for national planning in the tropics. Forest Service, USDA, General technical report WO-39, 198. 524 pp. An international conference and workshop, Chetumal, Mexico, January 25-31, 1988

Lands at risk in the Third World; local level perspectives. Little, P. ; Horowitz, M. ; eds. Westview Press, IDA monographs in development anthropology, 1987.

Natural management of tropical moist forests; silvicultural and management prospects of sustained utilization. Mergen, F. ; Vincent, J. R. ; eds. Yale University, School of Forestry and Environmental Studies, 1987. 212 pp.

Tidal swamp agro-ecosystems of southern Kalimantan. KEPAS Penelitian Agro-ekosistem ; Research Group on Agro-ecosystems. Agency for Agricultural Research and Development, Jakarta, 1985. 146 pp. Workshop report on the sustainable intensification of the tidal swamplands in Indonesia, held July 18-24, 1983. Sponsored by the Ford Foundation in collaboration with the Agency for Agricultural Research and Development.

Tropical ecology. Pomeeroy, D. ; and others. Longman Scientific & Technical, 1986. 233 pp. Ecology textbook for African undergraduates.

ARTICLES

Advantages, disadvantages and desirable characteristics of shade trees for coffee, cacao and tea. Beer, J. *Agroforestry systems*, 5(1):3-14, 1987.

Agroforestry; a last hope for conservation in Haiti? Zimmerman, T. *Agroforestry systems*, 4(3). 1986.

Agroforestry farming systems in the homesteads of Kerala, southern India. Nair, M. A. ; Sreedharan, C. *Agroforestry systems*, 4(4):339-364, 1986.

Agroforestry in the arid zones of India. Shankarnayan, K. A. ; Harsh, L. N. ; Kathju, S. *Agroforestry systems*, 5(1):69-, 1987.

Campeminos and conservation in the Central Andes; indigenous herding and conservation of the Vicuna. Bernhardson, W. *Environmental conservation*, 13(4):311-318, 1986.

Concepts of resource sharing in agroforestry systems. Buck, M. G. *Agroforestry systems*, 4(3):191-204, 1986.

Conservation of traditional agroecosystems. Oldfield, M. L. ; Alcorn, J. B. *BioScience*, 37(3):199-208, 1987.

Declining tree stocks in African countries. Anderson, D. *World Development*, 14(7):853-864, 1986.

Effect of land-clearing methods and post-clearing management on aggregate stability and organic carbon content of a soil in the humid tropics. Alegre, J. C. ; Cassel, D. K. *Soil science*, 142(5):289-295, 1986.

Environmental awareness and ecodevelopment in India; a training programme for students. Mathew, K. M. *Environmental conservation*, 13(4):351-3, 1986.

Episodic stemflow inputs of magnesium and potassium to a tropical forest floor during heavy rainfall events. Herwitz, S. R. *Oecologia*, 70(3):423-425, 1986.

An evaluation of the structure and function of tropical homegardens. Fernandes, E. C. M. ; Nair, P. K. R. *Agricultural systems*, 21(4):279-310, 1986.

Farming systems research; twelve lessons from the Mantaro Valley Project. Horton, D. *Agricultural administration*, 23(2):93-108, 1986.

Financial appraisal for some afforestation species in Bihar under risk illicit felling. Trivedi, S. N. *Forest ecology and management*, 17(4):261-278, 1987.

The food crisis and environmental conservation in Africa. Stiles, D. ; Brennan, R. *Food policy*, 11(4):298-310, 1986.

Forestry and famine; arguments against growth without development. Roche, L. *Commonwealth forestry review*, 65(2):99-108, 1986.

Forest water usage and interactions with nutrition of Pinus radiata. Turner, J. ; Lambert, M. J. *Oecologia Plantarum*, 8(1):27-44, 1987.

Four endemic Andean tuber crops; promising food resources for agricultural diversification. King, S. R. *Mountain research and development*, 7(1):43-52, 1987, February.

Heavy metal pollution of the mid-canal of Kandy; an environmental case study from Sri Lanka. Dissanayake, C. B. ; Niwas, J. M. ; Weerasooriya, S. V. *Environmental research*, 42(1):24-35, 1987.

Herbivory in simple tropical successional ecosystems. Brown, B. J. ; Ewel, J. J. *Ecology*, 68(1):108-116, 1987.

Household gardens; theoretical and policy considerations. Ninez, V. *Agricultural systems*, 23(3):167-186, 1987.

Human dimension in natural resource conservation; a Sahelian example from Niger. Newby, J. E. ; Grettenberger, J. F. *Environmental conservation*, 13(3):249-256, 1986.

Human impacts on some forests of the middle hills of Nepal. Part 3. Forest in the subsistence economy of Sindhu Palchok and Kabhre Palanchok and Ka. Mahat, T. B. ; Griffin, D. M. ; Shepherd, K. R. *Mountain research and development*, 7(1):53-70, 1987.

Identifying better development projects; a systems approach. Smith, P. J. *Agricultural administration and extension*, 25(1):13-24, 1987.

Indigenous agricultural revolution; ecology and food production in West-Africa. Richards, P. ; Okafor, F. C. *Journal of rural studies*, 2(3):258, 1986.

Indigenous responses to drought in Sub-Saharan Africa. Fleuret, A. *Disasters*, 10(3):224-229, 1986.

Industrial contributions to desertification in South America. Schofield, C. J. ; Bucher, E. H. *Trends in ecology and evolution*, 1(3):78-80, 1986.

Integrated rural energy centres for agriculture-based economies. Locke, H. B. ; Choudhury, S. N. R. ; Lecamwasam, D. C. D. *Proceedings of the Institution of Mechanical Engineers—Part A. Power and process engineering*, 200(4):267-282, 1986.

Isomzyme variation in tropical trees; procedures and preliminary results. Hamrick, J. L. ; Loveless, M. D. *Biotropica*, 18(3):201-207, 1986.

Light variation and carbon gain in rain forest understorey palms. Chazdon, R. L. *Journal of ecology*, 74(4):995-1012, 1986.

Macroeconomic issues in Latin America. Arida, P. *Journal of development economics*, 22(1):171-208, 1986.

Management of nematodes by cultural practices. Trivedi, P. C. ; Barker, K. R. *Nematropica*, 16(2):213-236, 1986.

Managing the soils of Sub-Saharan Africa. Lal, R. *Science*, 236:1069-1075, 1987, May 29.

Measurements of impact of off-road driving on grasslands in Masai Mara National Reserve, Kenya; a simulation approach. Onyeausi, A. E. *Environmental conservation*, 13(4):325-329, 1986.

Microcomputers in natural resource management in the Third World. Pereztrejo, F. ; Jameson, D. A. *Interciencia*, 11(5):242, 1986.

Micro-hydro power in the Peruvian Sierra. Edwards, R. *Appropriate technology*, 13(2):22-23, 1986.

Multiple objective programming; an approach to planning and evaluation of agroforestry systems. Part 2—An illustrative example. Mendoza, G. A. ; Campbell, G. E. ; Rolfe, G. L. *Agricultural systems*, 23(1):1-18, 1986.

Multipurpose tree yield data; their relevance to agroforestry; research and development and the current state of knowledge. Von Carlowitz, P. G. *Agroforestry systems*, 4(4):291-314, 1986.

Multistoried agroforestry garden system in West Sumatra, Indonesia. Michon, G. ; Mary, F. ; Bompart, J. *Agroforestry systems*, 4(4):315-338, 1986.

Native agriculture in the highlands of the Peruvian Andes. Cardich, A. *National geographic research*, 3(1):22+, 1987.

- Natural resource management in rural areas of northern Pakistan.** Dixon, R. K. ; Perry, J. A. *Ambio*, 15(5):301-305, 1986.
- Nature conservation as an integral part of land use in East Africa; the case of the Masai ecosystem of Northern Tanzania.** Prins, H. H. *Biological Conservation*, 40(2):141+, 1987.
- Neotropical savannas; their flora and vegetation.** Huber, O. *Trends in ecology and evolution*, 2(3):61-66, 1987.
- Net energy analysis of fuels from biomass; the case of Nigeria.** Nwachukwu, C. C. ; Lewis, C. *Biomass*, 11(4):271-290, 1986.
- New opportunities, new perspectives managing India's environment.** Jasanoff, S. *Environment*, 28(8):12-16, 1986.
- Nitrogen transformations following tropical forest felling and burning on a volcanic soil.** Matson, P. A. ; and others. *Ecology*, 68(3):491-502, 1987.
- Notes on the population dynamics of the Kasungu elephants.** Jachmann, H. *African journal of ecology*, 24(4):215-226, 1986.
- Nutrient content and digestibility of forage plants in relation to plant phenology and rainfall in the Kalahari, Botswana.** Skarpe, C. ; Bergstrom, R. *Journal of arid environments*, 11(2):147-164, 1986.
- Optimal design of nature reserves; consequences of genetic drift.** Boecklen, W. J. *Biological conservation*, 38(4):323-338, 1986.
- An overview of the Rio de Janeiro aerosol characterization study.** Daisey, J. M. ; and others. *JAPCA*; the international journal of air pollution control and hazardous waste management, 37(1):15-23, 1987.
- Patterns of temporal variation in Lake Titicaca. A high altitude tropical lake. I. Background, physical, and chemical processes and primary production.** Richerson, P. J. ; and others. *Hydrobiologia*, 138:205-220, 1986.
- The Pet Kot; a man-made tropical forest of Maya.** Gomezpompa, A. ; Flores, J. S. ; Sosa, V. *Interciencia*, 12(1):10-15, 1987.
- Philippine marine park pilot site; benefits and management conflicts.** White, A. T. *Environmental conservation*, 13(4):355-359, 1986.
- Phosphorus availability in savannah soils of Western Nigeria.** Ayodele, O. J. *Tropical agriculture*, 63(4):297-300, 1986.
- Phytoplankton and its dynamic in two tropical and temperate zone comparison.** Kalf, J. ; Watson, S. *Hydrobiologia*, 138:161-176, 1986.
- Plant community structure in relation to grazing and environmental changes along a north-south transect in the western Kalahari.** Skarpe, C. *Vegetation*, 68(1):3-18, 1986.
- Plant germplasm controversy.** Kloppenburg, Jr., J. ; Kleinman, D. L. *BioScience*, 37(3):190-198, 1987.
- Potential deficiencies of a pastoral diet; a case study of the Maasai.** Nestel, P. ; Geissler, C. *Ecology of food and nutrition*, 19(1):1-10, 1986.
- A potential family food production system for warm climates based on potato production from true seed in home gardens.** Wiersema, S. G. ; Booth, R. H. *Agricultural systems*, 23(2):95-106, 1987.
- Potentialities and limitations of conventional climatological data for desertification monitoring and control.** Landesburg, H. E. *Climatic change*, 9(1-2):123-128, 1986.
- Potential of Albizia lebbeck (Mimosaceae) as a tropical fodder tree; a review of literature.** Prisen, J. H. *Tropical grasslands*, 20(2):78-82, 1986.
- The potential of and constraints of fish culture in integrated farming systems in the Lam Pao Irrigation Project, Northeast Thailand.** Middendorp, A. J. ; Verreth, J. A. J. *Aquaculture*, 56(1):63+, 1986.
- A practical village biogas system for waste and agricultural residues.** Wise, D. L. ; Leuschner, A. P. ; Levy, P. F. *Resources and conservation*, 13(1):23-36, 1986.
- A procedure to evaluate energy contribution of biomass.** Pellizi, G. *Energy in agriculture*, 5(4):317-324, 1986.
- Rainwater management for establishing agroforestry on alkali soils.** Grewal, S. S. ; Abrol, I. P. ; Singh, O. P. *Indian journal of agricultural sciences*, 57(1):30-36, 1987.
- Rapid method for estimating solid waste generation rate in developing countries.** Ibiebele, D. D. *Waste management and research*, 4(4):361-366, 1986.

Regional environmental simulation of African cattle herding societies. Krummel, J. R. ; Oneill, R. V. *Human ecology*, 14(1):117, 1986.

Research opportunities to improve the production of homegardens. Mergen, F. *Agroforestry systems*, 5(1):57-68, 1987.

Rethinking continuous cultivation in Amazonia. Fearnside, P. M. *BioScience*, 37(3):209+, 1987.

Revegetation of artificial disturbances in grasslands of the Serengeti National Park, Tanzania. Belsky, A. J. *Journal of ecology*, 74(4):937-952, 1986.

The role of on-farm trials in the evaluation of composite technologies; the case of alley farming in Southern Nigeria. Atta-Krah, A. N. ; Francis, P. A. *Agricultural systems*, 23(2):133-152, 1987.

Shamba system; an indigenous system of food production from forest areas in Kenya. Oduol, P. A. *Agroforestry systems*, 4(4):365-375, 1986.

Shifting cultivation land use system under population pressure in Zambia. Chidumayo, E. N. *Agroforestry systems*, 5(1):15-26, 1987.

Simulation of forest carbon dynamics based on a dry-matter production model. 3. Effects of increasing CO₂ upon a tropical rainforest. Oikawa, T. *Botanical magazine*, Tokyo, 99(1056):419-430, 1986.

Some aspects of social problems facing conservation in Brazil. Ayres, J. M. *Trends in ecology and evolution*, 1(2):48-50, 1986.

Study of evaporation from tropical rain-forest; West Java. Calder, I. R. ; Wright, I. R. ; Murdiyarsa, D. *Journal of hydrology*, 89(1-2):13-32, 1986.

Successful control of the floating weed *Salvinia molesta* in Papua-New Guinea; a useful biological invasion neutralizes a disaster. Thomas, P. A. ; Room, P. M. *Environmental conservation*, 13(3):242-248, 1986.

Survival of perennial grass seedlings under intensive grazing in semi-arid rangelands. Salihi, D. O. ; Norton, B. E. *Journal of applied ecology*, 24(1):145-152, 1987.

"Sustainable Development" in Pacific micro-economies. Bertram, G. *World development*, 14(7):809-822, 1986.

Technology and employment practices in developing countries. Chen, K. ; Henderson, D. A. *Technological forecasting and social change*, 30(2):193+, 1986.

Testing for life historical changes in spatial patterns of four tropical species. Sterner, R. W. ; Rible, C. A. ; Schatz, G. D. *Journal of ecology*, 74(3):621-634, 1986.

Thoughts from the tropics. 6. Habitat sharpening. Janzen, D. H. *Oikos*, 48(1):3-4, 1987.

Tree management as part of two farming systems in the wet forest zone (Ivory Coast). De Rouw, A. *Oecologia plantarum*, 8(1):39-52, 1987.

Trees, seasons, and the poor. Chambers, R. ; Longhurst, R. *IDS bulletin*, 17(3):44-50, 1986.

Use of dust storm observations on satellite images to identify areas vulnerable to severe wind erosion. Breed, C. S. ; McCauley, J. F. *Climatic change*, 9(1-2):243- 1986.

Water re-use system for production of fingerling fishes in Brazil with emphasis on South American catfishes (*Rhamdia quelens* and *R. sapo*). Neto, J. R. ; Kohler, C. C. ; Lewis, W. M. *Tropical agriculture*, 64(1):2-6, 1987.

When agroforests drive back natural forests; a socio-economic analysis of a rice-agroforest system in Sumatra. Mary, F. ; Michon, G. *Agroforestry systems*, 5(1):27-56, 1987.

The World Bank's wildland policy. Goodland, J. A. *Environmental conservation*, 13(4):355, 1986.

TRI Publications

TRI has published four working papers recently: *Environmental Perception among Jamaican Teachers* by Doreceta A. Taylor, (\$7.50); *Silvicultural Practices and Plant Diversity in the Caribbean National Forest, Puerto Rico* by Judy L. Stone (\$4.25); *Silvicultural Practices to Enhance Fodder Production in Agroforestry Systems* by Jeffrey Y. Campbell (\$4.25); and *Planning and Management of Biosphere Reserves* by Alan Ragins (\$7.00). For a complete list of TRI publications and how to order them, please contact Katherine Snyder, Editor, TRI NEWS, Yale F&ES, 205 Prospect Street, New Haven, CT. 06511 USA.

The Tropical Resources Institute
205 Prospect Street
New Haven, CT. 06511
(203)432-5117

For more information about the Tropical Resources Institute
contact:

William R. Burch, Jr.
Director, Tropical Resources Institute (203)432-5119

or

John C. Gordon, Dean
Yale School of Forestry and Environmental Studies
(203)432-5109

ACKNOWLEDGEMENTS

Logo design by Sujata Guha

Illustration on page 6 by Ms. Elysa Hammond

TRI STAFF

Director
William R. Burch, Jr.

Assistant Director/Communications
Katherine A. Snyder

Assistant Director/Education
Sarah T. Warren

Administrative Secretary
June Mount

Caribbean Liaison
Nora Devoe

TRI NEWS

Editor
Katherine A. Snyder

Literature Editor
Joseph Miller

TRI COMMITTEE

Graeme Berlyn, Stephen Kellert, Bruce Larson, Joseph Miller,
Richard Miller, Thomas Siccama, David Smith

TRI ADVISORY BOARD

Robert Blake, International Institute for Environment and
Development; Gerardo Budowski, United Nations Peace
University; Jefferey Burley, Oxford Forestry Institute; Mason
Carter, Louisiana State University; David Challinor, Smith-
sonian Institution; Hilda Diaz-Soltero, Conservation Interna-
tional Foundation; Marc Dourojeanni, Universidad Nacional
Agraria, La Molina-Lima, Peru; John E. Earhart, Tropical
Forestry Program, World Wildlife Fund, and Chairman of TRI
Advisory Group; Louise Fortmann, University of California -
Berkeley; Victor Gonzalez, Celta Agencies, Inc.; David
Harcharik, U.S.D.A. Forest Service; Peter Huxley, International
Council for Research in Agroforestry; John Michael Kramer,
CARE; Thomas Lovejoy, World Wildlife Fund-US; Ariel Lugo,
Institute of Tropical Forestry; Ghillean Prance, New York
Botanical Garden; John Sullivan, U.S.A.I.D.

Support for the Tropical Resources Institute has come from the
A.W. Mellon Foundation and the Tinker Foundation.