

Annual Report Fiscal Year 1998

July 1, 1997-June 30, 1998



Organization for Tropical Studies
Organización para Estudios Tropicales

***Dedicated to providing leadership in education, research and
the responsible use of natural resources in the tropics.***

The Organization for Tropical Studies is a nonprofit consortium of more than 50 universities and research institutions from the U.S. and Latin America. OTS was established in 1963 to provide leadership in education, research and the responsible use of natural resources in the tropics. To address this mission, OTS conducts graduate, undergraduate and professional education, facilitates research, participates in tropical forest conservation, maintains three biological stations in Costa Rica and conducts environmental education programs.

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Message from the Executive Director

Fiscal year 1998 will be remembered for the year-long strategic planning process that began with the endorsement of OTS president Dr. Pedro León at the March 1997 Board of Directors Meeting. By early summer a presidential committee had been formed to assess OTS' current mission, goals and objectives. Chaired by Ross Simons (Smithsonian), the committee members included Garry Brewer (U. California-Berkeley), Russ Faucett (OTS Board of Visitors), Rodrigo Gámez (INBio), Frank Harris (U. Tennessee), Bette Loiselle (U. Missouri-St. Louis), Lucinda McDade (U. Arizona), Bill Stott (Ripon College) and Tom Yuill (U. Wisconsin).

By late summer, a comprehensive questionnaire had been sent to OTS' Board of Directors, Board of Visitors and staff. This was followed by a weekend planning session in September by the Strategic Planning Committee that, in addition to reviewing the responses from the questionnaires and setting down the parameters of how to proceed, met for an afternoon with the Board of Visitors to gain from their insight.

In late October the Executive Committee met at Duke and reviewed the progress of the Strategic Planning Committee and undertook a planning session of its own under Ross Simon's direction. In Miami in January the first draft of the strategic plan was actually vetted by the Strategic Planning Committee with the Vice President for Education, Don Wilson (Smithsonian) and OTS' new Academic Director (Nora Bynum) participating in the discussions.

The March 1998 meeting of the Board of Directors involved all of the principal constituencies in reviewing the draft strategic plan. The Executive Committee, Board of Directors, Board of Visitors and OTS senior staff engaged in a three-day session facilitated by Dr. Paul Risser (president of Oregon State University). Together, we agreed on the following goals for OTS:

- Provide leadership in professional training
- Provide leadership in tropical research
- Promote and practice sustainability in the tropics
- Increase public awareness about the tropics
- Support program objectives through improvements in finance, human resources, management and physical infrastructure

Fiscal year 1998 ended with a comprehensive revision of the strategic plan based on all of the comments received at the March 1998 meeting. Now the plan is ready for approval by the Board of Directors at the March 1999 meeting. How we accomplish the goals outlined in the strategic plan will be the basis for our work into the next millennium. As the highlights in this report illustrate, fiscal year 1998 will also be remembered for the tremendous year we had providing leadership in education, research and the responsible use of natural resources in the tropics. These accomplishments do much to ensure we can achieve a future envisioned in the strategic plan.



Executive Committee

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Pedro León (U. Costa Rica)
 VP Costa Rican Coordination:
 Claudia Charpentier (U. Nacional)
 VP Development:
 Russ Faucett (Barrington Partners)
 VP Education:
 Don Wilson (Smithsonian)
 VP Finance:
 Peyton Fuller (Duke U.)

VP Research:
 David Clark (U. Missouri-St. Louis)
 Secretary:
 Carol Augspurger (U. Illinois)
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 Ross Simons (Smithsonian)
 Past President:
 Julie Denslow (Louisiana State U.)

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 Jim Ackerman (U. Puerto Rico)
 Jack Ewel (U.S. Forest Service)
 James Hamrick (U. Georgia)
 Carol Horvitz (U. Miami)
 Bette Loiselle (U. Missouri-St. Louis)
 Emma Tuk Mena (U. Estatal a Distancia)

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 Larry Venable

Arizona State University

Leslie Landrum
 David L. Pearson

Auburn University

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 Craig Guyer

University of California-Berkeley

Gregory Gilbert

University of California-Davis

Charles R. Goldman
 Sharon Strauss

University of California-Irvine

F. Lynn Carpenter
 James Bever

University of California-Los Angeles

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University of Colorado

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University of Connecticut

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Cornell University

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 Manuel Zeledón

Duke University

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 Daniel Richter, Jr.

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 Emma Tuk Mena

University of Florida

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 Hugh Popenoe

Florida International University

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Noel Michele Holbrook

University of Illinois-Urbana-Champaign

Carol K. Augspurger
 Mark David

Indiana University

Keith Clay
 Donald Whitehead

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University of Maryland

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 Barbara Thorne

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 Curtice R. Griffin

University of Miami

Carol C. Horvitz
 Jay M. Savage

University of Michigan

John H. Vandermeer

Michigan State University

Tom M. Burton
 Peter G. Murphy

University of Minnesota

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University of Missouri-Columbia

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University of Missouri-St. Louis

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Museo Nacional de Costa Rica

Mariela Bermúdez M.
 Melania Ortíz V.

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Claudia Charpentier E.
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Ted Shear

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Don Miles
 Jan Salick

Oregon State University

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Beth A. Middleton
 John Phelps

State University of New York-Stony Brook

Charles H. Janson
 Patricia C. Wright

University of Tennessee

Sally P. Horn
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Tulane University

Thomas W. Sherry
 Julie L. Whitbeck

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University of Utah

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University of Washington

Ray B. Huey
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At Large

David Clark
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 Ross Simons
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Christiana Figueres
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World Bank

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Science
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Erika Deinert, Ph.D.
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Instructor, Undergraduate Program
Henry Salazar
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Annie Simpson
Group Marketing & Services Coordinator
Ana Carter
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Ruth Rodríguez
Head of Education Services
Orlando Vargas
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Rosa Sandoval
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Director
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Maintenance Manager

Education

In fiscal year 1998, OTS offered seven graduate-level field courses and the inaugural year of the Undergraduate Semester Abroad Program. With major support from the *Andrew W. Mellon Foundation*, the OTS education program had an excellent year amidst numerous organizational changes, including the transition to a new academic director.

Graduate Education

Tropical Biology: An Ecological Approach (OTS 98-1)

OTS 98-1 will always be known as the El Niño course—almost no rain in Guanacaste, wide rivers reduced to small trickles on the Osa Peninsula, and sunny skies in the cloud forest. Research projects were diverse including projects on landslide soils, palm diversity, bog cores, antlion predation, fish aggression and flower symmetry. Resource people for the course included Drs. Bob Timm (U. Kansas), Doug Gill (U. Maryland), Egbert Leigh (STRI), Allison Snow (Ohio State), and Jim Dalling (STRI). The itinerary was typical for a fundamentals course, with stops at all three OTS field stations, plus Santa Rosa, Monteverde, Cerro de la Muerte and Corcovado. Seventeen students took a post-course trip to Barro Colorado Island in Panama for a visit hosted by the Smithsonian Tropical Research Institute. Five post-course awards were made for students to work at La Selva and Palo Verde Biological Stations.

Coordinator: Dr. Deedra McClearn, OTS
Co-coordinator: Teresa Singer, U. Arkansas
TA: Carlos Ugalde, U. Costa Rica

Participants:

Larissa L. Bailey, North Carolina State U.
Daniel E. Bunker, U. Pittsburgh
Leonardo Chapa, U. Illinois
Johanna P. Choo, Rutgers U.

Brian P. Cross, U. Utah
Alex O. Dehgan, U. Chicago
Anne L. Engh, Michigan State U.
Stacey A. Forsyth, U. Arizona
Stacey L. Halpern, U. Minnesota
Erik Harvey, Arizona State U.
Katherine M. Howe, U. Minnesota
Todd Katzner, Arizona State U.
Catherine Kleier, U. California-Los Angeles

Terry R. Kruegar, U. Miami
Leonie C. Moyle, Duke U.
Kristian S. Omland, U. Connecticut
Satya V. Rhodes-Conway, U. California-Irvine
John Ruys, Arizona State U.
Dena M. Smith, U. Arizona
Jeffrey A. Steimetz, U. Illinois
Corine F. Vriesendorp, Michigan State U.
Marcus J. Wasilevich, Tulane U.

Dr. Jim Ackerman (U. Puerto Rico)
working with students at
Las Cruces Biological Station.



Ecología Tropical y Conservación (OTS 98-2)

The 22nd annual offering of the Spanish fundamentals course emphasized rigorous, hands-on field research, critical thinking and quality presentations to hone the scientific skills of the participants. Competition for the course remained exceedingly high as 22 students from 12 countries were selected from 110 applicants. Over a six week period, the students were exposed to seven different sites in Costa Rica including La Selva, Las Cruces and Palo Verde. A full roster of resource faculty rounded out the experience and networking opportunities for 98-2 participants. Among them were Drs. William Eberhard (U. Costa Rica/STRI), Cesar Domínguez (UNAM, Mexico), Orlando Vargas (OTS), Paul Hanson (U. Costa Rica), Bill Wscilo (STRI), Fermín Rada (Venezuela), Frank Joyce (UCEAP/Monteverde), Johnny Rosales (Monteverde Conservation League), Michael McCoy and Claudia Sierra (U. Nacional) and La Selva researchers Dr. David Clark (U. Missouri-St. Louis) and Rebecca Montgomery (U. Connecticut).

Coordinator: Dr. Alejandro Farji, U. de Comahue, Bariloche, Argentina
Co-coordinator: Federico Chinchilla, OTS
TA: Anya Illes, OTS

Participants:

Diana C. Alvira R., Colombia
James Aparicio E., Bolivia
Vernon E. Arias V., Costa Rica
Guillermo R. Bianchi P., Venezuela
Pedro G. Blendinger, Argentina
Karine Carvalho S., Brasil
Sergio Córdoba C., Colombia

Andrea Encalada R., Ecuador
Nico Mario Franz, Germany
Caty Frenkel van Gysegem, Costa Rica
Jonathan González S., Panamá
Andrea Loayza F., Bolivia
Silvia Lora Escobedo M., Argentina
Rosaura Luna R., México

Catherine Numa V., Colombia
Diego Osorno G., Nicaragua
Adriana Rodríguez F., Venezuela
Juan J. Rodríguez G., Perú
Katia I. Silvera M., Panamá
German V. Toasa T., Ecuador
Jorge C. Trejo T., México
Elisabet Verónica Wehncke, Argentina

Tropical Biology: An Ecological Approach (OTS 98-3)

The 1998 summer offering of *Tropical Biology* participants came to the course with diverse interests including herbivore resistance in plants from forest fragments, brood parasitism among finches, polymorphisms among dung beetles, and phylogeny of caecilians. Resource people for the course included Drs. Larry Gilbert (U. Texas), Cindy Sagers (U. Arkansas), Jack Putz (U. Florida), Don Wilson (Smithsonian), Erika Dienert (OTS), Sean O'Donnell (U. Washington), and Pedro León (U. Costa Rica) as well as many OTS notables— Drs. Jorge Jiménez (OTS), Deborah Clark (U. Missouri-St. Louis), David Clark (U. Missouri-St. Louis), Eugenio González (OTS), and Luis Diego Gómez (OTS). After the course 13 students traveled to Panama for a three-day stay on Barro Colorado Island hosted by the Smithsonian Tropical Research Institute. OTS also awarded post-course fellowships that resulted in seven participants conducting projects at La Selva and one participant conducting a project in Nicaragua.

Coordinator: Dr. Deedra McClearn, OTS
Co-coordinator: Celia Harvey, Cornell U.
TA: Victor Camona, OTS

Participants:

Elizabeth A. Archie, Duke U.
Jennifer L. Baldacci, U. California-Davis
John G. Bellow, U. Florida
Ted Cheeseman, Duke U.

Michael D. Collins, U. Tennessee
Anne M. Danielson-Francois, U. Arizona
Kevin J. Eddings, Yale U.
Cristian F. Estades, U. Wisconsin-Madison
Aaron J. Gassmann, SUNY-Stony Brook
Ian C. Gilby, U. Minnesota
Luciana M. Griz, U. Missouri-St. Louis
Kathleen M. Kay, U. Washington-Seattle
Edward G. LeBrun, U. Utah

Satya K. Maliakal, Louisiana State U.
Randall S. Mooman, Duke U.
Jason Piluk, U. Georgia
Erin J. Questad, U. Utah
William H. Schaedla, Arizona State U.
Justin G. Schuetz, Cornell U.
Adam R. Smith, U. Washington
Amy L. Sproston, U. Kansas
Suzette A. Stephens, U. Massachusetts-Amherst

**Students are tired and
muddy after a climb through
the red mangrove roots with
Jorge Jiménez.**

Agroecología (OTS 98-7)

Agroecología visited different sites for each of the five modules in the course. The hard work and knowledge of local resource people and short-term faculty were crucial to the success of the course. At Ochomogo, Cartago resident Luis Acuña set up farm sites and helped students evaluate agro-economic factors in the field; Jennifer Powers (Duke U.) covered critical soils analyses; and Carlos Ugalde (U. Costa Rica) directed insect biodiversity comparisons. Introductory lectures were provided by Drs. Gilbert Vargas (U. Costa Rica), Diógenes Cubero (Tropical Science Center), and Carlos Jiménez (U. Costa Rica). University of Costa Rica biologists Walter Marín, Monica Springer and Vernon Arias led multi-day faculty field problems at La Selva. Julio Arias (Instituto Tecnológico Costa Rica) made logistical arrangements at ITCR-San Carlos and accompanied the community field problems. Walter Marín (U. Costa Rica) returned to assist students with independent research projects at Las Cruces.

Coordinator: Dr. Mickie Swisher, U. Florida

Co-coordinator: Dr. José Manuel Mora, U. Costa Rica

TA: Juan Carlos Rodríguez, U. Florida

Participants:

Dora M. Alvarez, STIRI, Panamá
Yelinda Araujo, Venezuela
Nadiejda Barbera, Venezuela
Diego Bonilla, Ecuador

Amengol J. Caballero, Bolivia
María M. Collazo, U. Puerto Rico
Verónica Cordero, México
Byron Córdova, U. Nacional (Costa Rica)
Jorge A. Cruz, México
Enrique J. Dalmau, Cuba
Eligio García, México

César Guillen, U. Costa Rica
Erivelio Hernández, Honduras
Miltiano Moreta, Dominican Republic
Yolanda Nava, México
Victoria E. Reyes, U. Florida
Ruth Rodríguez, U. Nacional (Costa Rica)
Oscar Sánchez, U. Costa Rica
Susan E. Swales, U. Florida
Itavclerh Vargas, Perú

Tropical Plant Systematics (OTS 98-9)

Demand for the third offering of this course was high, with 42 applicants for the 22 available spaces. The selected group of participants represented diverse interests ranging from traditional plant taxonomy and molecular systematics, to plant community ecology, paleobotany and cultural anthropology. Sites visited over this six-week course included Las Cruces, Palo Verde and La Selva, as well as Albergue Cuericí in Cerro de la Muerte and the Las Alturas Biological Station, located in the rich and still poorly collected region of the southern Cordillera de Talamanca. Topics covered during the course included surveys of the representative monocots, dicots, ferns and fern-allies of Costa Rica, the

preparation of floras and monographs, theory and technique of phylogenetic analysis, vegetative identification of tropical woody plants, and inventory techniques for tropical vegetation. Several excellent keys were produced and should prove highly useful to researchers at the OTS stations. The capstone of the course was an all-day symposium of research results held at Las Cruces during the final week of the course. OTS awarded post-course fellowships to four participants for projects at La Selva.

Coordinator: Dr. Brad Boyle, OTS

Co-coordinator: Dr. Robbin Moran, New York Botanical Garden

Teaching Assistant: Mario Blanco, U. Costa Rica

Participants:

Mac Alford, Duke U.

Deby Arifiani, U. Missouri-St. Louis

Sandra Borgardt, Cornell U.

Catherine Cardelus, U. Connecticut

Jennifer Cruse, U. Georgia

Charles Davis, Harvard U.

Meredith Dudley, Tulane U.

Susan Grose, Smithsonian Institution

Jocelyn Hall, U. Wisconsin-Madison

Carlos Jaramillo, U. Florida

Rebecca Kershner, New York U.

Kendra Millam, U. Wisconsin-Madison

Andrew Miller, U. Illinois

Michael Moody, Washington State U.

Roland Roberts, Louisiana State U.

Eugenio Santiago-Valentin, U. Washington

Brian Spitzer, U. California-Davis

Amy Trauth-Nare, Arizona State U.

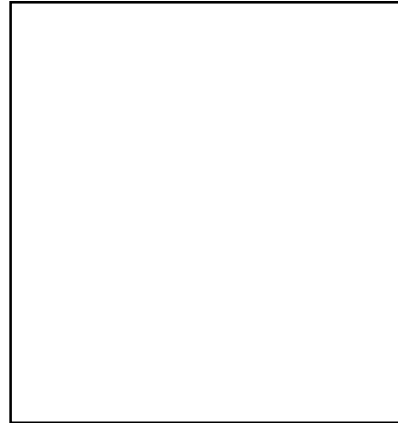
James Watkins, Jr., Iowa State U.

N. Mia Werner, U. Georgia

Kyle Williams, Duke U.

Alan Yen, U. Washington

**A quiet moment enjoying the view
in the Talamanca Mountains at
3,000 meters above sea level.**



Tropical Biodiversity (OTS 98-10)

As is traditional, this three-week course visited each of the three OTS sites and covered a wide range of topics. At Palo Verde, students studied ecology and evolutionary questions (using the ant/plant mutualistic system) and sociological questions. José María Rodríguez (OTS), led the course on an exploration of the potential conflicts between human land use and the goals of biological reserves which culminated in a workshop involving representatives from several different agencies. While in La Selva, Drs. Lee Dyer and Grant Gentry (Mesa State College) and Greg Cronin (U. Colorado/NOAA) led field projects on the interaction of plants and insects and the maintenance of diversity as well as chemical defense in plants. A field trip to the local Chiquita banana plantation gave the group an opportunity to see first-hand the effects of agriculture, and to learn about the changing farming practices that may allow coexistence with the adjacent biological reserve. At Las Cruces, Gary Krupnick (Penn State U.), Luis Diego Gómez (OTS) and Raúl Rojas (OTS) were resource faculty for studies of plant and bird diversity in different habitats and pollinator behavior. OTS awarded post-course fellowships to two participants for projects at La Selva.

Coordinator: Dr. Alan Thornhill, Rice U.

Co-coordinator: Dr. Peter Sherman, Marlboro College

Participants:

Laura K. Alley, Middle Tennessee State U.

John M. Andersland, Western Kentucky U.

Martin R. Arford, U. Tennessee

Carlos Barquero, OTS

Guillemo E. Gil, Brazil

Rebecca A. Hubbard, U. Pittsburgh

Nakia C. Jackson, Tulane U.

Jason W. Leathers, U. Kentucky

Michael G. McCay, U. California-Berkeley

Timon McPhearson, Rutgers U.

Patrick C. Owen, U. Connecticut

Heather D. Patti, North Carolina State U.

Janice E. Ragsdale, U. Utah

Molly A. Timmers, Hamilton College

Jeffrey P. Townsend, Harvard U.

Eileen M. Weinstein, Lehman College

Rickie D. White, U. North Carolina-Chapel Hill

Ecología da Floresta Amazônica (OTS 98-12)

This field course in Amazon forest ecology was held in Manaus, Brazil. This year there were 50 applications for the 20 available slots. The 20 students selected came from 11 institutions: 5 Brazilian and 6 outside of Brazil. The course visited a variety of forest types, ranging from sandy soil low forests to typical primary rain forest, to black- and white-water flooded forests. More than 20 visiting faculty participated in the course including Dr. William Eberhard (U. Costa Rica). The students also attended over 23 seminars on various topics related to the course curriculum. Of special note, last year's El Niño drought allowed the students to experience a tropical rain forest at its driest.

Co-Coordinator: Dr. Eduardo Venticinque, Biological Dynamics of Forest Fragments Project, and Dr. Aldcir Scariot, CENARGEM

Participants:

Cecília Patrícia Alves Costa, UNICAMP

Marina Antongiovanni da Fonseca, USP-IB

Francisco José Barbosa de O. Filho, USP-IB

Sandra Regina Baptista, Rutgers

Karina Boege Paré, UNAM - Inst. de Ecologia

Sarita Borges de Faveri, INPA/CPEC

Marcelo de Oliveira Gonzaga, UNICAMP

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Patrícia Guidão Cruz Ruggiero, USP-IB

Arlindo Gomes Filho, UNICAMP

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Carlos

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Ricardo J. Sawaya, IB-USP

Marcos Silveira, UnB

Maira Smith, INPA/CPEC

Joanna Marie Tucker, U. Arizona

Carolina Volkmer de Castilho, INPA/CPEC

Undergraduate Education

Fiscal year 1998 was the first full year of the *OTS-Duke Undergraduate Semester Abroad Program* in Costa Rica (USAP). To some degree, USAP resembled the graduate fundamentals course, *Tropical Biology: An Ecological Approach*. Like this course, USAP traveled throughout Costa Rica, visiting all three OTS field stations as well as Monteverde, Tortuguero and Santa Rosa. Visiting resource persons were a key component of the Undergraduate Semester Abroad Program. Like the graduate students, USAP groups took orientation walks, identified interesting problems and pursued independent research projects. Yet, in many ways USAP differed from the graduate fundamentals course. USAP is actually four courses, *Fundamentals of Tropical Biology*, *Field Research in Tropical Biology*, *Environmental Science and Policy of the Tropics*, and *Spanish Language and Latin American Culture*. Students received credit from Duke University for each of these courses and transferred these credits to their home institutions. The USAP also came with all the academic trappings of a college campus - a faculty (four instructors), frequent classroom instruction, textbooks, homework assignments, written examinations as well as oral and written presentations of field projects. Perhaps the most distinguishing feature, however, was USAP's attempt to introduce students more fully both to Spanish and Costa Rican culture. Students took an intermediate Spanish class (one year of college Spanish is a prerequisite), heard lectures in Spanish by Costa Rican scientists, interviewed Costa Ricans about economic and environmental issues, and lived with Costa Ricans for several weeks during the semester.

Fall 1997

The first-ever offering of the USAP included fourteen students from ten colleges and universities and ran from September 3 to December 16, 1997. The students benefited tremendously from the week-long participation of four resource persons. Dr. Nat Wheelwright (Bowdoin College) led bird and plant walks, delivered lectures, and led a field project on neophobia in hummingbirds. Dr. Robyn Burnham (U. Michigan) led projects in assessing the structure and diversity of current and past forests from leaf litter data. Dr. John Barrone (Smithsonian Tropical Research Institute) gave several lectures on the impact of insect herbivory on the community dynamics of tropical forests and led two field projects. Dr. Mo Donnelly (Florida International U.) gave two talks, led a discussion group, and organized a field project involving censusing techniques of anurans. In addition, the course benefited from shorter visits by Reinaldo Aguilar, a forester based in the Osa Peninsula, Jorge Jiménez (OTS) and Gary Hartshorn (OTS).

Fall 1997 Participants

Lisa E. Bell, Duke U.
Aisha T. Burden, Duke U.
Mark S. Fox, U. Maryland
Ilmi M. Granoff, Swarthmore
Nihara Gunawardene, Duke U.
Melisa Holman, Kenyon U.
Allison Homer, Reed
Jane MacLeod, Bowdoin
Casuarina McKinney-Richards, Duke U.
Julia L. Michalak, Carleton
Aaron C. Smith, Tufts U.
Adam C. Ruff, U. Louisville
Darcy G. Thomas, Bowdoin
Olivia S. Watson, Bates



Participating in a
field problem as
part of USAP Fall 97.

Spring 1998

The Spring 1998 semester began on January 13 with twenty-four students. The students had majors ranging from Biology and Environmental Studies to English and Political Science. The students benefited from the week-long participation of four resource persons. Dr. Jim Ackerman (U. Puerto Rico) led a field exercise testing the effect of floral advertisement on pollinator visitation in *Anthurium* and on floral morphology and biology. Dr. Joel Heinen (Florida International U.) led group discussions of conservation laws and policy. Dr. Sally Horn (U. Tennessee) introduced students to the world of soil cores and charcoal searching, opening eyes to the methods used to discover human land-use practices in Costa Rica. Dr. Monica Springer (U. Costa Rica) assisted the group with field studies of stream chemistry and biotic diversity, including identification and sampling to learn the utility of aquatic insect communities as indicators of environmental perturbation. The course benefited from shorter visits by Drs. Peter Curtis (Ohio State U.), Tom Gavin (Cornell U.), Paul Ehrlich (Stanford U.), and Grant Gentry (U. California-Los Angeles).

Spring 1998 Participants

Michael Beamer, Duke U.
Gunnar Carnwath,
Middlebury
Rachaele Carver, Davidson
Matthew J. Crawford, Tufts U.
Sara DeLong, Wellesley
Jessica E. Dryden,
Mt. Holyoke
Anie E. Dupre, Wofford
Daniel C. Ehlman, DePauw
Erin Fulkerson, Swarthmore
Christy Jo Geraci, Drew
Phillip J. Glassner, Tufts

Donna E. Griffin, Swarthmore
Angela Hadwin, Bryn Mawr
Kristin E. Hughes, Earlham
Emily D. King, Williams
Nancy Kong, Wellesley
Siri E. Kushner, Bowdoin
Sara A. McMahon, Wesleyan
Eliza S. Meade, Amherst
Lauren R. Moreno, Kenyon
Andrew Pattison, Skidmore
Alejandrina I. Rincon, Duke U.
Nathan Welton, U. Colorado
Kathryn Wilkening, U. Arizona

Research

OTS Fellowships and Awards

In fiscal year 1998, OTS awarded 41 fellowships totaling \$27,388 to U.S. and Latin American graduate students who were either enrolled in degree programs at OTS member institutions or who were OTS course alumni. In addition, OTS made four awards totaling \$4,000 through the Stanley Smith Horticultural Fellowship. Graduate awards through the newly created Donald and Beverly Stone Endowment, including several named fellowships, will be reported in the fiscal year 1999 Annual Report.

ANDREW W. MELLON GRADUATE FELLOWSHIP AWARDS

An examination of the attraction and initiation phases of courtship display in the amblypygid species of La Selva (Arachnida: Amblypygi) / Eileen Hebets (U. Arizona)

Ant defense and extrafloral nectaries / Aaron Gassmann (SUNY-Stony Brook)

Competition between native tree seedlings and non-native pasture grasses in degraded, abandoned pastures at the Las Cruces Biological Station: Establishment of tropical tree seedlings in abandoned pastures / Satya Rhodes-Conway (U. California-Irvine)

Dynamics of tree seedling recruitment in secondary tropical forests: an experimental approach / Juan Dupuy (U. Chicago)

Epiphytic fern diversity and stratification on the trunk of *Hycanina alchorneoides* / Catherine Cardelus (U. Connecticut), James Watkins (Iowa State U.)

Evaluation and adjustments of the project Adopt-a-Stream, Puerto Viejo de Sarapiquí, Costa Rica / Adriana Figueroa (U. Nacional, Costa Rica)

Floral phenology and pollination biology of *Clusia flava* (Clusiaceae) / Michael Moody (Washington State U.)

Introduction of Adopt-A-Stream to other communities in Costa Rica / Douglas Parsons (U. Georgia)

Male manakin response to conspecific and heterospecific acoustic displays / Elizabeth Archie (Duke U.), Adam Smith (U. Washington)

Pilot study of genetic structure in two Acridid grasshoppers / Brian Spitzer (U. California-Davis)

Pollinator effectiveness in *Calathea crotalifera*: is there potential for specialization in a "generalist" plant? / Kathleen Kay (U. Washington)

Pre-Hispanic settlements in the La Selva Biological Reserve, Sarapiquí, Costa Rica / Felipe Sol (UCR, Costa Rica)

Rapid induced ant recruitment following herbivory in the *Cecropia-Azteca* system / Anurag Agrawal (U. California-Davis)

Stabilimentum constructions in *Micranthema* at La Selva / Anne Danielson-Francois (U. Arizona), Justin Schuetz (Cornell U.)

Testing a model of harvesting behavior of *Atta cephalotes* / Timon McPhearson (Rutgers U.), Jeffrey Townsend (Harvard U.)

Understory light availability in monospecific tree stands / John Bellow (U. Florida)

ANDREW W. MELLON ECOSYSTEM FELLOWSHIP AWARDS

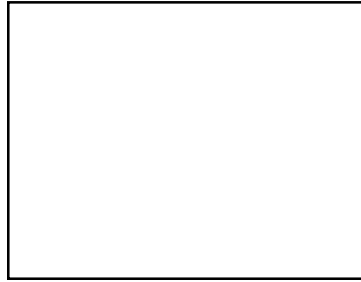
Distribution of *Heliconia* species at La Selva according to soil type / Suzette Stephens (U. Massachusetts)

Flora biology of some species of Cyclanthaceae and the natural history of its associated Curculionidae / Nico Mario Franz (UCR, Costa Rica)

Mixed-species tree species plantations in the humid tropics: an alternative for carbon sequestration / Dan Shepherd (Yale U.)

Modeling the consequences of heterogeneous light environments for seedling performance in tropical wet forests: a multi-scale approach / Rebecca Montgomery (U. Connecticut)

The role of cattle in wetland vegetation management for waterfowl habitat at Palo Verde National Park, Guanacaste Region, Costa Rica / William Burnbridge (U. Michigan)



Jaguar (*Panthera onca*). Larissa Bailey (NC State U.) took this photo on the SUR trail bridge as part of her OTS 98-1 independent project. Success in this project led her extended research as part of an OTS post-course grant at Palo Verde funded by the Turner Graduate Fellowship.

GLAXO PHARMACEUTICAL LATIN AMERICAN GRADUATE FELLOWSHIP AWARDS

Ecology of wrens (Birds: Troglodytidae: *Thryothorus* and *henricathina*) of a tropical forest / Pedro Blendinger (CRICYT, Argentina)

Terrestrial behavior and genital morphology of males of *Centris adani* (Hymenoptera: Anthophoridae) / Patricia Ortíz (U. Católica, Ecuador)

Feeding behavior of *Phyllostanus hastatus* and *P. discolor* / Norberto Giannini (U. Tucumán, Argentina), Federico Villalobos (UCR, Costa Rica)

Structure of a bat community in an abandoned tunnel in the dry forest in Costa Rica / Vernon Arias (UCR, Costa Rica)

CONSERVATION BIOLOGY FELLOWSHIP AWARDS

Conservation research and education at the Isla Juan Venado Mangrove Reserve, Department of Leon, Nicaragua, a collaborative initiative / Kevin Eddings (Yale U.)

Protected areas and local community relations: A case study at La Selva / Randall Moorman (Duke U.)

PEACE FROGS AWARDS FOR AMPHIBIAN RESEARCH

Attempted predation on a tree frog and the response of conspecific frogs to distress calls / Christopher Leary (Auburn U.)

Evolution and maintenance of color pattern polymorphisms in litter frogs (*Eleutherodactylus*): ecological genetic and phylogenetic approaches / Andrew Crawford (U. Chicago)

STANLEY SMITH HORTICULTURAL FELLOWSHIP AWARDS

Establishing a live collection of *Passiflora* spp at Wilson Botanical Garden / Gordon Ward (U. Georgia)

The use of leguminous mulch in horticultural practice / Isidore Rudefer (U. Georgia)

Plant Records Database / Tanya Rehse (Washington State U.)

Wetland restoration for Wilson Botanical Garden / David Bart (Rutgers U.)

TURNER GRADUATE FELLOWSHIP AWARDS

Camera-trapping of secretive nocturnal animals in Palo Verde National Park / Larissa Bailey (N.C. State U.)

Feeding behavior of *Phyllostanus hastatus* and *P. discolor* / Norberto Giannini (U. de Tucumán, Argentina), Federico Villalobos (UCR, Costa Rica)

Collection and identification of termites and their commensals and parasites in the Dictyoptera and Acaraea taxa in collaboration with the ALAS project / Mark Suarez (U. Maryland)

The distribution, abundance and impact of *Banisteriopsis caapi*, an invasive liana, in a low-elevation secondary growth forest, Costa Rica / Stacy Forsyth (U. Arizona)

Distance- and resource-based mortality and the dispersion profile of *Welfia georgii* (Arecaceae) / Corine Vriesendorp (Michigan State U.)

Understory fruit resources in the La Selva tropical rain forests / Johanna Choo (Rutgers U.)

Division of Labor and genetic composition of colonies in *Ectatoma ruidum* (Formicidae: Ponerinae) / Elizabeth Smith (U. Kansas)

Vocal discrimination in Montezuma Oropendulas (*Psarocolius montezuma*) / Terry Krueger (U. Miami)

Research at OTS Biological Stations

Project Title / Principal Investigator(s) / Researcher(s) and Assistant(s)

LAS CRUCES BIOLOGICAL STATION

- An initial investigation of the relationship between *Eumaeus godartii* (Lepidoptera: Lycaenidae) and Languriid beetles /** Joshua Ness (U. Georgia)
- Aquatic fauna of bromeliads: species loss and cascading effects /** Diane S. Srivastava (U. British Columbia, Canada)
- Avian census of forest fragments /** Jim Zook (Stanford U.)
- Avian diversity in the agroscape. Birds in coffee plantations /** Catherine Lindell (Michigan State U.)
- Biodiversity and phylogeny of Ganodemataceae (Polyporales) /** Jean-Marc Moncalvo (Duke U.)
- Cerambycidae of Costa Rica /** Louis LaPierre (U. California - Los Angeles)
- Cerambycidae of CR - taxonomy, ecology, biogeography and ethology of longhorned woodboring beetles /** Frank Hovore (U. California - Los Angeles)
- Coleoptera and pollination of Cyclanthaceae /** Luis Diego Gómez (OTS)
- Collection of Curculionidea /** Christopher Lyal (Natural History Museum)
- Countryside biogeography of moths: survival in the matrix of a fragmented landscape /** Taylor Ricketts (Stanford U.)
- Countryside biogeography: The future of biodiversity in human dominated landscapes /** Gretchen Daily (Stanford U.)
- Cultivation of free-living tropical protozoa /** Thomas Cavalier-Smith (U. British Columbia, Canada)
- Cyanoglucosides in *Passiflora* spp. /** Gordon Ward (U. Georgia)
- Cycad toxins and *Aulacoscelis costaricensis* (Col.) /** Luis Diego Gómez (OTS)
- Diaspidids of Costa Rica (Homoptera: Coccoidea) /** Francesco Porcelli (Inst. Entomologia, Italy)
- Distribution of biodiversity in forest patches and in the agricultural landscape /** Paul R. Ehrlich (Stanford U.)
- Effects of forest fragmentation on resident bird populations /** Thomas A. Gavin (Cornell U.)
- Effects of forest fragmentation on resident forest birds of Coto Brus, Costa Rica /** Rene Borgella Jr. (Cornell U.)
- Elateridae (Coleoptera) of Costa Rica /** Paul J. Johnson (South Dakota State U.)
- Eleutherodactylus*: ecological genetic and phylogenetic approaches /** Andrew Crawford (U. Chicago)
- Establishment of tropical tree seedlings in abandoned eroded pasture: relative importance of above- and below-ground competition /** Satya Rhodes-Conway (U. California - Irvine)
- Evolution and maintenance of color pattern polymorphisms in litter frogs (*Eleutherodactylus podiciferus*) /** Andrew Crawford (U. Chicago)
- Flora costaricensis: Droseraceae /** Luis Diego Gómez (OTS)
- Fossil Flora of El Brujo, Buenos Aires, Costa Rica /** Luis Diego Gómez (OTS)
- Genetic variability of *Persea americana* (Lauraceae) /** Arani Yousef (Inst. für Obstbau U. Hohenheim, Germany)
- Herpetological distribution and abundance on LC Ridge Trail and nearby forest fragments: the long-term effects of habitat fragmentation on populations of Costa Rican amphibians and reptiles /** Martin Schlaepfer (Cornell U.)
- History of Costa Rica conservation: the role of OTS /** Leslie J. Burlingame (Franklin and Marshall College)
- Hummingbird use of premontane forest fragments in southern Costa Rica /** Allison Snow (Ohio State U.)
- Impact of honeybees in fruit set and crop yield of *Coffea* /** David Ward Roubik (SIRI)
- Implementation of an "Adopt-a-Stream" project in Coto Brus, Costa Rica /** Douglas Parsons (U. of Georgia)
- Insects on *Cecropia* /** Louis La Pierre (U. California - Los Angeles)
- Lakes, lake sediments and environmental history in Costa Rica. Diatomae of Costa Rica /** Kurt Haberyan (Northwest Missouri State U.)
- Leaf litter Curculionidae of Costa Rica /** Robert Anderson (Canadian Museum of Nature)
- Maranthaceae of Costa Rica /** Helen Kennedy (U. British Columbia)
- Mass mortality of the anuran fauna at upland sites in Costa Rica and western Panamá /** Karen Lips (St. Lawrence, Southern Illinois U.)
- Molecular study of the origins of the unisexual lizard *Lepidophyma reticulatum* (Xantusiidae) /** Robert L. Bezy (Los Angeles County Museum of Natural History)
- Molecular systematics of Colocasioideae (Araceae) /** Jane Whitehill (U. Missouri - St. Louis / Missouri Botanical Garden)
- Mycorrhizae in epiphytic and other Costa Rican ferns /** Luis Diego Gómez (OTS)
- Mycorrhizae in roots of palms /** Jack B. Fisher (Fairchild Tropical Garden)
- Mycota of Costa Rica /** Luis Diego Gómez (OTS)
- Nutrients in fruits eaten by birds and mammals /** Edmund Stiles (Rutgers U.)
- Paleoecology of the Las Cruces area: Sediment records of environmental history /** Sally Horn (U. Tennessee)
- Paleoecology of the Las Cruces area: Soil charcoal record of environmental history /** Robert Sanford (U. Denver)
- Phosphorus particles in soil of natural ecosystems and in some agroecosystems /** Gloria Meléndez (U. Costa Rica - CIID)
- Phosphorus release and conservation in the litter of a modified Costa Rica slash-mulch bean production system (frijol tapado) /** Isidor F. Ruderfer (U. Georgia)
- Reproductive and evolutionary biology of Lepidoptera /** Edward Morrow (U. Liverpool)
- Reproductive biology of butterflies /** Gage Matthew (U. Liverpool)
- Research toward sustainable land use and biodiversity in a mosaic of agriculture and tropical forest /** Bruce Haines (U. Georgia), Christopher Peterson (U. Georgia)
- Resupinate basidiomycetes of Costa Rica /** Luis Diego Gómez (OTS)
- Seasonality of spittlebugs (Homoptera: Cercopidae) at Las Cruces /** Vinton Thompson (Roosevelt U.)

Sistemática de leguminosas / Nelson Zamora (INBio, Costa Rica)

Sistemática y taxonomía de los helechos diplazoides / Leticia Pacheco (U. Autónoma de México - Iztapalapa)

Stratiomyidae (Diptera) of Costa Rica / Vladimir Berezovsky (Natural History Museum of Los Angeles)

Stream macroalgae: systematics and biogeography / Robert Sheath (U. Guelph, Canada)

Study of lice and their use in taxonomy of birds / Robert Fisher (Juniata College)

Systematics of parasitic phorid flies (Insecta: Diptera: Phoridae) / Brian Brown (Natural History Museum of Los Angeles)

Tachinid flies of Fila Cruces / Manuel Zumbado (INBio)

The ecology and demography of the shrub *Clidemia hirta* (Melastomataceae) in its areas of origin (Costa Rica) and introduction (Hawaii) / Saara DeWalt (Louisiana State U.)

The effect of P addition and inoculation (*Rhizobium*) on nodulation of *Canavalia ensiformis* / Denise McKinney (Hiram College)

The role of mycorrhizal fungi in determining success of forest tree species establishment in former pastures of southern Costa Rica / Laura Aldrich-Wolfe (Cornell U.)

Tropical moist forest recovery from human-induced disturbance - Las Alturas primary site / Karen D. Holl (U. California)

Use of an agricultural countryside by tropical forest birds / Jennifer Hughes (Stanford U.)

Water beetles of Costa Rica / Rob Roughley (U. Manitoba, Canada)



Paul Ehllich (Stanford U.) collects insects in the Las Cruces Biological Station reserve in conjunction with his project - Distribution of biodiversity in forest patches and in the agricultural landscape.

LA SELVA BIOLOGICAL STATION

A chronological survey of the densities of generalist versus specialist parasitic wasps (Hymenoptera: Ichneumonidae) / Beth Shapiro (U. Georgia)

A cross-site comparison of the faunal influence on decomposition / Liam Heneghan (U. Georgia)

A study of bird diversity in México, Costa Rica and South America / Rudolph Gelis (Berea College)

A survey of the termites of La Selva / Mark Suárez (U. Maryland)

A xerox herbarium for Monteverde / Willow Zuchowski (Monteverde)

Activity patterns of canopy mammals / Deedra McClearn (OIS)

Alternatives for reforestation with native trees in Sarapiquí, Costa Rica (TRIALS II) / Richard Fisher (Texas A&M U.), Julio Calvo (CCI) / Eugenio González (OIS), Jeremy Hagger (ICRAF), Pablo Arroyo (OIS)

Altitudinal migration of butterflies in Costa Rica / William Haber (Monteverde)

Antiparasitoid defenses in tropical lepidopteran larvae (ORUGAS) / Lee Dyer (Mesa State College), Grant Gentry (Mesa State College) / Margot Rathbone (Mesa State College, EARIH), Earthwatch Volunteers

Armored scales of Costa Rica / Francesco Porcellì (Istituto Etologia Agraria, U. Bari, Italy)

Aroid pollination - comparison between two habitats: Barro Colorado Island (Panamá) & La Selva (Costa Rica) / Danny Beath (SIRI)

Arthropod diversity in a lowland tropical rain forest (ALIAS) / Robert Colwell (U. Connecticut), Jack Longino (Evergreen State College), Henry Hespenheide (U. California, Los Angeles) / Valerie Behan-Pelletier (Agriculture Canada), Donald Davis (SIRI), Paul Hanson (U. Costa Rica), Thomas Goldschmidt (U. Münster, Germany), Evert Lindquist (Agriculture Canada), Lawrence Kirkendall (U. Bergen), Piotr Naskrecki (U. Connecticut), Jerry Powell (U. California, Berkeley), Danilo Brenes (OIS/INBio), Nelci Conztrillo (OIS/INBio), Maylin Paniagua (OIS/INBio), Ronald Vargas (OIS/INBio)

Arthropods in banana and other tropical monocultures under different pesticide regimes / Robert Matlock (OIS) / Elinor Brennan (OIS)

Avian nesting success in continuous and fragmented forest (NIDOS) / Bruce Young (Nature Conservancy), Jim Zook (Freelance)

Bee pollination of trees in a tropical wet forest / Rainer Thiele (U. Tübingen, Germany), Ju-Lin Weng (U. Costa Rica)

Behavioral ecology of ground ants / Scott Kirksey (U. South Florida)

Behavioral ecology of La Selva bats / Anne Brooke (U. Tennessee)

Biodiversity of parasitoid wasps / Shawn Marsh (U. Georgia)

Bird monitoring at Tortuguero / Brian O'Donnell (US Forest Service)

Bird population changes at La Selva / Bruce Young (OIS) / Dennis Rogers (Freelance)

Bird songs of Montezuma Oropendola colonies / Terry Krueger (U. Miami)

- Brood parasitism by cowbirds on *Oropendolas*** / Emma Cunningham (Cambridge U., United Kingdom)
- Carbon, water and energy balance (CARBON)** / Steve Oberbauer (Florida International U.), Deborah Clark (U. Missouri, St. Louis), David Clark (U. Missouri, St. Louis), Edzo Veldkamp (U. Göttingen, Germany) / Henry Loescher (U. Florida), Joseph O'Brien (Florida International U.), Jens Mackensen (U. Göttingen, Germany), William Brenes (OIS), Leonel Campos (OIS)
- Changes in soil organic matter with land-use change in Sarapiquí** / Jennifer Powers (Duke U.)
- Changes in the diet of migratory neotropical birds during pre-migratory and migratory periods** / John Prather (U. Arkansas)
- Characterization of diatoms and nutrients in La Selva rivers** / Gerlinde Hebel (U. Costa Rica), Rafael Rodríguez (U. Costa Rica), Ellen Mayer (Centro de Investigación Marina, U. Costa Rica), Astrid Michels (Centro de Investigación Marina, U. Costa Rica)
- Collecting mushrooms for systematic studies** / Jean-Marc Moncalvo (Duke U.)
- Common plants of Costa Rica: a guide book** / Margaret Gargiullo (Rutgers U.)
- Community ecology of exotic species** / Terrence McGlynn (U. Colorado)
- Comparative reproduction of *Pithecellobium* at La Selva and Barro Colorado Island** / Daniel Bunker (U. Pittsburgh)
- Conservation of animal biodiversity in managed forests: possible role of defaunation on the recruitment of timber tree species in Sarapiquí, Costa Rica** / Jesús Rosales (CATE) / Vicente Henra (CATE)
- Costa Rican ecological representation** / Canelia Bontaites (California Institute of Integral Studies), Mark Follman (California Institute of Integral Studies)
- Decomposition of saprophytic Basidiomycetes in tropical forests** / Gerhard Kost (U. Marburg, Germany)
- Demography of the endemic *Aphelandra starkii* (Acanthaceae)** / Lucinda McDade (U. Arizona)
- Density, diversity and size class distribution of the lianas of La Selva** / Stefan Schnitzer (U. Pittsburgh), Saara Dewalt (U. Pittsburgh)
- Diet selection of *Phyllostomus* bats** / Norberto Giannini (U. Tucumán, Argentina), Federico Villalobos (U. Costa Rica)
- Digestion in machaca (*Brycon guatemalensis*) fruit eating fish** / Michael Horn (California State U., Fullerton) / Anna Gawlicka (Canadian National Researcher), Sandra Barach (California State U., Fullerton), Elaine Logothetis (California State U., Fullerton)
- Dispersal of the rolled leaf beetle *Cephaloleia* on *Calathea crotolifera*** / Derek Johnson (U. Miami)
- Diversity of epiphytes in tropical forests** / Marcela Caceres (U. Federal Pernambuco, Brazil)
- Diversity of forest litter Coleoptera** / Chris Carlton (Louisiana State U.), Alexey Tishchkin (Louisiana State U.), Vicky Moseley (Louisiana State U.)
- Biological basis of sustainability in reconstructed tropical ecosystems (HUEBIOS)** / Jack Ewel (USDA Forest Service) / Dawn Berggren (U. Florida), Miguel Cifuentes (OIS), Marco Gutierrez (U. Costa Rica), Ankila Hiremath (U. Florida), Matthew Kelty (U. Massachusetts) / Virgilio Alvarado (OIS), Walter Cruz (OIS), Roger Gómez (OIS), Gilbert Hurtado (OIS), Olman Paniagua (OIS), Silvino Villegas (OIS)
- Ecology and management of *Cordia alliodora*** / Susan Hummel (Oregon State U.)
- Ecology of nectar-feeding bats** / Marco Tschapka (U. Erlangen, Germany)
- Ecology of tropical rain forest trees (TREES)** / David Clark (U. Missouri, St. Louis), Deborah Clark (U. Missouri, St. Louis) / William Brenes (OIS), Leonel Campos (OIS)
- Ecophysiology of understory and gap herbs** / Arthur C. Gibson (U. California, Los Angeles), Phil Rurdel (U. California, Los Angeles), M. Rasoul Sharifi (U. California Los Angeles)
- Effects of land use change on soil trace gas emissions** / Edzo Veldkamp (U. Göttingen) / William Reiners (U. Wyoming), Ken Driese (U. Wyoming), Shnguang Lin (U. Wyoming)
- Evolution of cichlid egg sizes** / Ronald Coleman (U. California, Berkeley)
- Flight studies of the *Megalopterus coeruleus* damselfly (Odonata: Zygoptera)** / Frederick Saintours (U. Massachusetts), Robert Stevenson (U. Massachusetts), Lawrence Connolly (U. Massachusetts)
- Flora of La Selva** / Robert Wilbur (Duke U.) / Gerry Moore (Duke U.), Reinaldo Aguilar (INBio)
- Flower visiting behavior resource preferences and predators of long-tongued hawkmoths** / Lutz Thilo Wasserthal (Instituto für Zoologie, Germany)
- Forest regeneration after cacao removal** / Carol Horvitz (U. Miami) / Harsh Bardhan Vasistha (U. Miami), Dionne Skervin (U. Miami), Rachel Beck-King (U. Miami), Mario Blanco (U. Costa Rica), Annemarie Jameson (U. Miami), Derek Johnson (U. Miami), Matthew Slocum (U. Miami)
- Fruit resource in La Selva** / Johanna Choo (Rutgers U.)
- Global position of La Selva** / Jeff Luvall (NASA)
- Glycoalkaloids of *Solanum* spp and their significance as mediators of fruit-frugivore interactions** / Martin Cipollini (Bany College)
- Historical analysis of OIS involvement in conservation and applied biology in Costa Rica** / Leslie Burlingame (Franklin & Marshall College)
- Is there host specificity in bromeliads?** / Catherine Cardelus (Columbia U.)
- Hybrid study on *Bactris coloradonis* and *Bactris* spp.** / Robin Sears (Columbia U.), Steve Gracey (Columbia U.), Jenya Kaufman (Columbia U.)
- Impact of native timber tree species on soil landowners in the lowlands of the Atlantic region** / Priscila Chaverri (IICR)
- Individual behavior and group performance during leaf harvesting by leaf-cutting ants** / Susan Giles (Monash U.), Martin Burd (Monash U.)
- Influence of light availability on seedling mortality of a common understory palm, *Welfia regia*** / Corine Vriesendorp (U. Michigan)

Insect biodiversity / John Pickering (U. Georgia), Charles Parker (U.S. Geological Survey)

Insect interaction on ripe fruits / Brian Inouye (Duke U.)

Investigation of idiobiont parasitoids and altered levels of herbivory in lepidopteran hosts / Megan Blasler (U. Georgia), Josh Ness (U. Georgia)

Land use in the Sarapiquí region / Jane Read (Louisiana State U.)

Land-use history of La Selva (biogeochemistry) / Robert Sanford (U. Denver) / Cuong Doan (U. Denver), Karen Harrell (U. Denver), Melissa McMahon (U. Denver), Roderick Morrison (U. Denver)

Lichens in the tropical forest / Doris Wolff (U. Costa Rica)

Light and tree species diversity (BOSQUES) / Robin Chazdon (U. Connecticut), Julie Denslow (Louisiana State U.) / Marvin Castillo (ITCR), Juan M. Dupuy (U. Connecticut), Tatiana Robles (UCR), Marvin Castillo (ITCR), Silvia Iriarte (U. Connecticut), Braulio Vilchez (ITCR), Marcos Molina (OIS), Yorlery Molina (OIS), Jeanette Paniagua (OIS)

Light transmittance in the canopy / Geoffrey Parker (Smithsonian Institution), Melissa Parker (Smithsonian Institution)

Maintenance of bird populations in forest fragments / Robert Matlock (OIS)

Mammals census / Camilla Carroll (U. Maryland)

Maintenance of diversity of epiphytes in a tropical forest / Robert Lücking (U. Ulm, Germany), Andrea Lücking (U. Ulm, Germany)

Mixed species tree plantations in the humid tropics: An alternative for carbon sequestration / Daniel Shepherd (Yale U.)

Modeling the consequences of heterogeneous light environments for seedling performance in tropical wet forest / Rebecca Montgomery (U. Connecticut) / Kirsten Jensen (U. Connecticut), Brianna Haab (Bradley U.)

Monitoring of endangered bird species in Braulio Carrillo - La Selva / Bruce Young (Nature Conservancy) / Jim Zook (Freelance)

Natural history & community ecology of Satyrid butterflies / Michael Singer (U. Texas-Austin)

Natural history, behavior, and genetics of the paper wasp *Mischocyttarus collarellus* (Hymenoptera : Vespidae) / Elizabeth Smith (U. Kansas)

Nutrient cycling across soil fertility gradients / Jennifer Powers (Duke U.)

Observation of tropical Odonates / Bradley Dickey (U. Kentucky), Kenneth Hopper (U. Kentucky)

Parental effects on offspring fitness in *Dendrobates pumilio* / Maura Maple (Indiana U.) / Andria Beeler (U. Kentucky), Matthew Russell (Dallas Zoo)

Phorid parasitoids of *Paraponera clavata* ants / Shelley Morehead (U. Utah)

Piper species in the understory of primary forests / Bettina Engelbrecht (Technische Hochschule Darmstadt, Germany)

Pollination biology of the genus *Begonia* / Douglas Schenske (U. Washington)

Pollination of *Cyclanthaceae* / Nico Franz (U. Costa Rica)

Polymorphism on an aposematic anuran: an experiment to test natural selection / Andrew Crawford (U. Chicago)

Population dynamics of leaf cutter ants *Atta cephalotes* / Bruce Haines (U. Georgia), Laura Kreach (U. Georgia)

Population response of insect herbivores and pathogens to plantations of native trees in Costa Rica (PLAGAS) / Elizabeth Braker (Occidental College), Robert Marquis (U. Missouri, St. Louis) / Andrea Azuma (Occidental College), Kristen Bell (Occidental College), José Alejandro Pallas (ITCR), Alvaro Herrera (U. Latina), Erika Schwillk (Occidental College), Rachel Rodríguez (Occidental College), Elliot Wilkinson (Occidental College), Mika Zipusch (Occidental College)

Prehispanic settlement at the La Selva Biological Station / Felipe Sol (U. Costa Rica)

Protozoa of La Selva / Tom Cavalier-Smith (U. British Columbia)

Rapid induced responses in the *Cecropia-Azteca* system / Anurag Agrawal (U. California, Davis), Benjamin Dubin Thaler (U. California, Davis)

Reproductive success in the bat *Saccopteryx bilineata* / Gerald Heckel (Erlangen U., Germany)

Silviculture and ecology of secondary forests / Manuel Guariguata (CATE) / Ana Mariscal (CATE)

Soil nutrient level relations to the occurrence and diversity of tree legumes / Rick Wesch (Texas A&M U.)

Stingless bee ecology / Michael Breed (U. Colorado)

Study of CO₂ fluxes on primary forest soils / Patrick Crill (U. New Hampshire)

Study of frog calling sites in a multispecific neotropical community / Carolyn King (California State U.-Northridge), Shawn Loughnan (California State U.-Northridge), Ann Strieby (California State U.-Northridge)

Systematics and behavior of *Apocephalus* / Brian Brown (Los Angeles County Museum), Erick Holscher (Los Angeles County Museum), Jill Paldi (Los Angeles County Museum)



Soil pit used to measure the CO₂ content at different depths (from 5 cm to 3.5 meters) in the Carbon, Water and Energy Balance (CARBONO) Piroject.

Systematics and evolution of Euptychiine butterflies / Debra Murray (Louisiana State U.)

Systematics of the beetle family Cerambycidae / Frank Hovore (U. California, Los Angeles)

The catalytic effect of tree plantings on the rehabilitation of native forest diversity on degraded tropical lands / Jennifer Powers (OIS/World Bank)

The distribution and impact of *Banisteriopsis caapi*, an invasive liana / Stacey Forsyth (U. Arizona)

The effect of herbivorous mammals on the regeneration of *Dipteryx panamensis* and *Pentaclethra maculosa* / Silvia Lobo (U. Costa Rica/Museo Nacional de Costa Rica)

The implications of understory vegetation composition for forest restoration and agroforestry in Costa Rica / Kristen Michaelides (Yale U.)

The influence of light environment on extent of VA mycorrhiza in *Inga* / Julie Whitbeck (Stanford U.)

The role of *Cecropia*-inhabiting ants on insect herbivore community structure and herbivore diversity on the *Cecropiaceae* / Louis LaPierre (U. California, Los Angeles)

Topography of La Selva / Doug Rider (AmyTech.)

Transpiration in evergreen and deciduous trees at La Selva and Barro Colorado Island / Louis Santiago (U. Hawaii)

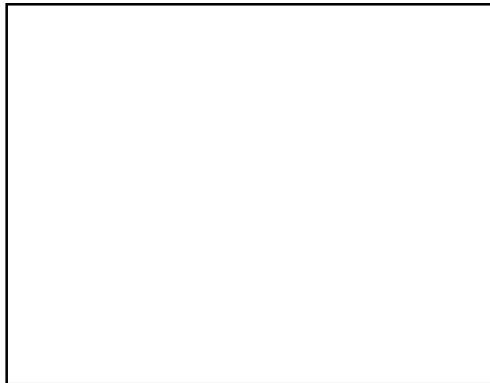
Variation of heterostylous *Psychotria* / Marten Edwards (Case Western Reserve U.)

Variation in the plant sexual system heterostyly in Rubiaceae and Acanthaceae / Any Faivre (U. Arizona)

Volcanic processes introduce chemical discontinuities into lowland tropical streams: Ecological responses to geothermally-derived solutes (STREAMS) / Catherine Pringle (U. Georgia), David Genereux (Florida International U.), John Duff (US Geological Survey), Alan Jackman (U. California, Davis), Frank Triska (US Geological Survey), Alonso Ramirez (U. Georgia)/ Minor Hidalgo (OIS), Walter Frielingsdorf (Florida International U.), Jason Farabaugh (OIS), Sharon Wood (Florida International U.)

What factors control the abundance of *Atta cephalotes* at La Selva / Heather Wells (U. Georgia)

***Wolbachia* in neotropical arthropods** / John Werren (U. Rochester)



Examples of the more than 200,000 specimens collected as part of the Arthropod diversity in a lowland tropical rain forest (ALAS) project.

PALO VERDE BIOLOGICAL STATION

Attempted predation on a tree frog and the response of conspecific frogs to distress calls / Christopher Leary (Auburn U.)

Camera-trapping at waterholes in Palo Verde National Park / Larissa Bailey (North Carolina State U.)

Comportamiento territorial y aspectos de la morfología genital de los machos de *Centris adani* (Hymenoptera: Anthophoridae) que influyen en la selección de pareja por la hembra / P. Ortíz (U. Católica)

Cultivation and diversity of tropical free-living non-pathogenic Protozoa / T. Cavalier-Smith (U. British Columbia, Canada)

Dinámica y distribución espacial del bosque seco tropical primario / Jorge Jiménez (OIS), Eugenio González (OIS)

Efecto del pastoreo con ganado en la laguna estacional del Parque Nacional Palo Verde / Arnoldo Paniagua, Michael McCoy (U. Nacional de Costa Rica)

Population status and demography of *Guaiacum sanctum*, *Astronium graveolens* and *Sideroxylum capiri* at Palo Verde National Park / A. Guevara (Area de Conservación Tempisque - MINAE), Eugenio González (OIS)

Factores que determinan el establecimiento y distribución de *Laguncularia racemosa* en ambientes de alta sedimentación en la costa Pacífica de Costa Rica / P. Hansen, P. Delgado (Louisiana State U.)

Gene flow into tropical forest fragments / Jim L. Hamrick (U. Georgia), V. Apsit, D. Trapnell (U. Georgia)

Genetic variation of the wild rice population found at Palo Verde / Alejandro Zamora (U. Costa Rica)

Paleoecology of the Palo Verde area: Soil charcoal records of environmental history / Robert Sanford, Richard Wong, Samantha Groves, Tony Reynolds (U. Denver)

Recopilación y clasificación de información biofísica y ambiental de la cuenca baja del Río Tempisque / Jenny Pérez (OIS)

Seed ecology of *Parkinsonia aculeata* at Palo Verde National Park / R. Cochard (James Cook U.)

Size and sex zoning in a Libellulid dragonfly / B. Dickey (U. Kentucky)

The occurrence and diversity of tree legumes as influenced by soil properties in selected tropical forests in Costa Rica / R. Wesch (Texas A&M U.)

The role of cattle in wetland vegetation management for waterfowl habitat at Palo Verde National Park, Guanacaste Region, Costa Rica / W. Burnidge (U. Michigan)

Environmental Policy

In fiscal year 1998 the Environmental Policy Program offered the two traditional professional courses for U.S. and Latin American policymakers, as well as two new courses: one targeted to Brazilian policymakers and one for Latin American business leaders. Through these courses professionals from the U.S. and Latin America experience the same field-oriented training program that is the OTS trademark in graduate education. The goal of the Environmental Policy Program is to reach professionals who devise and implement policies that affect tropical resources but who often have minimal training in environmental sciences.

Principios Ecológicos para el Desarrollo Sostenible en América Latina (OTS 98-6)

The Latin American decision-makers course, now in its tenth offering continues to serve as an innovative training experience for public policymakers by building on OTS' core strengths of scientific research and intensive, hands-on education. The fifteen-day program included basic ecological principles, as well as environmental economics, land-use issues, wildland management, community involvement, eco-tourism and other topics, tied together by the vision of sustainability. The course visited a number of contrasting sites, including Guanacaste, Manuel Antonio and Braulio Carrillo National Parks, La Selva and Monteverde Biological Stations, Puntarenas and several rural locations. Twenty-five participants from eleven countries participated in the course sponsored for the third consecutive year by the U.S. Fish and Wildlife Service.

Coordinator: Raúl Solórzano, Superior Director of Natural Resources, Costa Rica
Co-coordinator: Carlos Manuel Rodríguez, Vice Minister of the Environment and Energy, Costa Rica

Participants:

Oscar L. Acosta, Coordinator, Public Prosecution of Environment and Health Issues, El Salvador
José Luis Aranayo, Technical Assistant, Center for Rural Education and Integrated Development, Bolivia
José J. Barahona, Legal Counsel on Agrarian and Environmental Issues, Office of the Attorney General, Costa Rica
Jorge Luis Campaña, Environmental Education Officer, OIKOS Association, Ecuador
Luis E. Campos, General Coordinator of Public Prosecution, El Salvador
Nelson A. Doñán, Chief, Environmental Division, National Civil Police, El Salvador
Pedro C. Estrada, Professor/Researcher, Social Research Center, Tamaulipas Autonomous University, México
Martín Gómez, Development Coordinator, Sierra de Manantlán Biosphere Reserve, México
Ana María González, Marine Biologist, Agency for Sustainable Development of the San Andrés Islands, Colombia
Torás A. Guardia, Legal Assistant, Ministry of Foreign Affairs, Panamá
Lorenzo Hincapié, President of the Board, Natura Foundation, Panamá
Oscar M. McKay, Executive Director, Natura Foundation, Panamá
Leonardo A. Mieres, Coordinator, International Policy Committee, House of Representatives, Venezuela
Rixcie Newball, Economist, Agency for Sustainable Development of the San Andrés Islands, Colombia
Ricardo A. Pinel, Manager, El Imposible National Park Project, El Salvador Ecological Foundation (SalvaNATURA), El Salvador
Juan Pablo Quaro, Social Promoter, Foundation for Nature Defense, Venezuela
Olman Rodríguez, Legal Assistant, Office of the Attorney General, Costa Rica
José León Talavera, President, Association for the Development of the Esperanza Verde Reserve (ASDEVERDE), Nicaragua
Lourdes Tapia, Executive Director, Cibao Ecological Society (SOECI), Dominican Republic
Gladys Tejada, Tourism Development Coordinator, Central Bank, Dominican Republic
Enrique Ulate, Judge, Agrarian Court of Appeals, Costa Rica
Rubén Urzúa, National Director for Conservation, Wild Heritage Management Agency, Chile

Interdependence: Economic Development and Environmental Concerns (OTS 98-8)

With major support from the *International Fund for Animal Welfare*, OTS offered the eleventh edition of the U.S. Decision-Makers Course 15-22 February in Costa Rica. This week-long field-course provided twenty participants with an understanding of international issues related to tropical forestry, sustainable development, biodiversity and climate change. The course visited contrasting sites in Costa Rica, including Palo Verde, Arenal and La Selva, and benefited from visits to projects as diverse as a hydropower dam, a banana plantation and a sustainable forestry operation.

Coordinators: Dr. Alex Moad, U.S. Forest Service and Dr. Elizabeth Losos, Smithsonian Institution
Co-coordinator: Christiana Figueres, Center for Sustainable Development in the Americas



Ana María González (Colombia)
presents achievements and challenges
related to her work in environmental
planning for the San Andrés Islands.

Participants:

Dorothy Bowers, Vice President, Environmental & Safety Policy, Merck and Company, Inc.
Scott Brady, Legislative Assistant, Senator Max Cleland
Sharon Buccino, Legislative Counsel, Natural Resources Defense Council
Kathryn Clay, Legislative Assistant, Senator Patrick Moynihan
Stephanie Daigle, Professional Staff Member, Senate Environmental & Public Works Committee
Delacroix Davis, Staff Assistant, House Appropriations Committee
Christine Eustis, Legislative Specialist, US Fish and Wildlife Service, Office of Legislative Affairs
Orlando González, International Activities Specialist, EPA/Office of International Activities
Ray Harry, Manager, Environmental Issues/Government Affairs, Southern Company
Lawrence Gurbiner, Regional Environmental Officer, US Embassy, San José, Environmental Hub for Central America & the Caribbean
Derek Newby, Legislative Assistant, Representative David Price
Mark Peterson, Special Assistant, Office of the Speaker
Ross Pinfrey, Renewable Energies Program, USAID
Hal Salvasser, Director, Pacific SW Research Station, USDA Forest Service
Hank Savage, Assistant Counsel, Office of Legislative Counsel
Adam Serchuk, Research Director, Renewable Energy Policy Project
Roberta Soltz, Director, Environmental Compliance, Metropolitan Water District of Southern California
Kathleen Weiss, Assistant Manager, Government Relations, Westvaco Corporation
Robert Wolcott, Acting Assistant Administrator, US Environmental Protection Agency, Office of Policy, Planning and Evaluation
Cynthia Wolloch, Deputy Chief, Fulbright Program for Latin America, US Information Agency

Princípios Ecológicos para a Tomada de Decisões na Amazônia (OTS 98-14)

This first offering of the Brazilian decision-makers course, sponsored by *USAID-Brazil*, brought together 20 participants from the Manaus region for a 4-day intensive field experience. The course and curriculum were based on the successful U.S. and Latin American decision-makers course format, as well as adapted to the realities of the Amazon region. The course used a field approach by visiting several different development ventures in the Manaus region and discussing positive and negative aspects of these projects with the help of the course resource people. Topics addressed in the course included fragmentation and landscape management, ecological-economic zoning, economic alternatives, agroforestry, natural resource management, and biodiversity and environmental economics.

Course Coordinator: Dr. Rita Mesquita, EDEFF-INPA

Participants:

Alcirene Maria da Silva Cursino, Prof., Implantação da Educ. Ambiental, SEMED
Bianor Saraiva N. Júnior, Procurador Federal-INRA
Edson Maia de Almeida, Coord. Assuntos relativo ao Meio Ambiente da SEMUDI, Secretaria Municipal do Interior de Maués
Eleonora de Paula e Souza Dias, Fundação de Rádio e TV Cultura e FUNAI, Produtora de documentários sobre meio ambiente
Elias Emanuel Rebouças de Lima, Repórter de Telejornalismo, TV Amazonas
Gedeao Timóteo Amorim, Pró-Reitor para Extensão, Fundação Universidade do Amazonas
Jaith de Oliveira Chaves Filho, Diretor de Desenvolvimento Turístico, Emp. Amazonense de Turismo
João Frederico G. Cruz, Secretário Municipal de Indústria, Comércio, Turismo e Meio Ambiente, Secretaria Municipal de Turismo
John Patreick Steenbuck, Gerente Operacional, COOMAM Coop/SBEP
Kátia Helena Serafina Cruz, Chefe da sessão responsável pelos programas de assentamento-INRA
Luiz Fernando do Amaral Gurgel, Consultor de Educação Ambiental, Inst. Desenvolvimento e Recursos Humanos do Amazonas-IDRH-AM
Maria Rita Furtado Rodrigues, Coord. do Setor para Assuntos relativos ao Meio ambiente, Inst. Superior de Estudos, Pesquisa e Desenvolvimento dos Direitos Civis - IDC
Mário Braule Pinto, Procurador Geral-INRA
Aminda Mendonça, Gerente do Depto. Interiorização do Turismo, Emp. Amazonense de Turismo-EMAMTUR
Ulisses Viana Costa, Assessor/Sociologia/Antropologia, CUPER/Coordenadoria de Análise
José Raimundo Lopes da Costa, Chefe de Departamento/CEPAM, Secretaria do Meio Ambiente de Itacoatiara
Josely de Macêdo Bezerra, Secretária Municipal de Turismo, Prefeitura Municipal de Barcelos
Otávio Queiroz Cabral, Diretor Programa de Pequenas e Micro Empresas-FIEAM
Rui Carlos Castro de Alencar, Analista de Assuntos Sociais, CUPER/Coordenadoria de Análise
Walter Walfrides de Oliveira, Economista, CENAQUE-IBAMA-Goiás

Toma de Decisiones Empresariales y Calidad del Ambiente en América Central

The first offering of *Corporate Decision Making and Environmental Quality in Central America* was funded by the *Tinker Foundation*. With twenty participants from five countries, the five-day short-course took place at La Selva Biological Station and at Hotel El Rodeo. This short-course was conceived to motivate and educate Central American corporate leaders and senior-level executives, representing national and multinational private companies operating in the region, on environmental issues in order to orient their activities toward sustainable development. The curriculum centered around three case studies, selected to illustrate the steps leading to the establishment of an environmental management system in a firm, which were all discussed on-site. They were a reforestation and sawmill operation (La Esperanza de Sarapiquí), a Chiquita Brands banana plantation and a cardboard factory (Empaques Santa Ana). Additional activities included discussions on environmental management systems, Central American environmental legislation, and ecological principles for the businessperson.

Co-coordinators: José María Rodríguez, OTS and Ana L. Quirós, ECO GLOBAL

Participants:

Olvin Francisco Andino Méndez, Corporación Cressida, Honduras
Luis Barraza De Freitas, Presidente, Asociación Panameña de Desarrollo Sostenible, Panamá
Julio Conrado Batres Hernández, Industria Gráfica Guatemalteca, S.A. (IGRAFIGSA), Guatemala
José Cano, Banacol de Costa Rica, S.A.
Leonardo Castro Baroni, Ingeniero de Recursos, Amanco de Costa Rica
Jaime Guillermo Cercas Solano, Bio-Miel S.A., Costa Rica
Alvaro E. Coto Keith, La Esperanza de Sarapiquí, S.A., Costa Rica
Marco A. Esquivel A., Proyecto Manejo Sostenible del Rastrojo de Píña, Pulpas de Celulosa de Centroamérica, Costa Rica
Ornar Gómez González, Banacol de Costa Rica, S.A.
Jaime Federico Hazard Chocano, Proyectos Ambientales Los Andes, S.A., Guatemala
Ricardo Isaac Kestler Aguilar, Gerente, División Agrícola, Plantaciones Nuez del Pacífico, S.A., Guatemala
Ana María Martínez Mendosa, Hércules de Centroamérica, S.A. (Hercasa), Nicaragua
Marco Antonio Mena Brenes, Imprenta Nacional, Costa Rica
María D. Monge Aguilar, Fundación Nicaraguense para el Desarrollo Sostenible (FUNDENIC), Nicaragua
Olman Muñoz Céspedes, CEPOF, Costa Rica
Oscar Manuel Osorio, PIELSA, Guatemala
Raúl Robles Bercián, Corporación Bananera, S.A. (COBSA), Guatemala
Roberto Ruiz Barrantes, Corbana, S.A., Costa Rica
Eduardo A. Vargas Aguilar, Depto. de Facilidades, Motorola de Centroamérica, S.A., Costa Rica
Rolando Vásquez Morera, Instituto del Café de Costa Rica

Environmental Education

The OTS Environmental Policy Program also works to educate a broader audience, specifically communities surrounding the biological stations, to promote sustainable development activities. In fiscal year 1998, OTS conducted the following environmental education activities:

Traditional Nature Walks. More than 1,560 school children and local residents visited OTS biological stations to learn about biodiversity and the significance of science in protecting tropical forests.

Science Education for Local Communities. La Selva Biological Station began the process of developing a science education program for local communities to foster stewardship and to help protect the integrity of the Braulio Carrillo corridor and La Selva. Activities in fiscal year 1998 included an inventory of the schools in the La Selva vicinity, data on classes and class sizes, and the development of a curriculum of fifteen modules each composed of a lesson on a key ecological or conservation concept linked to simple laboratory or field exercises. Implementation of this project will occur in fiscal year 1999.

Adopt-a-Stream. Adopt-a-Stream Program was expanded to include Las Cruces in addition to La Selva. At Las Cruces, Adopt-a-Stream was implemented by Raúl Rojas (former Station Naturalist) and OTS grantee Doug Parsons (U. Georgia) who worked with local high school teachers to initiate this program. The Adopt-a-Stream Program will continue with 10th grade students from the Humberto Melloni High School of Coto Brus monitoring the waters of the Java Stream near the school.

APRENABRUS Activities. Several environmental education activities were done in conjunction with APRENABRUS, the oldest environmental organization in Coto Brus, the county that includes Las Cruces, including a workshop to determine the future course of action for this organization.

Participatory Rural Appraisal Workshop. A workshop was held in October 97 and for community leaders from La Tirimbina, a small and very poor town located near Braulio Carrillo National Park, 20 km southwest of La Selva. Twelve leaders from the town took part in this participatory methodologies workshop. A major outcome was the development of strategies for natural resources conservation activities in the Tirimbina community.

Introduction to Environmental Conflict Resolution Management. Two workshops were held in conjunction with CEDERENA (Environmental Law and Natural Resources Center) as part of the training activities of the Meso-American Conflict Resolution Network, of which OTS is a founding member. The first was at La Selva with a number of people representing a wide variety of public and private institutions from Puerto Viejo de Sarapiquí participating in the workshop. The second was held at Palo Verde and brought together public and private sector participants from Honduras, Nicaragua, Panama and Costa Rica. The objective of these workshops was to encourage the participation of all community stakeholders in identifying and solving environmental conflicts without having to go to court.

Las Cruces Biological Station

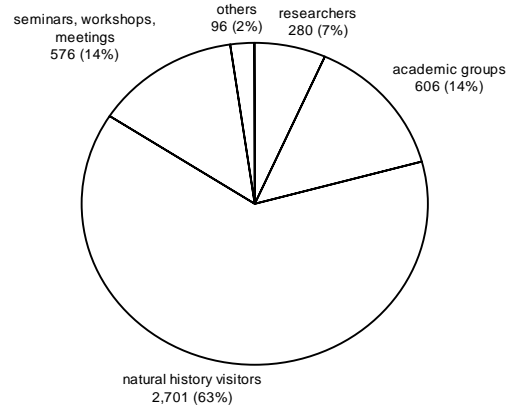
Las Cruces is located on Costa Rica's southern Pacific slope and is OTS' 266-hectare reserve of mid-elevation rain and cloud forest. Las Cruces is also home to the Robert and Catherine Wilson Botanical Garden, a 10-hectare managed area consisting of one of the most important living botanical collections in Central America.

Visitation

In fiscal year 1998, day and overnight usage at Las Cruces Biological Station totalled 15,268 person-days consisting of researchers (14%), academic groups (25%), natural history visitors (51%), seminars, workshops and meetings (5%) and others (5%). Day and overnight visitation has grown more than 75% in the past two years. Day visits accounted for 5,694 person-days with natural history visitors accounting for the bulk of these visits. Individual walk-on visitors increased from 2,258 person-days in fiscal year 1997 to 3,263 person-days in fiscal year 1998. This figure does not include Latin American school groups, who have free entrance and are now coming from longer distances in the Southern Region of the country and from Panama. The amount of time researchers, students and natural history visitors are staying at Las Cruces has increased significantly. Researcher usage grew more than 85% in fiscal year 1998 and can be attributed to longer research projects fueled by facilities improvements including labs, library resources and accommodations. Natural history person-days increased 65% in fiscal year 1998 mostly due to longer visits by organized birding tours and Elderhostel groups.

Conservation

In fiscal year 1998, funds were secured for the purchase of a pasture contiguous to Las Cruces' primary forest. Known as the Rojas Triangle, this former cattle pasture is now called Melissa's Meadow in honor of major donors Robert and Julie Heck and their daughter Melissa. Acquisition of the 31 hectare area on the west side of the Río Jaba provides important research options and protection of the watershed as the forest will be restored with the implementation of a challenging reforestation program. Approximately two-thirds of the pasture will be reforested using tree species native to the county. One-third of the area will be dedicated to natural regeneration and other restoration ecology research applications. Just days after the official purchase of the land, OTS Board of Directors member Dr. Jean Marie Hartman and a Rutgers University landscape design department student/faculty team arrived to participate in a workshop dedicated to planning reforestation of the new property. Their recommendations, after ten days on-site, also include plans for an arboretum and for restoration of a small natural marsh. In the meadow a temporary nursery for seedlings will be established, with seeds acquired from the Las Cruces Reserve and from local cooperative nurseries. As assisted and natural forest regeneration efforts succeed in suppressing the pasture grasses, the name of this important property will change to Melissa's Forest.



4,259 people visited Las Cruces Biological Station in fiscal year 1998 for a total of 15,268 person-days

Research Highlights

During the year, 59 researchers worked on 30 research projects at the station. The emphases in research projects based at Las Cruces continue to be in conservation biology and landscape restoration. (See pages 12-13 for a complete listing of research projects.)

Facilities and Resources

No funds were allocated in fiscal year 1998 to new facilities, but priorities of facility needs were established with the aid of the Las Cruces Advisory Committee. These priorities include housing for undergraduate and graduate faculty and a new toolshed and workshop. During this fiscal year, the databases for living collections were rebuilt in a new format to include 5,053 plant accessions, the highest number since 1986. This database is an important tool for botanical research, providing site of accession in the grounds, date of acquisition and provenance.



A recent addition to OTS, Melissa's Meadow is 31 hectares (75 acres) of degraded pasture land contiguous to Las Cruces' primary forest.

La Selva Biological Station

With its state-of-the-art laboratories, on-line geographic information system, extensive trails, and large forest reserve bordering Braulio Carrillo National Park, La Selva is one of the world's most important sites for tropical forest research. La Selva is located in the Caribbean lowlands of Costa Rica and comprises 1,536 hectares of old and secondary growth forests, plus experimental habitats.

Visitation

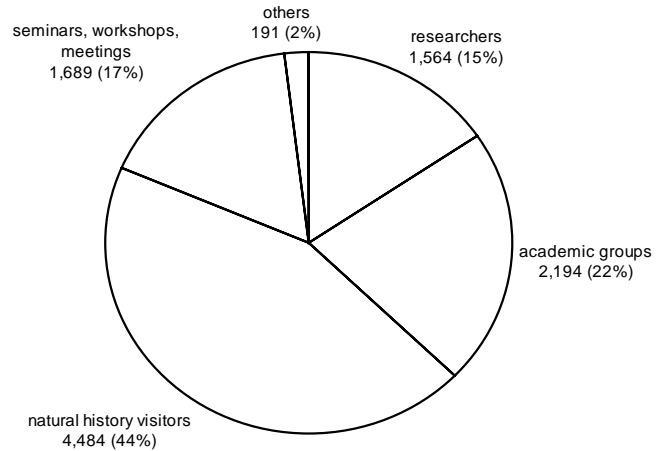
In fiscal year 1998, day and overnight visitation at La Selva consisted of 23,981 total person-days distributed among researchers (38%), academic groups (27%), natural history visitors (18%), seminars, workshops and meetings (11%) and others (6%). Overall, the station experienced an increase in overnight visitation of 13% from last fiscal year. The day program targeted to natural history visitors increased 10% in fiscal year 1998.

Research Highlights

During the year, more than 230 researchers and assistants used La Selva Biological Station for work on 111 projects. (See pages 13-16 for a complete listing of research projects.) At least 86 publications were published in fiscal year 1998 based on research performed at La Selva. The STREAMS project, with PI Cathy Pringle (U. Georgia), was reinvigorated with the construction of two V-notch weirs on tributary streams within La Selva. The NIDOS project, with PI Bruce Young (The Nature Conservancy), began a comparative study of avian nesting success in old-growth and forest fragments -- and documented the first Great Potoo nest in Mesoamerica .

Facilities and Resources

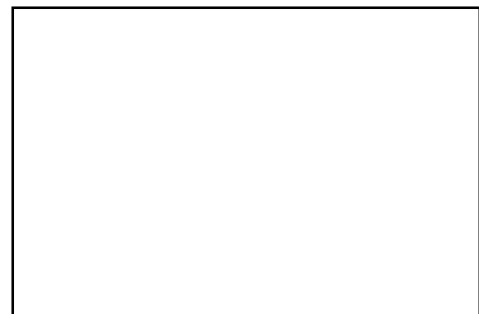
During fiscal year 1998, OTS purchased the small Galeano property that borders La Selva's northeast corner along the Puerto Viejo River to add to the protective buffer of La Flaminea. Several major bridge and trail improvements were made during the year, including replacing the CCC trail (Camino Circular Cercano) and the arboretum and river station bridges with longer lasting galvanized steel structures and upgrading 300 meters of muddy trails with paving stones. Thanks to the generous support of the *Grand Circle Foundation*, a new Welcome Center was completed to accommodate natural history visitors. This center will also contain research displays highlighting the important work being conducted at La Selva. A prototype Database Management System was also established in fiscal year 1998, that included setting policies on data management and administrative procedures for information management and capturing data and metadata for most projects at La Selva. As part of the NASA Canopy Vegetation LIDAR Remote Sensing Project, an airborne Vegetation Canopy Lidar (VCL) simulator flew over the entire La Selva reserve in March and collected data on the La Selva forests. These data provide La Selva researchers with information on canopy height, canopy and ground topography, canopy density from the ground to maximum canopy height, and data on canopy gaps. These data will be useful for estimating above ground forest biomass and other tropical forest research questions.



10,122 people visited La Selva Biological Station in fiscal year 1998 for a total of 23,981 person-days

Conservation

Protection of the La Selva-Braulio Carrillo Corridor remains an important aspect of conservation activities. With reduced patrols by MINAE (the Costa Rican Ministry of Environment and Energy), the La Selva guards encountered more frequent evidence of incursions by hunters in the biological corridor. La Selva staff joined a commission for the protection of the area and worked on three areas related to park protection: (1) environmental education; (2) park patrols; and (3) sustainable development on the park's boundaries. As part of this cooperative effort, La Selva's guards also patrolled with MINAE guards in the area of the corridor entry points.



A view from the River Station; originally built in 1974 and renovated to include two new bedrooms this year, it continues to house students and researchers.

Palo Verde Biological Station

Unique in its landscape richness and wildlife, Palo Verde National Park contains one of the most extensive marshes and some of the oldest patches of dry forest remaining in Central America. The OTS facilities are in the heart of the 19,804 hectare Palo Verde National Park, located in the northwest Costa Rican lowland of Guanacaste Province.

Visitation

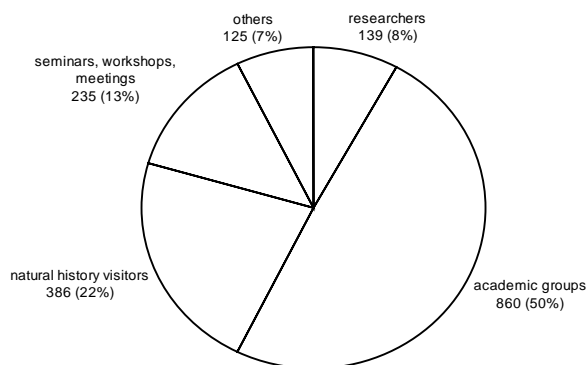
In fiscal year 1998, usage at Palo Verde Biological Station totalled 4,620 person-days. This represents a 76% increase from fiscal year 1997, with all user categories seeing significant growth. These visits were distributed among researchers (15%), academic groups (63%), natural history visitors (9%), seminars, workshops and meetings (7%), and others (6%). The record usage is largely due to the recent improvements in facilities and infrastructure. Palo Verde Biological Station hosted 287 natural history day-visitors during the year, mainly from Elderhostel visits.



Isla de Pájaros (Bird Island) is the most important nesting site for Roseate Spoonbills (*Ajaia ajaja*) in the Tempisque River. The Spoonbills arrive at Palo Verde when the seasonal marsh begins to dry out in order to feed on small fish found in shallow water.

Conservation

The OTS-ACT Commission (joint project between OTS and Area de Conservación Tempisque) met regularly to coordinate operational activities of Palo Verde National Park and the Palo Verde Biological Station. In coordination with SINAC (Sistema Nacional de Areas de Conservación) and the Ramsar Convention, international and national workshops were conducted to analyze the past, present and future management of Palo Verde National Park, specifically wetland management and restoration. These workshops led to the development of general guidelines for the rehabilitation of the Palo Verde wetlands and subsequent promulgation of an Executive Decree allowing management of these wetlands. A zoning plan, research policies, park entrance fee structure, and planning for electrification of the park and station were also coordinated through the commission.



1,745 people visited Palo Verde Biological Station in fiscal year 1998 for a total of 4,620 person-days

Research Highlights

During the year, 47 researchers conducted research in 17 research projects. Research use of Palo Verde continues to be primarily short-term projects as highlighted in the research section of this report. (See page 16 for a complete listing of research projects.) Of special note are two long-term research projects: Philippe Hensel (Louisiana State U.) and Patricia Delgado Sánchez (Louisiana State U.) are studying mangrove communities along the Pacific coast of Costa Rica and James Hamrick (U. Georgia) is conducting a project on gene flows into tropical forest fragments.

Facilities and Resources

In fiscal year 1998, efforts were concentrated on maintenance and minor improvements of the existing facilities, including installing fencing, painting, upgrading bathrooms, installing mosquito screens and modest landscaping. Progress was also made in developing information resources for Palo Verde visitors. The Tempisque Lowland Database was completed during fiscal year 1998 and contains more than one thousand bibliographic references. It includes all scientific and technical papers published in major fields dealing with natural resources and agriculture including agronomy, soils, birds, ecology, zoology, physiology, botany and restoration ecology. In addition, Ulises Chavarría (Tempisque Conservation Area) led the effort to collect, identify and conserve as herbarium specimens the plants of Palo Verde National Park. This herbarium collection is housed at the Station and is an important tool for students and researchers to identify plants found in the park.

Development

Annual Fund

The OTS Annual Fund raised a total of \$258,454 in unrestricted revenues during fiscal year 1998. This was a 54% increase in revenue over the previous year. As in the past, many donors targeted their contributions to specific program areas: \$14,180 for La Selva Biological Station, \$90,252 for Las Cruces Biological Station/Wilson Botanical Garden, \$1,828 for Palo Verde Biological Station, \$3,605 for education, and \$148,589 for general operations. Gifts to the Annual Fund support the organizations' on-going operations.

Grants and Contracts

The following grants and contracts were awarded to OTS in fiscal year 1998:

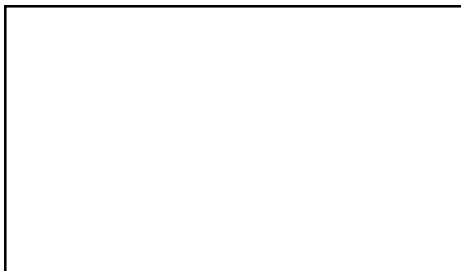
| <i>Donor</i> | <i>Purpose</i> | <i>Amount</i> |
|--|---|---------------|
| Association Liaison Office for University Cooperation in Development | Graduate Course in Peru (1999-2001) | \$100,000 |
| International Fund for Animal Welfare | U.S. Decision-Makers Course | \$40,000 |
| Andrew W. Mellon Foundation | Graduate Education Program (1999-2001) | \$945,000 |
| National Science Foundation | Database Management and Connectivity | \$146,340 |
| Peace Frogs | Amphibian Research Fellowships | \$10,000 |
| Rainforest Alliance | Land Acquisition and Protection | \$9,718 |
| Stanley Smith Horticultural Trust | Las Cruces Signage and Interpretive Literature | \$13,000 |
| Tinker Foundation | Latin American Corporate Decision-Makers Course | \$36,000 |
| US Fish and Wildlife Service | Latin American Decision-Makers Course | \$25,000 |
| Raytheon Systems Development Company | US Army Terrain Mapping Project | \$52,593 |
| | Total Grants and Contracts | \$1,377,651 |

Restricted Campaigns

In fiscal year 1998, OTS focused on the Environmental Policy Endowment and land acquisition at Las Cruces. The Environmental Policy Endowment grew by \$245,000 through the following corporate gifts and foundation grants in fiscal year 1998. This endowment, created primarily to fund the U.S. Decision-Makers Course, also benefits the broader environmental policy program featured on pages 17-19.

| | |
|---|----------|
| Charles Steward Mott Foundation | \$75,000 |
| The Summit Foundation | \$40,000 |
| ARCO Foundation | \$5,000 |
| Chiquita Brands | \$10,000 |
| Citicorp Foundation | \$5,000 |
| Edison Electric Institute | \$60,000 |
| Merck and Company | \$5,000 |
| Southern Company | \$5,000 |
| Dole Foods/Standard Fruit of Costa Rica, S.A. | \$25,000 |
| Weyerhaeuser Company Foundation | \$5,000 |
| Zeneca Plant Science | \$10,000 |

The Melissa's Meadow project (see page 20) consisted of a leadership gift of \$44,000 from Robert and Julie Heck who visited the Garden through a Saga Holidays Tour. For their support OTS renamed the property Melissa's Meadow in honor of their daughter. In addition, more than \$50,000 was generated from individual donors for acquisition and reforestation.



Gary Hartshorn, Jay Savage, Rebecca Papendick, Pedro León and Rodolfo Silva at the 3rd Annual San José Gala. During this event, Dr. Savage was given a special award for his long-standing commitment to OTS. The San José gala is held each year to fund Costa Rican scholarships and on-going operations.

Donors

A special thanks to the following individuals, foundations, corporations and government agencies for their support in fiscal year 1998 (July 1, 1997-June 30, 1998). It is only through this support that OTS can continue to provide leadership in education, research and the responsible use of natural resource in the tropics.

Grand Sponsors / Gran

Patrocinadores (100,000+)
Andrew W. Mellon Foundation
National Science Foundation
Association Liaison Office for
University Cooperation in
Development

Sponsors / Patrocinadores (50,000+)

Charles Steward Mott Foundation
Edison Electric Institute
Raytheon Systems Development
Company

Major Benefactors / Gran Benefactores (25,000+)

Michelle Cloud
Dole Foods/Standard Fruit of
Costa Rica, S.A.
Eli Lilly and Co. Foundation
Robert and Julie Heck
International Fund for Animal
Welfare
The Summit Foundation
Tinker Foundation
US Fish and Wildlife Service

Benefactors / Benefactores (10,000+)

Conservation International
Chiquita Brands
Benjamin and Ruth Hammett
Peace Frogs
Stanley Smith Horticultural Trust
Stephanie Stone de Feoli/
Zenurray Foundation
Zeneca Plant Science

Champions / Campeones (5,000+)

ARCO Foundation
Joan Slatkin Barton
Chevron Research &
Technology Company
Citicorp Foundation
COBAL
Paul and Anne Ehrlich
JiJi Foundation
Robert M. Kramer, Esq., Richard
H. Simons Charitable Trust
Merck and Company
Rainforest Alliance
Southern Company
Weyerhaeuser Co. Foundation

Stewards / Administradores (2,500+)

William Brooks
Doris Brown
Conservation and Research
Foundation
Russell B. Faucett
Great North Productions, Inc.
Claude Hope

Randall C. Jones
Daniel Kemper & Joanna Mason
Roger & Isobel Perry
Stanley Ritland & Alice
Hutchinson
Jerry & Sheila Freeman,
Ston Forestal
Francis G. Toldi

Partners / Asociados (1,000+)

Susan D. Ackerman
Agencia de Viajes Horizontes
Banco Banex
Banco Interfin
Bayer de Costa Rica
Elinor S. Benes
Virginia C. Clarkson
Clemens Family Foundation
Dr. & Mrs. David C. Coleman
Compañía Mercantil
Mary & Harry Cornwall
Corporación Matra, S.A.
Gretchen C. Daily
E. Jean Daubernire
Patricia DeCoursey
Roberto C. Dorion
Margaret Enderlein
William R. Engels
John & Lila Foster
Robert M. Goodman
Gary & Lynne Hartshorn
Neil & Marilyn Hornor
Hotel Presidente, C.R.
Frank T. Hovore
Howard Rosen Productions
Mrs. William F. Kirsch
Leonard M. Kurz
Kurz Family Foundation
Clark & Lyda Lampion
Richard & Carol Laursen
Rebecca & Scott Lehmann
David & Evelyne Lennette
Ralph & Lanna Lewin
Ira & Janina Marks Charitable
Trust
Mark McMahon & Earl Robinson
Gary & Nancy Meffe
James Moore
Motorola, S.A.
Marigold Murray de Genis
Margaret Murray Lindo
Harry & Arlene Nance
Heidi Nitze
Arthur M. Pappas
Portico, S.A.
Helen K. Preston
Purdy Motor, S.A.
Jay Savage & Rebecca Papendick
Jarid Simons
Murray & Lillian Slatkin
Ann C. Stephens
Donald & Beverly Stone

Janice & Edward Swab
F. Christian & Betty Thompson
TV Man Union
Christophe & Christiane Tyson
Paige Winebarger

Patrons / Patrocinadores (\$500 +)

Lynne Carmichael
C. Ronald Carroll
Peter Chabora & Roberta Koepfer
David & Margaret Cooke
Corporación Cressida
Ida Cortés Núñez
Thomas R. Davis & Ellyn Bush
Carol Dolinskas
Daniel & Gretchen Funk
Mr. & Mrs. Peter Gilmore
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Bill & Mary Hartman
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Fred Levinson
McAlexander Travel
David K. McDonald
Joseph & Jean Mulroy
Peter K. Nelson
Dan & Alice Nicolson
Marilyn and Blake Reeves
Remington Products Company
Lawrence Rosenfeld
Roblfo Silva
Sinauer Associates, Inc.
Phillip Sillins
Michael W. Steinberg &
Lisa A. Shapiro
Richard Stoltenberg
Virginia & Riley Willcox
Mr. & Mrs. Alfred Wilsey
Pamela Wilson
Robert Wolcott
Alvin Y. Yoshinaga

Sustainers / Colaboradores (\$250 +)

Richard & Diana Allan
Kinsey A. Anderson
Robin M. Andrews
Max & Paulette Badgley
Barbara L. Bentley
Katheryn Bolles
Michael Breed
Bert G. Brehm
Garry D. Brewer
Bucks County Audubon Society
Mr. & Mrs. Francis Cabot
Mary E. Case
Christina Cheatham &
Matt Alfemann
M. Lynne Com
James H. Cupery
Peter S. Curtis and
Allison A. Snow
Roseann Densmore
Jack & Phyllis Dolhinow
John E. Earhart
W. Hardy Eshbaugh III
Christiana Figueres
Jonathan Fink
Richard F. Fisher
James Ford
Luis Gamboa
Jonathan Giles & Karen Steinour
Gilbert Glass
Richard H. Goodwin
James L. Hamrick
Walter H. Hodge
Murray G. Honick
Mrs. Thomas J. Hubbard
Samuel C. Jones
Samuel & Francine Kasoff
Kids for Saving Earth
Suzanne B. King
Richard K. Koehn & Sheryl Scott
James V. LaFrankie
Dr. & Mrs. Harry Lange
Sally C. Levings
Bette Loiselle & John Blake
John W. McCoy
Deborah McMillan
Rogers McVaugh
Bjorn & Margot Monson
Natural History Ltd.
Brent D. Opell
Ronald H. Petersen
Pharmacia Incorporated
Richard & Rachel Porter
David Queller & Joan Strassmann
Ann & Anis Racy
Robert & Bertha Rains
Robert Ricklefs & Susanne Renner
James E. Rodman
Norman & Alice Rubash
John R. Sauer
Todd Shelly & Ethel Villalobos
John & Margaret Sparks
Charles Stanberry &
Helene Dublisky
Peter F. Stevens
Allen Thoma & Diane Fong
George Tuttle & Ben Cushman
Stephen A. Wainwright
David & Marvalee Wake
Jocelyn M. Wallace
Peter J. Watkins
Jeff & Missy Wert
Mary Jane West-Eberhard
Nathaniel T. Wheelwright
Don & Kathleen Wilson
Frank G. Witebsky
Catherine Ziegler

Despite every effort to avoid them, errors may occur in the process of producing this annual report. If your name has been omitted or misprinted, please notify us and accept our apologies.

Finances

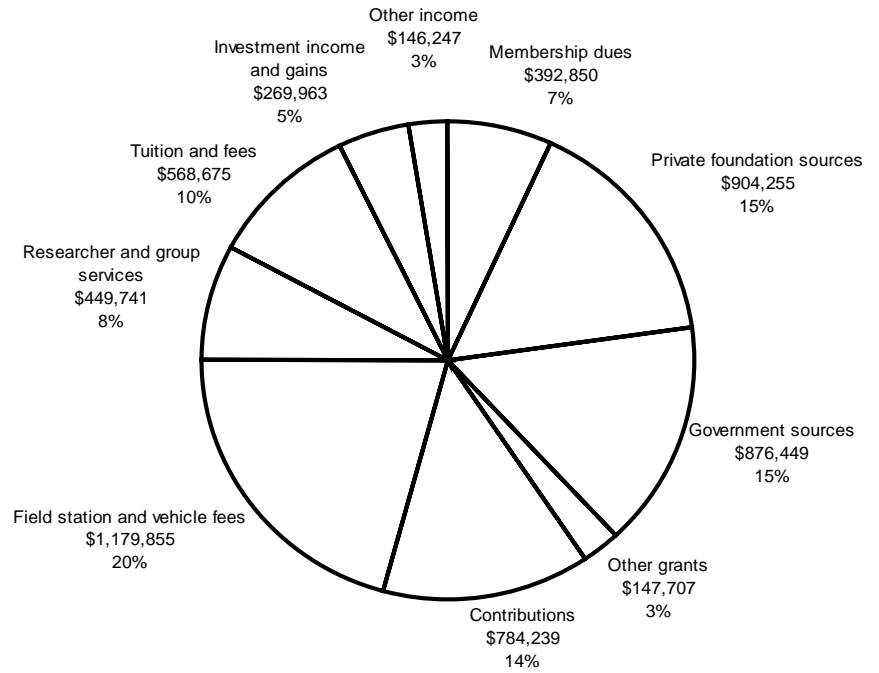
Fiscal year 1998 was OTS' strongest financial year ever across all unrestricted, designated, and restricted funds. Final figures show an increase in total net worth of \$880,052. This increase was offset by a decrease (-\$133,746) in the organization's plant funds due to the annual depreciation expense exceeding infrastructure and equipment additions.

The increase in net worth is due primarily to four factors. First, the organization's designated accounts, including the Environmental Policy and Education reserves, and the restricted accounts, including the Braulio Carrillo and Melissa's Meadow land funds, showed tremendous growth (+\$424,406). The organization experienced continued growth in its endowment funds, including an impressive 16.7% return on investment (+\$226,498). OTS experienced a solid year in the organization's unrestricted operating fund by controlling expenses and increasing the Annual Fund by more than 50% (+\$87,880). Finally, an accounting policy change in the way OTS administers its private foundation grants also contributed to the large bottom line (+254,708). Private foundation grants are now recognized as revenue upon receipt of the award letter versus being deferred and recognized when the funds are spent.

The following audited financial statements contain columns for both OTS and for ESINTRO, the for-profit Costa Rican corporation created in the fall of 1995 to handle OTS sales and related taxable items.

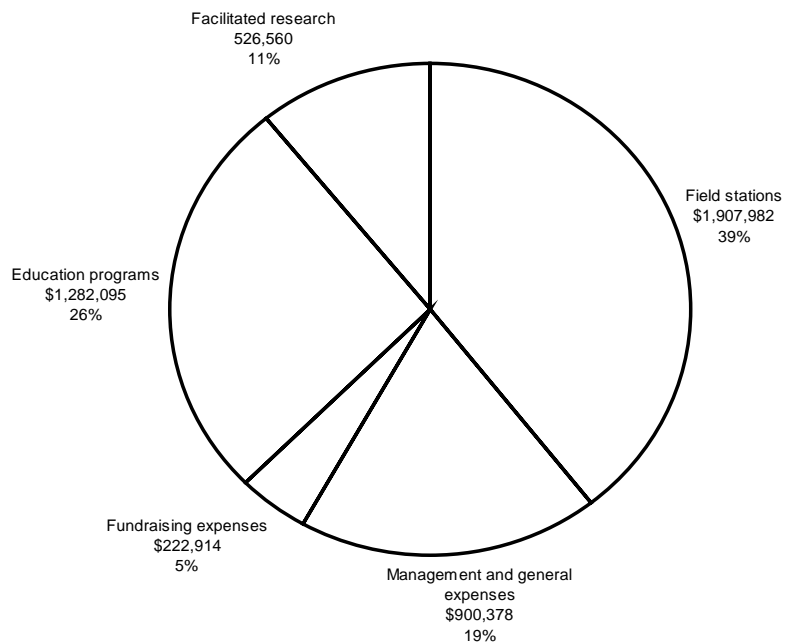
Support and Revenue

\$5,719,981



Expenses

\$4,839,929



Audited Financial Statements

Independent Auditors' Report

The Board of Directors
Organization for Tropical Studies, Inc.

We have audited the accompanying consolidated statements of financial position of the Organization for Tropical Studies, Inc. and subsidiary as of June 30, 1998 and 1997, and the related consolidated statements of cash flows for the years then ended, and the consolidated statement of activities for the year ended June 30, 1998. These consolidated financial statements are the responsibility of the Organization's management. Our responsibility is to express an opinion on these consolidated financial statements based on our audits.

We conducted our audits in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Organization for Tropical Studies, Inc. and subsidiary as of June 30, 1998 and 1997, and their cash flows for the years then ended and the changes in their net assets for the year ended June 30, 1998 in conformity with generally accepted accounting principles.

Our audits were made for the purpose of forming an opinion on the consolidated financial statements taken as a whole. The supplementary information included in the consolidated statement of financial position and the related consolidated statements of activities and cash flows related to the Organization for Tropical Studies, Inc. and the Estudios E Investigaciones Tropicales S.A. (ESINTRO), collectively "the Organizations," is presented for purposes of additional analysis of the consolidated financial statements rather than to present the financial position, changes in net assets and cash flows of the Organizations. Such information has been subjected to the auditing procedures applied in the audits of the consolidated financial statements and, in our opinion, is fairly stated in all material respects in relation to the consolidated financial statements taken as a whole.

October 26, 1998

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY
Consolidated Statements of Financial Position
June 30, 1998 and 1997

| | <u>Supplementary Information</u> | | | |
|--|---|---------|---------------|---------------|
| | Organization for Tropical Studies, Inc. | ESINTRO | 1998 Total | 1997 Total |
| Assets | | | | |
| Cash and cash equivalents (notes 3 and 8) | \$ 2,203,855 | 26,318 | 2,230,173 | 1,495,010 |
| Accounts receivable (note 7) | 130,727 | 1,392 | 132,119 | 140,895 |
| Contributions receivable, net | 13,673 | — | 13,673 | 11,331 |
| Investments (note 3) | 2,702,726 | — | 2,702,726 | 2,270,886 |
| Land, buildings and equipment, net (note 4) | 2,627,252 | 1,183 | 2,628,435 | 2,761,882 |
| Other assets | 34,943 | 22,492 | 57,435 | 84,948 |
| Total assets | 7,713,176 | 51,385 | 7,764,561 | 6,764,952 |
| Liabilities and Net Assets | | | | |
| Liabilities: | | | | |
| Accounts payable | 40,362 | 5,379 | 45,741 | 65,779 |
| Other liabilities | 325,502 | 15,571 | 341,073 | 212,283 |
| Accumulated postretirement benefit liability (note 9) | 112,145 | — | 112,145 | 101,340 |
| Total liabilities | 478,009 | 20,950 | 498,959 | 379,402 |
| Net assets: | | | | |
| Unrestricted (notes 5 and 8) | 4,292,086 | 30,435 | 4,322,521 | 4,058,681 |
| Temporarily restricted (note 5) | 2,135,639 | — | 2,135,639 | 1,540,690 |
| Permanently restricted (note 5) | 807,442 | — | 807,442 | 786,179 |
| Total net assets | 7,235,167 | 30,435 | 7,265,602 | 6,385,550 |
| Contingencies (note 8) | | | | |
| Total liabilities and net assets | \$ 7,713,176 | 51,385 | 7,764,561 | 6,764,952 |

See accompanying notes to consolidated financial statements.

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY

Consolidated Statements of Activities

Year ended June 30, 1998

(with comparative amounts for the year ended June 30, 1997)

| | <u>Supplementary Information</u> | | | | | | 1998 Total | 1997 Total (note 2) |
|---|---|-------------------------|-----------------------|---------------------------|---------------------------|---------------|---------------|---------------------------|
| | Organization for Tropical Studies, Inc. | | | Temporarily Restricted | Permanently Restricted | 1998 Total | | |
| | Unrestricted | ESINTRO Unrestricted | Total Unrestricted | | | | | |
| Revenues: | | | | | | | | |
| Operating revenues and support: | | | | | | | | |
| Membership dues | \$ 392,850 | — | 392,850 | — | — | 392,850 | 386,100 | |
| Grants, contracts and similar agreements: | | | | | | | | |
| Private foundation sources | 649,547 | — | 649,547 | 254,708 | — | 904,255 | 747,168 | |
| Government sources | 779,139 | — | 779,139 | — | — | 779,139 | 1,087,552 | |
| Grant indirect recovery | 97,310 | — | 97,310 | — | — | 97,310 | 112,527 | |
| Other | 147,707 | — | 147,707 | — | — | 147,707 | 114,029 | |
| Total grants, contracts & similar agreements | 1,673,703 | — | 1,673,703 | 254,708 | — | 1,928,411 | 2,061,276 | |
| Contributions | 548,856 | — | 548,856 | 214,120 | 21,263 | 784,239 | 978,429 | |
| Field station fees | 947,720 | 157,641 | 1,105,361 | — | — | 1,105,361 | 725,678 | |
| Vehicle rental fees | 74,494 | — | 74,494 | — | — | 74,494 | 81,794 | |
| Researcher and group services | 449,741 | — | 449,741 | — | — | 449,741 | 657,593 | |
| Tuition and fees | 568,675 | — | 568,675 | — | — | 568,675 | 183,974 | |
| Investment income | 58,225 | — | 58,225 | 74,993 | — | 133,218 | 79,873 | |
| Unrealized gains on investments | 3,696 | — | 3,696 | 133,049 | — | 136,745 | 67,088 | |
| Other | 67,490 | 78,757 | 146,247 | — | — | 146,247 | 115,276 | |
| Total operating revenues | 4,785,450 | 236,398 | 5,021,848 | 676,870 | 21,263 | 5,719,981 | 5,337,081 | |
| Net assets released from restrictions | 81,921 | — | 81,921 | (81,921) | — | — | — | |
| Total revenues and other support | 4,867,371 | 236,398 | 5,103,769 | 594,949 | 21,263 | 5,719,981 | 5,337,081 | |
| Expenses: | | | | | | | | |
| Program expenses: | | | | | | | | |
| Field stations | 1,764,211 | 143,771 | 1,907,982 | — | — | 1,907,982 | 1,803,034 | |
| Education programs | 1,282,095 | — | 1,282,095 | — | — | 1,282,095 | 1,431,552 | |
| Facilitated research | 526,560 | — | 526,560 | — | — | 526,560 | 663,770 | |
| Total program expenses | 3,572,866 | 143,771 | 3,716,637 | — | — | 3,716,637 | 3,898,356 | |
| Management and general expenses | 823,024 | 77,354 | 900,378 | — | — | 900,378 | 797,838 | |
| Fundraising expenses | 222,914 | — | 222,914 | — | — | 222,914 | 270,291 | |
| Total management, general and fundraising expenses | 1,045,938 | 77,354 | 1,123,292 | — | — | 1,123,292 | 1,068,129 | |
| Total expenses | 4,618,804 | 221,125 | 4,839,929 | — | — | 4,839,929 | 4,966,485 | |
| Increase in net assets | 248,567 | 15,273 | 263,840 | 594,949 | 21,263 | 880,052 | 370,596 | |
| Net assets at beginning of year (note 2) | 4,043,519 | 15,162 | 4,058,681 | 1,540,690 | 786,179 | 6,385,550 | 6,014,954 | |
| Net assets at end of year | \$ 4,292,086 | 30,435 | 4,322,521 | 2,135,639 | 807,442 | 7,265,602 | 6,385,550 | |

See accompanying notes to consolidated financial statements.

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY
Consolidated Statements of Cash Flows
Years ended June 30, 1998 and 1997

| | Supplementary Information | | | |
|---|---|---------|---------------|---------------|
| | Organization for Tropical Studies, Inc. | ESINTRO | 1998 Total | 1997 Total |
| Cash flows from operating activities: | | | | |
| Change in net assets | \$ 864,779 | 15,273 | 880,052 | 370,596 |
| Adjustments to reconcile change in net assets to net cash provided by operating activities: | | | | |
| Depreciation on buildings and equipment | 273,284 | — | 273,284 | 277,415 |
| Decrease in accounts receivable | 4,450 | 4,326 | 8,776 | 86,644 |
| (Increase) decrease in contributions receivable | (2,342) | — | (2,342) | 22,002 |
| (Increase) decrease in other assets | 31,195 | (3,682) | 27,513 | (22,691) |
| Increase (decrease) in accounts payable and other liabilities | 109,048 | (296) | 108,752 | 40,562 |
| Increase in accumulated post-retirement benefit liability | 10,805 | — | 10,805 | 18,682 |
| Contributions restricted for permanent net assets | (21,263) | — | (21,263) | (485,727) |
| Net unrealized gains on investments | (136,745) | — | (136,745) | (67,088) |
| Net cash provided by operating activities | 1,133,211 | 15,621 | 1,148,832 | 240,395 |
| Cash flows from investing activities: | | | | |
| Purchases of equipment | (139,539) | (298) | (139,837) | (510,624) |
| Purchases of investments | (1,152,144) | — | (1,152,144) | (1,289,836) |
| Net proceeds from sales of investments | 857,049 | — | 857,049 | 703,032 |
| Net cash used in investing activities | (434,634) | (298) | (434,932) | (1,097,428) |
| Cash flows from financing activities: | | | | |
| Contributions restricted for permanent net assets | 21,263 | — | 21,263 | 485,727 |
| Net cash provided by financing activities | 21,263 | — | 21,263 | 485,727 |
| Net increase (decrease) in cash and cash equivalents | 719,840 | 15,323 | 735,163 | (371,306) |
| Cash and cash equivalents at beginning of year | 1,484,015 | 10,995 | 1,495,010 | 1,866,316 |
| Cash and cash equivalents at end of year | \$ 2,203,855 | 26,318 | 2,230,173 | 1,495,010 |

See accompanying notes to consolidated financial statements.

ORGANIZATION FOR TROPICAL STUDIES, INC. AND SUBSIDIARY

Notes to Consolidated Financial Statements

June 30, 1998 and 1997

(1) Organization

The Organization for Tropical Studies, Inc. (the Organization) is chartered as a nonprofit corporation under the laws of the State of Florida for the purpose of furthering education and research in tropical sciences, and is supported by a consortium of institutions of higher education located in North and Central America. The Organization maintains its general office in Durham, North Carolina on the campus of Duke University, an administrative office in San Jose, Costa Rica, and three field stations in Costa Rica (La Selva, Las Cruces and Palo Verde) for instructional and research purposes.

Included in the consolidated financial statements of the Organization is *Estudios E Investigaciones Tropicales S.A.* (ESINTRO), a for-profit subsidiary of the Organization. ESINTRO was incorporated for sales made to field station visitors of food, lodging, clothing, beverages, and other miscellaneous items. The Organization is the sole stockholder of ESINTRO.

A summary of the financial data applicable to the operations in Costa Rica compared to total operations as included in the consolidated financial statements as of and for the years ended June 30, 1998 and 1997 is as follows:

| | 1998 | | 1997 | |
|---------------------------------|---------------------------|---------------------|---------------------------|---------------------|
| | Costa Rican Operations | Total Operations | Costa Rican Operations | Total Operations |
| Total assets | \$ 2,909,585 | 7,764,561 | 2,986,966 | 6,764,952 |
| Total liabilities | 53,589 | 498,959 | 52,171 | 379,402 |
| Total revenue and other support | 4,146,490 | 5,719,981 | 3,909,628 | 5,337,081 |
| Total expenses | 4,369,652 | 4,839,929 | 4,291,834 | 4,966,485 |

Funding of the Organization is provided principally by dues from the member institutions, field stations and vehicle rental charges, tuition and fee charges for courses offered by the Organization, grants from the National Science Foundation and various private foundations, and private gifts.

The Organization is exempt from Federal income taxes under Section 501(c)(3) of the Internal Revenue Code.

(2) Summary of Significant Accounting Policies

The consolidated financial statements of the Organization have been prepared on the accrual basis of accounting. The significant accounting policies followed are described below to enhance the usefulness of the consolidated financial statements to the reader.

Net assets and revenues, expenses, gains and losses are classified based on the existence or absence of donor-imposed restrictions. Accordingly, net assets of the Organization are classified and reported as follows:

Permanently restricted – Net assets subject to donor-imposed stipulations that they be maintained permanently by the Organization. Generally, the donors of these assets permit the Organization to use all or part of the income earned on related investments for general or specific purposes.

Temporarily restricted – Net assets subject to donor-imposed stipulations that may or will be met either by actions of the Organization and/or the passage of time.

Unrestricted – Net assets that are not subject to donor-imposed stipulations.

Revenues from sources other than contributions are reported as increases in unrestricted net assets. Contributions are reported as increases in the appropriate category of net assets, except that contributions which impose restrictions that are met in the same fiscal year they are received are included in unrestricted revenues. Expenses are reported as decreases in unrestricted net assets. Gains and losses on investments are reported as increases or decreases in unrestricted net assets.

unless their use is restricted by explicit donor stipulations or by law. Expirations of temporary restrictions recognized on net assets (i.e., the donor-stipulated purpose has been fulfilled and/or the stipulated time period has elapsed) are reported as reclassifications from temporarily restricted net assets to unrestricted net assets. Temporary restrictions on gifts to acquire long-lived assets are considered met in the period in which the assets are acquired or placed in service.

Contributions, including unconditional promises to give, are recognized as revenues in the period received. Contributions received for capital projects or perpetual or term endowment funds and contributions under split-interest agreements or perpetual trusts are reported as nonoperating revenues. All other contributions are reported as operating revenues. Conditional promises to give are not recognized until the conditions on which they depend are substantially met. Contributions of assets other than cash are recorded at their estimated fair value at the date of gift. Contributions to be received after one year are discounted at a rate commensurate with the risk involved. Amortization of the discount is recorded as additional contribution revenue in accordance with donor-imposed restrictions, if any, on the contributions. Allowance is made for uncollectible contributions based upon management's judgment and analysis of the creditworthiness of the donors, past collection experience and other relevant factors.

(a) Principles of Consolidation

All significant intercompany balances and transactions have been eliminated in consolidation.

(b) Cash and Cash Equivalents

Except for \$282,447 as of June 30, 1998 and \$253,845 as of June 30, 1997 in bank accounts in Costa Rica and temporary investments of \$960,993 as of June 30, 1998 and \$335,476 as of June 30, 1997, cash and certain investments are managed by Duke University. Monies managed by Duke University are invested in the University's "Institutional Reinvestment Account" (IRA). The rate earned on monies invested in the IRA is based on 100% of the 30-day U.S. Treasury Bill rate, regardless of the performance of the IRA's assets. The Organization considers all investments with original maturities of less than 90 days to be cash equivalents.

(c) Land, Buildings and Equipment and Depreciation

Land, buildings and equipment are stated at cost at date of acquisition or fair value at date of donation in the case of gifts. Depreciation of buildings and equipment is provided over the estimated useful lives of the respective assets on the straight-line basis.

(d) Investments

Investments in equity securities and debt securities are reported at fair value with unrealized gains and losses reported in the statement of activities. Investment income includes realized gains and losses on investments, interest and dividends.

(e) Translation of Foreign Currencies

Assets and liabilities denominated in Costa Rican colones (all "monetary items") are translated into U.S. dollars at the rate prevailing at the balance sheet date of 256.40 and 232.50 colones as of June 30, 1998 and 1997, respectively, to the U.S. dollar. Transactions in colones have been translated into U.S. dollars at rates prevailing at the transaction dates. Such rates ranged from 232.50 to 256.40 and 207.20 to 232.50 colones to the U.S. dollar during fiscal years 1998 and 1997, respectively. The translation of foreign currencies resulted in losses of \$4,334 and \$3,197 for fiscal years 1998 and 1997, respectively, which are included in the accompanying consolidated statements of activities.

(f) Use of Estimates

The preparation of consolidated financial statements in conformity with generally accepted accounting principles requires management to make estimates and judgments that affect the reported amounts of assets and liabilities and disclosures of contingencies at the date of the consolidated financial statements and revenues and expenses recognized during the reporting period. Actual results could differ from those estimates.

(g) Comparative Amounts

Comparative amounts for 1997 have been presented in the accompanying consolidated statement of activities in total but not by net asset class in order to provide an understanding of the Organization's operations. Such information does not include sufficient detail with respect to the consolidated statement of activities to constitute a presentation in conformity

with generally accepted accounting principles. Accordingly, such information should be read in conjunction with the Organization's consolidated statement of activities for the year ended June 30, 1997, from which the comparative information was derived.

(h) Reclassification

Certain items in the 1997 financial statements have been reclassified to conform with the presentation adopted in the current year.

(i) Restatement

In 1998, the Organization determined that grants from private foundations are contributions. Such grants had previously been accounted for as exchange transactions and recorded as deferred revenue. As a result, the previously reported increase in net assets for the year ended June 30, 1997 was reduced by \$165,855. In addition, net assets have been restated as follows:

| | 1998 | 1997 |
|--|---------------------|---------------------|
| Net assets at beginning of year, as previously reported | \$ 5,062,528 | \$ 4,526,077 |
| Adjustment for contributions previously recorded as deferred revenue | 1,323,022 | 1,488,877 |
| New assets at beginning of year, as adjusted | <u>\$ 6,385,550</u> | <u>\$ 6,014,954</u> |

(3) Investments

Temporary investments, which are included in cash and cash equivalents, at June 30, 1998 and 1997 include the following:

| | 1998 | 1997 |
|---|-------------------|----------------|
| Corporate bond | \$ — | 90,000 |
| Money market account, earning interest at 4.57% and 4.27% at June 30, 1998 and 1997, respectively | 960,993 | 245,476 |
| | <u>\$ 960,993</u> | <u>335,476</u> |

Investments at June 30, 1998 and 1997 consist of the following:

| | 1998 | 1997 |
|-----------------|---------------------|---------------------|
| Bonds: | | |
| U.S. Government | \$ 688,025 | 244,192 |
| Corporate | 400,000 | 934,000 |
| Mutual funds: | | |
| Common stocks | 948,819 | 569,824 |
| Corporate bonds | 665,882 | 522,870 |
| | <u>\$ 2,702,726</u> | <u>\$ 2,270,886</u> |

(4) Land, Buildings and Equipment

Land, buildings and equipment are summarized at June 30, 1998 and 1997 as follows:

| | 1998 | 1997 |
|-------------------------------|---------------------|---------------------|
| Land | \$ 673,585 | 673,585 |
| Land improvements | 424,020 | 424,020 |
| Buildings and improvements | 2,233,168 | 2,233,168 |
| Motor vehicles | 325,645 | 325,645 |
| Equipment | 1,216,718 | 1,172,813 |
| Furniture and furnishings | 13,665 | 13,665 |
| Construction-in-progress | 64,654 | 19,574 |
| | 4,951,455 | 4,862,470 |
| Less accumulated depreciation | <u>(2,323,020)</u> | <u>(2,100,588)</u> |
| | <u>\$ 2,628,435</u> | <u>\$ 2,761,882</u> |

(5) **Net Assets**

The Organization has designated certain net assets classified as unrestricted for specific purposes or uses. As a result, substantially all of the net assets classified on the consolidated statements of financial position as unrestricted net assets at June 30, 1998 and 1997 have been invested in property and equipment or are designated for specific uses.

Unrestricted net assets consist of the following at June 30, 1998 and 1997:

| | <u>1998</u> | <u>1997</u> |
|--|---------------------|------------------|
| Net investment in property and equipment | \$ 2,628,435 | 2,761,882 |
| Funds designated by governing board: | | |
| Estimated severance pay | 211,181 | 213,155 |
| Asset renewal | 520,655 | 477,510 |
| Organizational support | 520,930 | 231,295 |
| Unrestricted and undesignated | <u>441,320</u> | <u>374,839</u> |
| | <u>\$ 4,322,521</u> | <u>4,058,681</u> |

Temporarily restricted net assets consist of the following at June 30, 1998 and 1997:

| | <u>1998</u> | <u>1997</u> |
|---|---------------------|------------------|
| Term endowment funds to be used for fellowships | \$ 316,580 | 113,211 |
| Contributions for station improvements and land acquisition | 241,329 | 104,457 |
| Educational programs | <u>1,577,730</u> | <u>1,323,022</u> |
| | <u>\$ 2,135,639</u> | <u>1,540,690</u> |

Net assets were released from donor restrictions by incurring expenses satisfying the restricted purposes or by the passage of time. Purpose restrictions were accomplished by incurring \$81,921 in expenses for fellowships, station improvements, land acquisition and educational programs.

Permanently restricted net assets at June 30, 1998 and 1997 consist of perpetual endowment funds. The income from these investments in perpetuity is spendable for instruction, scholarships and operations.

(6) **Functional Allocation of Expenses**

The costs of providing the various programs and other activities of the Organization have been summarized on a functional basis in the statement of activities. Accordingly, certain costs have been allocated among the programs and supporting services benefited.

(7) **Relation with Duke University and Grantors**

The Organization has an agreement with Duke University whereby the University acts as fiscal agent for the Organization. As a result of this agreement, federal and state grants and contracts are made to the University on the Organization's behalf. Private foundation grants and contracts are awarded to the Organization and managed through Duke University. Total amounts reported as revenues and expenses under grants and contracts to the University amounted to \$1,637,600 in fiscal year 1998 and \$2,043,600 in fiscal year 1997. Accounts receivable at June 30, 1998 and 1997 include \$10,394 and \$26,597, respectively, due from Duke University for amounts expended for grant purposes but not yet reimbursed.

During 1998 and 1997, the University provided administrative and other services to the Organization for which the University received a net indirect overhead allocation from the Organization which amounted to \$49,482 and \$67,850, respectively.

At June 30, 1998, the Organization had the following unexpired grants and contracts:

| <u>Grantor</u> | <u>Purpose</u> | <u>Total award</u> | <u>Total unexpended</u> | <u>Expiration</u> |
|--|--|--------------------|-------------------------|-------------------|
| <i>U.S. Government Agencies</i> | | | | |
| NSF | Research data management & connectivity for three neotropical field stations | \$ 170,000 | 53,351 | January 1999 |
| NSF | Arthropod diversity at La Selva-Phase III | 350,004 | 228,323 | July 2000 |

| <u>Grantor</u> | <u>Purpose</u> | <u>Total award</u> | <u>Total unexpended</u> | <u>Expiration</u> |
|---------------------------------------|--|---------------------|-------------------------|--------------------|
| NSF | Administration, maintenance and development of the La Selva Station | 1,100,000 | 275,205 | January 1999 |
| U.S. Fish and Wildlife Service | International workshop in wetland management | 4,200 | 490 | January 1999 |
| <i>Non-Government Agencies</i> | | | | |
| University of Connecticut | Woody species regeneration at La Selva | 143,400 | 100,353 | June 2000 |
| General Service Foundation | Latin American education program | 50,000 | 22,460 | December 1998 |
| Glaxo Holdings- Puerto-Rico | Support for Puerto Rican tropical biology students | 33,333 | 16,846 | No expiration date |
| A.W. Mellon Foundation | Training and research in tropical ecology (1993-1995) | 850,000 | 16,561 | No expiration date |
| A.W. Mellon Foundation | Training and research in tropical ecology (1996-1998) | 850,000 | 146,297 | December 1998 |
| A.W. Mellon Foundation | Clark's ecological research | 200,000 | 168,940 | June 2000 |
| A.W. Mellon Foundation | La Selva-STRI collaboration | 175,000 | 58,064 | No expiration date |
| A.W. Mellon Foundation | Planning for an undergraduate program | 250,000 | 36,994 | No expiration date |
| A.W. Mellon Foundation | Training and research in tropical ecology (1999-2001) | 945,000 | 945,000 | December 2001 |
| George B. Storer | Bird monitoring station at La Selva Station | 10,000 | 1,755 | No expiration date |
| Stanley Smith Horticultural Trust | Curatorial fellowships, internships and documentation of plant records | 40,000 | 4,452 | No expiration date |
| Stanley Smith Horticultural Trust | Curatorial fellowships, internships and documentation of plant records | 20,000 | 18,000 | No expiration date |
| Stanley Smith Horticultural Trust | Interpretive bilingual literative and signage at the Wilson Garden | 13,000 | 10,433 | December 1998 |
| Tinker Foundation | Corporate decision-making in Central America | 79,000 | 31,163 | December 1998 |
| International Fund for Animal Welfare | Support for U.S. Decision-Makers Course | 40,000 | 3,275 | No expiration date |
| Raytheon Systems Development Company | U.S. Army Lidar terrain mapping project at La Selva Station | <u>52,593</u> | <u>10,766</u> | No expiration date |
| | | \$ <u>5,400,530</u> | <u>2,148,728</u> | |

The Organization has received written communications for the following new grants and additional funding for existing grants subsequent to June 30, 1998:

| <u>Grantor</u> | <u>Purpose</u> | <u>Commitment amount</u> | <u>Expiration</u> |
|----------------------------|---|--------------------------|-------------------|
| NSF | Administration, maintenance and development of La Selva Station | \$ 1,575,000 | January 2002 |
| NSF | Database management and connectivity for OTS field stations | 141,340 | May 1999 |
| Association Liaison Office | Tropical ecology training in Peruvian Amazon | 100,000 | July 2001 |

| <u>Grantor</u> | <u>Purpose</u> | <u>Commitment amount</u> | <u>Expiration</u> |
|---|---|------------------------------|-------------------|
| International Fund for Animal Welfare | Support for follow-up program to U.S. Decision-Makers Course | <u>10,000</u> | June 1999 |
| | | \$ <u>1,826,340</u> | |

(8) Contingencies

Under Costa Rican law, an employee can receive as severance pay the equivalent of one month's salary for every year of employment, up to a maximum of eight years, if it is determined by the courts that his employment was terminated without just cause, plus one additional month's salary. If all employees of the Organization were terminated at June 30, 1998 and 1997 without just cause, the liability for severance pay would be \$211,181 and \$213,155, respectively. The Organization has designated cash of the identical amounts to make payments under the law, if necessary. The Board of Directors has designated a portion of the unrestricted net assets for the estimated contingent severance pay liability. Severance payments would be made from the designated net assets, and an amount equal to each year's increase or decrease in estimated liability will be transferred to or from the designated net assets.

The Organization is involved in claims and legal actions arising in the ordinary course of business. In the opinion of management, the ultimate disposition of these matters will not have a material adverse effect on the Organization's financial position, results of operations or liquidity.

(9) Benefit Plans

Duke University employees assigned to the Organization participate in either the University's contributory defined contribution pension plan or the University's noncontributory defined benefit pension plan. Net pension expense, which is funded annually, amounted to \$49,300 and \$44,400 for the years ended June 30, 1998 and 1997, respectively.

These employees are also participants in the University's unfunded defined benefit postretirement medical plan. The net periodic postretirement benefit cost amounted to \$10,805 and \$18,682 for the years ended June 30, 1998 and 1997, respectively, and the associated liability was \$112,145 and \$101,340 as of June 30, 1998 and 1997, respectively.

It is not possible to present separately the actuarial present value of benefit obligations or the net assets available for benefits under either the contributory defined contribution or the noncontributory defined benefit pension plans because no determination has been made of the allocation of such amounts between Duke University and the Organization. Furthermore, it is not possible to present separately the actuarially determined accumulated benefit obligation for the Organization for the postretirement benefit plan because no determination has been made of the allocation of such amounts between Duke University and the Organization.