A Newsletter of the Organization for Tropical Studies VOLUME 2010, ISSUE THREE

View From The Canopy

In This Issue

PASI Workshop Introduces Participants to Embedded Sensor Networks

With funding from the National Science Foundation International Programs, OTS held a Pan-American Advanced Studies Institute (PASI) to introduce 31 tropical ecologists from the Americas to recent developments in embedded sensor networks. The two-week training took place August 16-31, 2010 at Las Selva Biological Station. In collaboration with the Center for Embedded Networked Sensing (CENS) of the University of California at Los Angeles, and also with support from National Science Foundation, La Selva has established a Rainforest Ecological Research Portal supported by a cluster of towers outfitted with the necessary cyber-infrastructure for demonstrations and field projects. Construction and outfitting of these towers just concluded, and they were inaugurated the first day of this PASI.

The elaborate configuration of walk-up towers, a canopy bridge, and several radio towers in the old growth forest at La Selva Biological Station is the product of several years of planning, two years (10,000 person hours) of construction, and the financial support of the NSF cross-cutting program, Major Research Instrumentation (MRI).

The tower system is supplied with environmental sensors (temperature, light, and humidity), cameras, and mobile devices that can move through the canopy via remote control. Individual research projects utilize specialized equipment such as sound recording devices and scintillometers. Power is supplied by electrical and fiber optic cables that run underground from the laboratory out to the array. Data from the sensors may be transmitted by fiber optic cables or wirelessly through internet connections among the towers and other points at La Selva.

Embedded Sensor Networks allow automated recording of variables across large spatial scales, and open possibilities for countless applications in ecological research. The frontiers of ecology expand as biologists think of new applications and engineers develop the necessary tools to increase our understanding of how ecological systems work.

The PASI (Panamerican Advanced Studies Institute) workshop on "Research Use of Sensor Networks" was custom-designed to introduce 31 young researchers from North America and Latin America to the La Selva MRI system and the amazing opportunities for transformative, integrative research using advanced sensor systems. The course was coordinated by Dr. Phil Rundel (UCLA), Dr. Carolina Murcia (OTS), and Dr. Alex Gilman (UCLA), and supported by more than a dozen leading researchers in biology and engineering fields. The group explored potential new applications of embedded sensor networks in tropical ecology and discussed how the field can be reshaped as ecologists generate hypotheses to uncover new aspects of tropical forests. The topics of this course included vertebrate communication, both acoustic and seismic, automated animal monitoring through recordings and computer-based species identification, the ecology of animal movement, freshwater hydrology, soil

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Embedded Sensor Networks

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Christine Scoffoni, Faith Inman-Narahari and Jessica Pasquet-Kok

organism and dynamics, remote sensing and its coupling with on-the-ground sensors, digital image processing, plant hydraulics, carbon cycling and large scale sensor networks.

Out of 80 workshop applications, 31 were selected from the United States, Costa Rica, Colombia, Argentina, Chile, Bolivia, Brazil, Mexico and Guatemala. They represented twelve universities from the U.S., seven from the rest of the Americas and two from Europe. For two weeks, students attended lectures that showcased how this cutting edge technology is being used to address new research questions across broad fields, uniting biologists with computer programmers and engineers.

Through practical exercises, participants had hands-on learning with prototype technologies and bioinformatics tools used and/or developed by the faculty. In the forest they learned to radio track GPS sensors, climbed the MRI towers at La Selva which are strung with sensors to measure environmental conditions, and later in the classroom learned how to program and manipulate these web controlled sensor networks. Additionally the participants learned how faculty use sensors to collect carbon eddy flux profiles, conduct bioacoustic monitoring, collect and analyze remote sensing data, determine water use efficiency in tropical plants, analyze stream nutrient loads and study new root growth and soil community interactions at 100x magnification. During the course the participants designed new research projects, conducted practical exercises in which they utilized online databases of animal movement and communication data, learned to program and analyze data in Python and R, discussed pros and cons of sensor networks and examined the application of high technology sensors across scales ranging from several centimeters for soil investigations to continental scale with NEON across the US.

For additional information on the embedded sensors or to conduct research at La Selva, please contact Dr. Deedra McClearn, La Selva Station Director, at <deedra.mcclearn@ots.ac.cr>

Comments from participants:

Almost everything on the course was completely new for me. Now I have the knowledge and contacts that will be important to start new projects and answer questions that I didn't find possible to answer in the past.

The highly diverse and professional group of students made this experience even more enriching in and outside the classroom.

Meeting the people and learning about a diversity of research was extremely inspiring. It was also wonderful to actually see, touch and use some of the sensing tools from satellite remote sensing to thermocouples. I have been aware of much of this technology for some time, but had never used it. Through this experience I think I will have the confidence to employ these new methods and the knowledge to suggest a wider range of alternative devices to my local research community.

I have a broader understanding of how sensors can be used to address diverse questions in ecology, and more importantly, knowledge of where to find the resources to learn more. It has also been inspiring to work closely with so many excellent ecologists (both instructors and students).

Online Holiday Auction Opens November 22

Starting on **November 22, 2010**, OTS will be auctioning off a number of fun and unique items to raise money for our core programs and operations. The auction will run from November 22, 2010 to December 3, 2010 at **http://www.biddingforgood.com/otsauction**.

The auction proceeds will support students and researchers at our stations. Auction items range from eco-friendly vacation getaways to donated items guaranteed to delight the science community. So, tell your friends, family and community. Let the bidding begin!

- Autographed Copy of *The Odyssey of a Woman Field Scientist*
- Trip to Iracambi Atlantic Rainforest Research Center
- VIP trips to OTS Stations

Whether you purchase unique holiday gifts or a special item for yourself, your purchases will directly support education and research of tropical biology and conservation at OTS stations.

www.biddingforgood.com/otsauction ■ November 22 – December 3, 2010

Increasing Infrastructure Enhances Research Partnerships

Increasing OTS' infrastructure is fundamental to catalyzing research. This can be accomplished by acquiring more land and equipment or by developing institutional partnerships that will allow us share resources with other institutions in Costa Rica. This synergy with other institutions is not only important to increase our potential to do research but also to increase our impact in Costa Rica and Central America.

Dr. Carolina Murcia, OTS Science Director, in collaboration with IT Coordinator Oscar Madrigal and Director General Liana Babbar, have negotiated two agreements to meet this goal. The first is with the Instituto Meteorológico Nacional (IMN). This MOU sets the stage for collaborative research between scientists of our consortium and colleagues at IMN. Through collaborative research, researchers can have access to the extensive meteorological dataset that has been otherwise unavailable. The MOU will also secure the advice of IMN on issues regarding meteorological equipment purchase, updating and maintenance of our met stations, and the necessary maintenance to the meteorological data collected by OTS.

The second agreement involves OTS in the establishment of a National Biodiversity Dataset (CRBIO, Sistema Costaricense de Información sobre Biodiversidad). This initiative, led by the Comisión Nacional para la Gestión de la Biodiversidad (CONAGEBIO), Instituto Nacional de Biodiversidad (INBio), Museo Nacional de Costa Rica, and OTS, seeks to provide an integrated and free access to information on Costa Rican Biodiversity, in order to support decision-making processes and further research. CRBio was launched in November 2009, and is available at www.crbio.cr.

In the last year, OTS also became a representative to the Board of Directors of Red Costarricense de Reservas Naturales (Costa Rican Natural Reserve Network). This association assembles around 230 owners of properties dedicated to the conservation of natural resources. Members include individuals, hotels, lodges, travel agencies, NGOs, and educational institutions. OTS has been a member since 1995; and, this year was elected to the Board of Directors.

The IT Department continues to work with the stations as well as programmatic and administrative departments to improve their access, standardization, and storage of information. For example, in an effort to standardize the meteorological data from the stations, the IT staff installed an application that allows real-time multivariate analysis of the data. This allows GIS data from the three stations to be uploaded to Google Maps. Additionally, a database has been fully established for the digital herbaria at all three stations and the Wilson Botanical Garden. In conjunction with the Education Department, the IT Department is developing a server to make conceptual maps available on a permanent basis for educational activities. By using a tool that conceptualizes knowledge (CMAP), it is possible to build knowledge bases that will be easier for students and teachers to understand. IT and the Education Department, working with OTS' Costa Rica Institutions Committee (CRIC), are also beginning to explore online educational opportunities. Library support, in particular, BINABITROP, remains a critical activity of the IT Department. BINABITROP now has 34,806 publication entries, 10,892 of which have a free-access pdf file. The BINABITROP Project has been on hold during our library transition, but will be reactivated in October, with 2,000 new entries to the database. Meanwhile, the IT Department has taken a lead role in securing funds from IABIN to create a searchable database of old OTS course book projects. We estimate that the first 2,000 (of a total of 12,732) records will be created with this funding.

For more information about OTS online data sources, please visit www.ots.duke.edu.

Awareness makes you a stronger advocate for the tropics! Sign up for OTS' E-Canopy, a monthly English language electronic newsletter for friends of OTS, on our website. www.ots.duke.edu.

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OTS Graduate Courses in Costa Rica 2011-2012

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Nothing can replace the hands-on experience of a field-based course in the tropics! This is what OTS offers through its broad range of Tropical Biology and Ecology graduate level courses in Spanish or English in Costa Rica. OTS graduate courses are open to students enrolled in graduate degree programs, with preference given to students at OTS member institutions.

For more information, please visit us online at **www.ots.duke.edu.**

Traditional Courses (5-8 week courses) 2011 and 2012

Ecología Tropical y Conservación (in Spanish)
January 14 – February 23, 2011
*Application Deadline:
June 15, 2010

Tropical Biology: An Ecological Approach
June 9 – July 28, 2011
*Application Deadline:
March 4, 2011

Ecología Tropical y Conservación (in Spanish)
January 12 – February 21, 2012
*Application Deadline:
June 15, 2011

Tropical Biology: An Ecological Approach
Mid January – mid March, 2012
*Application Deadline:
October 10, 2011

Tropical Plant Systematics
June 14 – July 17, 2012
*Application Deadline:
March 1, 2012

Specialty Courses (2 week courses) 2011

Ecology and Conservation of Neotropical Rivers
May 7 – 22, 2011
*Application Deadline:
February 1, 2011

Conservation and Restoration Genetics
May 20 – June 5, 2011
*Application Deadline:
February 10, 2011

Inquiry in Rainforests: an in-service program for teachers
July 16 – 29, 2011
*Application Deadline:
March 15, 2011

*Notification date is within 30-45 days after the application deadline
All courses will maintain open enrollment past the original deadline date until filled

About OTS

OTS is a non-profit consortium of over 60 research institutions, colleges and universities from the United States, Latin America, Africa and Australia. OTS' mission is to promote education, research, and the responsible use of natural resources in the tropics.

The View from the Canopy is produced by the OTS Development Office. To submit comments or news items, please contact Cathleen Lemoine at 919-684-6969 or via e-mail at cathleen.lemoine@duke.edu.

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