

## TEOS 05 La Selva Rainforest Ecological Portal

### TEOS 05.1 Overview

In 2007 CENS faculty collaborated with the Organization for Tropical Studies on a successful NSF proposal for a major research instrumentation (MRI) deployment of instrumented canopy towers and walkways to be constructed in the rainforest of La Selva Biological Station in Costa Rica. This site is the premier location in the world for tropical rainforest research. The broad goal of this project to establish what was described as a Rainforest Ecological Portal that could help to transform environmental research, education, and monitoring at La Selva by the development of these instrumented tower and associated sensor arrays.

### TEOS 05.2 Approach

Multiple sensors will be mounted in a series of nodes at several canopy positions to monitor microclimate conditions above, within, and below the rainforest canopy. Additionally, multiple research-grade pan-tilt-zoom cameras will be installed, enabling an unequaled 3-D view into environmental phenomena. Both short-term instructional uses, as well as extended research programs, will be enabled with a diversity of instruments deployed on a landscape scale. The arrays forming the Ecological Portal will generate data streams informing a myriad of questions in tropical ecology and physiology, including plant and animal diversity patterns, structure-function relationships, and the phenology of growth and reproductive processes of the La Selva biota.



Figure 1. Construction of one of the aluminum walk-up towers at La Selva.

### TEOS 05.3 System Description

The Rainforest Ecological Portal consists of three walk-up aluminum canopy towers 32 to 46 m in height. Two of the towers are connected by a 25 m aluminum canopy walkway which crosses through the upper canopy foliage about 25 m above the ground. When completed, the deployment will include eight nodes of microclimate sensors, specialized instrumentation, and a series of pan-tilt-zoom cameras all linked by fiber optic cables to servers in the laboratory clearing about half a kilometer away from the towers.

### TEOS 05.4 Accomplishments

Over the past year work crews have completed the building phases of the project which has required a managed crews of 6 to 8 workers who have completed a total of approximately 10,000 person hours to accomplish all of the necessary construction phases of the project. The accomplishments over this period have been the following:

- Phase 1. Constructed three walk-up towers and the connecting 25 m canopy bridge.
- Phase 2. Guyed back approximately 30 trees at canopy level with cable to protect towers and bridge.
- Phase 4. Dug 600 m of trench to run power and fiber optic cable from lab clearing to towers.
- Phase 5. Constructed power center at base of Tower 1 to house transformers and other electrical and fiber optic connections
- Phase 6. Built access sidewalks to the base of the three walk-up towers.
- Phase 7. Laid fiber optic and 600 volt electrical cables from the lab clearing to the towers.

### TEOS 0.5 Future Directions

This coming spring staff from CENS and ISI (University of Southern California) will be deploying the instrumented sensor nodes, PTZ cameras, and linking these to the new servers in the laboratory clearing at La Selva.

With funding from the National Science Foundation, CENS is partnering with the Organization for Tropical Studies (OTS) to conduct a Pan-American Advanced Studies Institute (PASI) workshop at the La Selva Biological Station in Costa Rica to introduce tropical ecologists from the Americas to recent developments in sensor technologies and



Figure 2. The canopy walkway extends for 25 m, connecting two of the walk-up towers, and is positioned 25 m above ground at the height of the crowns of the emergent trees.

technologies, and describe the range of sensors and instrumentation now being used in temperate forest research and available for tropical rainforest research programs. Particular emphasis will be given to developing research hypotheses and how instrumentation can be used to address these hypotheses. The workshop will then move on to providing an overview of the nature and use of sensor networks for ecological research, including their design, deployment, maintenance and manner in which data is collected and accessed. Finally, there will be a series of lectures covering specific applications of instrumentation and sensor networks to studies of forest carbon flux, plant hydraulics, soil ecosystem science, animal communication, and aquatic systems.

sensor networks. Phi Rundel and Eric Graham from CENS are co-coordinators for the course with Dr. Carolina Murcia from OTS.

This two week training course will be held August 16-31, 2010, and allow 12 scientists to lead a group of 30 tropical ecologists in exploring new technologies that are available to aid in developing and expanding research programs in tropical ecological research. Two other CENS faculty, Dr. Tom Harmon and Dr. Mike Allen will also be participating as instructors in the PASI workshop. The program is aimed at senior Ph.D. students, post-doctoral fellows, and young faculty from the United States and the Americas.

The cluster of instrumented canopy towers and walkways described above will be used as core facilities during the PASI workshop. Lectures and field projects that form the PASI program will be divided into modules that first review how the field of ecology has advanced through the development and application of new