Proposal for a Supplement to the LTER Network Office

To Enhance Information Flow among LTER and SLTER sites

Overview

The National Science Foundation recently requested proposals for supplements to existing Long Term Ecological Research (LTER) programs for the purpose of establishing T1 connectivity to field stations that serve the LTER programs. As part of these supplement requests, LTER sites were invited to establish similar levels of connectivity at associated Schoolyard LTER (SLTER) sites. Twelve sites requested funds to improve connectivity to 20 secondary schools affiliated with LTER sites. The present proposal requests funds for a centralized effort to exploit this improved Internet accessibility to enhance dissemination of information between LTER and SUER sites.

Funds are requested to develop a Schoolyard LTER Web site with information about all SUER sites and links to relevant LTER pages. This Web site will provide a centralized point of access for students to learn about scientific activity at LTER sites and research projects at other SLTER sites. The following activities will provide visually attractive and educational material for the development of the Web site.

• Acquire and subset satellite imagery covering each of the SUER sites and provide these images in an easily accessible format. A tutorial about the acquisition and use of satellite imagery will be illustrated by examples such as the calculation and interpretation of Normalized-Difference Vegetation Indices (NDVI).

• Edit existing video imagery of scientists demonstrating LTER projects and provide access to these videos on the SUER home page. In addition, a limited amount of new footage of LTER and SUER sites will be obtained for the Web site.

• Obtain equipment necessary for real time feeds of LTER field experiments and measurements. The "LTERcam" will provide opportunities for SLTER and other students to observe scientists conducting major experiments in the field in real time via the Web site (e.g., the Harvard Forest hurricane simulation, Konza Prairie controlled burns). Such technology can also be adapted for use in other kinds of outreach activities such as the "Science on the Mall" program. An SLTER Web site

A well-developed site on the World Wide Web is crucial to the success of the SLTER program. Through the Web site, students will access each other's work as well as work at other SLTER sites. The Web site will allow easy access to databases, both for data input and data sharing. It will foster access to LTER scientists and LTER Sites. The Web site will incorporate a mechanism for displaying clips of LTER scientists working in real-time by way of the site's remote Web video cameras. It will be fully interactive, allowing students to input and manipulate their own Web sites and data. It will allow access to satellite imagery and make the imagery accessible to all SLTERs. In essence, it will serve all the same functions as the main LTER Web site. Like the main LTER Web site, the Network Office is the best place to develop and house the SUER Web site.

Development of an appropriate Web site will require the equivalent of one fulltime programmer working together with a half-time content designer through completion of the project (which will require approximately 12 months, including testing and training). Content and design will be generated in part through consultation with the LTER Education Committee and the individual SLTER schools. LTER Site Information Managers will train SLTER students to use the Web site. Three components to be

developed under this proposal will contribute to the content of the Web site: an archive of SLTER satellite imagery, a video archive of LTER/SLTER activities, and capability for real-time feeds from LTER sites.

Archive of Satellite Imagery

The LTER Network Office will provide satellite imagery of LTER and SUER site locations in a format usable by school projects. Imagery currently available from the LTER archive ("http://www.Itemet.edu/research/technology/satellite/") as well as more recent imagery to be ordered from the NASA/Eros Data Center Archive will be used for this purpose. The license agreement for global change research between LTER and

NASA will permit the LTER Network Office to order recent data for this use from NASA Archive rather than the more costly commercial data from Space Imaging Inc. The bulk of the imagery ordering and processing will be performed by a remote sensing/GIS graduate research assistant with general oversight by LTER Network Office staff.

Landsat Thematic Mapper data will be read from the original image source (300+mb), subset into usable sizes, and written as standard TIFF format files. Full resolution imagery as well as larger area images will be generated for use. The imagery will be modified from its original source, into value added products such as atmospheric corrected imagery, NDVI vegetation products and composite color imagery to satisfy the original EOSAT license restrictions that remains with the data. The modifications will permit all data for this project to be accessed in the public domain. The output files will be placed on the Internet for viewing and downloading by teachers and students in the browse image format of the LTER archive - i.e. "http://www.lternet.edu/temp/images.html". This will be achieved by adding specific Web areas for each LTER/SLTER site to the general SLTER Web site. Each site will contain these data to provide examples of remote sensing imagery for teachers and students to incorporate into educational projects.

Compiling a Video Library of LTER and SLTER Activities

In collaboration with John Dennis Productions, we will integrate available and newly-acquired video sequences from LTER and SLTER sites into the Web site. Video from LTER sites will demonstrate ongoing scientific activities. Sequences from Sevilleta, Kellogg, Coweeta, North Temperate Lakes, Plum Island Sound, and Luquillo LTER sites and the Baltimore SLTER site are already available. Under this proposal, additional sequences will be acquired from two more SLTER sites. John Dennis Productions will create clips for the Web site in coordination with the Web designer stationed at the LTER Network Office. In addition, they will prepare a two-minute scripted piece describing activities at SLTER sites as a part of the Web site and for use in other venues.

Real-time feeds from LTER sites

Live video from LTER sites will greatly enhance the conveyance of information to the SLTER projects by making it possible to tune-in to site science, experimental manipulations and other events. Real-time access to scientists in the field, taking advantage of the latest in web video technology, live chat, and collaboration software will give students a first hand look at LTER. It will be very exciting to transmit LIVE feed of events at LTER sites, like an approaching hurricane at Luquillo, a great burn at Konza, or
the Harvard Forest hurricane simulation experiment. The centerpiece of this effort, "LTERcam", will use 2.4 Ghz wireless transmitters to send live, high-resolution color images to a server connected to the Internet via the new LTER field site T-1 connectivity. Sites participating in the schoolyard LTER connectivity program will be able to install the "LTERcams" at their field stations to capture color video images of their site and their science in action. These "LTERcams" can be physically mounted to a pole, tower, building, etc. and/or moved around in a semi-fixed mode (e.g. heavy-duty tripod) to take advantage of seasonal or other special events. The "LTERcams" will provide 7-day X 24hour access to what's happening at LTER sites. They will be left running at LTER/SLTER sites when not used for event recording to permit data capture of things like a day's time-lapse weather or the progress of particular experiments or manipulations.

The technology we have initially chosen for this request is the FoNet ActionCam at an approximate cost of $1200 each. These units feature remote control (pan/tilt/zoom) cameras and camera-to-server wireless transmission and all-weather housings. The video feed from the cameras along with limited control capabilities will be made available through a Web interface that will be a key part of the SUER Web site. Computers at the site will control the feed of information back to the SLTER web interface. This technology is not suitable for "evening news" style audio/video products. However, existing LTER Network Office equipment can be used to capture other live, scripted discussions and demonstrations of ecology in the field. We will cover scheduled or special events by providing access to the equipment or providing NET staff to capture this higher-quality video. Video of these special events will also be made available on the

SUER Web site after being captured and compressed to formats that can be made available via the Web.

Conclusion

The availability of high-speed Internet access at SLTER sites is an important step in integrating research and education at the secondary school level. However, in order to take full advantage of enhanced connectivity, interesting and relevant materials must be made accessible to the students at SLTER sites. This proposal outlines several steps toward developing a centralized access point at the Network Office that will provide students with exciting images, timely information, and centralized data storage and access, to enhance their own ecological research. Access to video and satellite imagery via the SUER Web site will provide immediate opportunities for students to take advantage of improvements in connectivity.

The presentation of ecological information, satellite images, and video on the SUER Web site provides an excellent opportunity for the dissemination of knowledge about the LTER and SLTER programs to the public. We anticipate that the resources we develop will be used widely by individuals and classes outside of the LTER/SLTER community. By broadly advertising real-time broadcasts of experiments, we anticipate attracting a wide primary/secondary school audience. In addition, the existence of such a Web site will provide excellent opportunities for a variety of outreach programs to reach all segments of the public.