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### **Spatial Data and Analysis Committee Documents**

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# Summary and Recommendations to the LTER Executive Committee

## LTER Ad-hoc Remote Sensing Committee Conference Call 11 November 2008 Final Draft Report 5 December 2008

**Attending:** Andrew Fountain (chair), MCM; Morgan Grove, BES; Mark Williams, NWT; Dave Verbyla, BNZ; John Vande Castle, LNO.

The charge from the LTER Executive Committee as communicated by Phil Robertson was to create an ad hoc Remote Sensing Advisory Committee to advise the EB on current site needs for the LNO remote sensing archive and the best path forward. The committee is proposed to be chaired by Andrew Fountain (MCM) and to include Mark Williams (NWT), Morgan Grove (BES), Dave Verbyla (BNZ), and John Vandecastle (LNO, ex officio).

The ad-hoc committee discussed both the Remote Sensing (RS) and GIS data archive and Technical Coordination at the LTER Network Office (LNO).

The remote sensing archive was established following recommendations of past LTER technology committee reports for a consistent remote sensing data archive for use by LTER sites. Following an initial acquisition of Landsat and Spot data, other data have been added primarily to preserve data used in NASA collaborations, in cross-site research, and to make these data available for LTER site use.

The original purpose of the LNO GIS/RS coordination was to,

‘...to assist the research of the sites by facilitating technical aspects of GIS/RS data and tools. The aim is to cover aspects of GIS/RS that is useful to the LTER Network as a common group, more than aiding any individual site research program - although this type of assistance is given when needed.’

(first paragraph, LTER Network Office Remote Sensing, GIS and Technological Coordination Background, by John Vande Castle; [www.lternet.edu/technology/background/background.html](http://www.lternet.edu/technology/background/background.html) )

In recent times, there has been a lull in effective communication between the LNO and GIS/RS LTER community such that the direction and needs between the two have not been well coordinated. Therefore the call for this ad-hoc committee is timely to rejuvenate communication towards enhancing the GIS/RS LTER capabilities across all sites. Furthermore, with the inclusion of social science at all sites motivates a re-examination of our GIS/RS needs and capabilities.

A poll of the committee members from the four sites indicated that none of them have used the LTER archive of satellite images. All went directly to the source of the imagery (e.g. NASA, USGS) and purchased/downloaded what they needed. What is available on the LNO website is minimal and relatively out of date. The committee felt that to use the LNO as an archive for all remote sensing products was impractical because of the sheer volume of data available (e.g. Landsat, SPOT, Ikonos, Modis, AVHRR) and data needed/utilized. The storage size of some of the products precludes feasible transfer through the web or other file transfer protocols. The initial GIS/RS efforts of LNO were of great use when the LTER Network was starting in the 1990s but now in-house expertise and needs have exceeded that provided by the LNO. Given the extensive use of both remote sensing products and GIS

data by most or all sites there is no reason to expect the LNO to provide sufficient data or the services needed. However, the committee did discuss the usefulness of the LNO obtaining a record of Landsat-5 data since these data are available from 1985 to the present. It would be valuable to have the LNO review and obtain cloud-free images for all LTER sites for use in cross-site research and for the individual sites. Obtaining these data would be a valuable service to the LTER Network. Data from Landsat-7 was also discussed, but because of data problems (scan-line correction error problem on Landsat-7) only the center of Landsat-7 data are of sufficient quality for most use. The committee felt that use of Landsat-7 data could be better evaluated by the individual sites.

The committee felt that the LNO mission should be altered to better serve the needs of the community of sites. Generally speaking LNO can be a primarily a clearinghouse of information on what remote sensing products are available by mining historic archives and maintaining currency with new and emerging data sets and technologies. Specific tasks are identified as follows.

### Remote Sensing (RS)

1. Develop a database of sources for historic and current aerial imagery for all sites and provide this on the LNO website.

A number of agencies have flown aerial photography for decades and a record of information where these images can be acquired would be of great value in studies of historic landscape changes at each of the sites. Current aerial photographic missions are flown by the National Agricultural Imagery Program and the US Forest Service (Dept Agriculture). Many states also fly their own photographic missions for a number of different purposes, as well.

Included in this database could be some journal articles of general interest to ecologists and provide a gateway for students or professionals. These would be provided by the sites or individuals in addition to LNO. For example,

Lefsky et al. 2002. LIDAR Remote Sensing for Ecosystem Studies. *Bioscience*. 52:19-30.

Cohen et al. 2004. *Landsat's* role in ecological applications of remote sensing. *BioScience*, 54:535-546.

2. LNO should take the lead on developing cooperative agreements to acquire LIDAR (NCALM) for all sites and arrange for Hyperspectral (NASA airplane) to acquire imagery for all sites on repeated interval and/or for special disturbance events. LNO should also maintain coordination with planned space-based LIDAR and Hyperspectral data missions of NASA, such as DESDynI and HYSPIRI.

NCALM is an NSF-supported group that acquires LIDAR for scientific investigations. A high quality DEM provided by LIDAR would be useful to all sites. It would provide vegetation (and built environment) heights, help to estimate total carbon in vegetation cover, and provide information on changes over time. After disturbance events it would aid in estimating areas affected, vegetation loss and eventual recovery.

NASA also supports scientific projects by flying an aircraft with hyperspectral imaging instruments. Hyperspectral imaging can measure species, vigor, and productivity.

Given the magnitude of the request, this effort should be organized by the LNO in cooperation and leadership from the sites. These data could be distributed to the sites and/or housed at the LNO similar to the AVIRIS hyperspectral data already archived from research at the SEV, JRN, AND and HFR sites.

3. Develop an archive of the best Landsat-5 imagery for each site.

Although all agreed that the LNO should not be an archive, the Landsat-4,5,7 imagery is currently freely available the LNO should download 'good' (cloud-free) images for each site to maintain a small archive for inter-site use ideally with at least one scene from the 1980s, 1990s, and 2000 decades. More extensive use of the full Landsat archives, including use of Landsat-7 data will be up to each site.

4. Each site should, at minimum, identify their RS holdings, make RS products available via the web where possible. Inclusion of sufficient metadata is important.

The committee agreed that the extensive RS holdings for each site should be at least identified by each site on their web page. In those cases where the data files are not too large they should be available for download with metadata.

## GIS

1. The LNO should facilitate GIS/GPS capabilities and data exchange among sites.

LTER sites differ greatly in their GIS capabilities, particularly with respect to the social science analysis. Knowledge and technology transfer from the highly experienced sites to other sites should be facilitated by LNO. This requires LNO be acutely aware of the GIS/RS and GPS capabilities of each site and develop activities to facilitate knowledge transfer. In addition the expert sites need to take the initiative to share their expertise. A close working relationship between sites and LNO is required.

## General

1. The LNO provides an important service by facilitating communications on spatial analysis between sites, between site investigators and key individuals in various agencies, and representing LTER interests with these agencies.

The committee feels that several sites have greatly advanced their expertise in spatial analysis yet this could be more effectively shared among sites. The LNO could take a lead in facilitating this expertise sharing among sites through 'webinars', training workshops at the LTER All Scientist Meetings, and perhaps hosting techniques papers and presentations at the LNO web site.

2. The 'Remote Sensing and GIS Technical Coordination' should be recast as 'Spatial Data and Analysis Coordination'.

Given the rapid growth in GIS software and the merging of remote sensing products with GIS data, the two are often inseparable.

3. A Spatial Data and Analysis committee should be established.

The purpose is to motivate continued coordination between LNO and the sites, and to maintain a collective expertise in the emerging technologies and data opportunities beneficial to the LTER (e.g. LIDAR, Hyperspectral). The committee would meet first at the 2009 All Scientists Meeting and have one conference call on the off years. The committee chair will be drawn from one of the sites. Membership is for two years. We envision this committee to serve merely as a mechanism for periodic and coordinated communication between LNO and the sites to enhance top-down and bottom-up information flow.