

Working Group Report: “Exploring the effect of scale-dependent processes on ecological systems using networked sensors”

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Key Participants: Scott Collins

The workshop held at the LTER ASM (Colorado, 2006) was a continuation on a sensor network theme begun at the 2003 ASM in Seattle. Follow-up activities from the previous workshop resulted in a cover article in *Bioscience* (July 2005, Vol. 55, No. 7). The outcome of the Seattle workshop was identification of available sensor network technologies and their potential applications in ecosystems science. The workshop held at the 2006 ASM was a logical next step in the evolution of the sensor network science and technology story within the LTER network. The focus here was to identify ecological science that could only have resulted from data obtained from sensor networks. The investment in sensor technology by the ecological community in the past few years is now producing dividends in the form of new knowledge about ecosystems. As was true of the development of the technology of sensor networks, the LTER network has taken a leadership role in the advancement of the science of ecological sensor networks.

The workshop consisted of two keynote presentations followed by round-table discussions by the participants. Keynote presentations were:

- Paul Hanson - From observations through models to process: inference from high-frequency lake data
- Scott Collins - Sensor Web applications: Microclimate variability, global warming and intelligent sensor networks in ecological research

These presentations are available for viewing on the <http://wireless.vcrlter.virginia.edu> web site, along with presentations from the 2003 workshop and additional information related to wireless sensor networks.

The group of participants was diverse, but an “around the room” survey of interests found five recurrent themes: the use of images/sound/light to study ecological processes, sensor networks in aquatic (3D) environments, studies of microbes and carbon cycling, tracking and monitoring of organisms, and monitoring of physical/chemical processes.

Working group discussions focused around the question “What will sensor network data do for you?” with a special focus on the scientific questions and models driving the research. The discussion clearly identified sites and processes that are characterized by high spatial and temporal variability as candidates for the use of sensor networks to answer questions that cannot be answered using traditional techniques. Specific examples included the measurement of light environments under canopies where “flickering” light can have substantial effects on productivity, process studies in aquatic wave environments, detection of ecological thresholds, and the ability to conduct more detailed examinations of process dynamics. The participants also discussed other issues,

such as the need for more advanced quality control and quality assurance techniques to handle the flood of data that can result from sensor networks, and the need to develop social networks to facilitate the sharing of experiences, uses and techniques.

The principal recommendation of the workshop was that a synthesis publication was needed to detail what we have learned, scientifically, from using sensor network technologies. There was a keen sense in the group that the extensive promise of sensor networks needed to be grounded in real-world scientific applications aimed at real ecological questions, or as put more succinctly by a group member “We want to get more in terms of fact, not just potential”. A synthesis publication that brought together examples of real scientific applications would be of tremendous value.

Subsequent to the workshop we have queried the group via email to solicit examples suitable for inclusion in such a synthesis paper. Additionally, we have submitted a request for follow-up funding to pursue the writing and publication of the synthesis paper.

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