

Project Summary

Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Development and Test of Instrumentation and Software to Monitor the Sensory Environment

Discipline: Interdisciplinary
Type of Project: Research
Funding Agency: National Park Service
Other Partners/Cooperators: Colorado State University
Effective Dates: 5/15/2013 - 2/28/2016
Funding Amount: \$859,920 [FY14: \$385,258; FY13: \$474,662]

Investigators and Agency Representative:

NPS Contact: Kurt Fristrup, National Park Service, 1201 Oakridge Drive, Suite 100, Fort Collins, CO 80525, 970.267.2102, kurt_fristrup@nps.gov

Investigator: Dr. Mahmood R. Azimi-Sadjadi, Professor, Department of Electrical and Computer Engineering, C201E Engineering Building, Colorado State University, Fort Collins, CO 80523, 970-491-7956, azimi@engr.colostate.edu

Project Abstract: Noise is pervasive pollutant in protected natural areas. Data collected by CSU Research Associates in 22 National Park units (Lynch et al. 2011) show that noise is audible about one quarter of the time (hourly median value across all hours and sites), and some wilderness sites can have hourly noise audibility levels exceeding 50%. Surveys of the American public have documented the vital importance of acoustical environments as a reason for protecting natural areas, as well as the critical role that acoustical conditions play in determining the quality of visitor experience. Noise has also been shown to be an important factor in wildlife ecology (Barber et al. 2010, Benítez-López et al. 2010, Francis et al. 2009). Ecological light pollution is an emerging concern for wildlife management (Longcore and Rich 2004).

The NPS needs instruments capable of autonomous data collection and processing for periods of one year or more. Some of these instruments need the capacity to acquire, process, and wirelessly transmit data summaries and operational status. No viable commercial options exist. This research and development project is exploring technological options to meet these needs. In tandem with the hardware development, this project is investigating options for automatic processing of acoustical data, to cope with the larger volumes of data that continuous monitoring systems will generate. Prior projects funded by NPS have significantly reduced the cost, size, weight, and complexity of sound level monitoring systems for acoustical surveys of park conditions lasting up to one month. This project conducted in collaboration with Colorado State University researchers will pursue a variety of potential products. This is not an exhaustive list.

- acoustical monitoring instrument designed for indefinite deployments, with array processing and wireless communication capabilities.
- systems for monitoring and displaying vehicle noise levels for transportation monitoring in national park units, which will be used in cumulative impacts analyses in air tour management plans.
- systems for maintaining synchronized timing across widely separated instruments,
- ultrasonic monitoring capabilities.
- instruments for measuring variation in sound propagation.
- advanced signal processing algorithms for automatic detection and classification of different man-made and natural acoustic events from the collected data.

This project will advance scientific understanding and engineering capabilities to support more effective management of public lands and to provide a higher quality experience for visitors. The research activity is intended to address several public interests: expanding scientific capabilities for monitoring sensory environments, promoting collaborative conservation working groups consisting of academic professionals and natural resource managers, furthering the education and career development of university students and research staff, providing opportunities for project participants to produce peer-reviewed papers and outputs for scientific conferences reporting these research results, stimulating interdisciplinary research and education at CSU by promoting interactions between the Warner College and the College of Engineering. This promotion of interdisciplinary activity may extend to hosting scientific workshops or conferences, though none is planned at this time.

Outcomes with Completion Dates: March 30, 2015

Electronic copies of field data, software, CAD files, reports, and scientific papers resulting from the project; instruments and other hardware.

Keywords: soundscapes, acoustic monitoring, NPS-Natural Sounds Program, Colorado State University