

Project Summary

Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Development and testing of instrumentation and software for acoustical monitoring in National Parks

Discipline: Interdisciplinary
Type of Project: Research
Funding Agency: National Park Service
Other Partners/Cooperators: Colorado State University
Effective Dates: 9/7/2010 – 7/31/2012
Funding Amount: \$632,383

Investigators and Agency Representative:

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Project Abstract: The purpose of this project is to stimulate engineering research and development of technologies that bear on acoustical resource management and noise regulation in protected natural areas. Several items of potential effort are listed here, but project plans are designed and executed on the basis of biweekly meetings between the CSU research team and the NPS ATR. This regular schedule of meetings enables the project to take advantage of the latest information available to NPS and CSU.

Proposed Engineering and Analytical Tasks

1. Finalize protocols and software for measuring calibrated 1/3rd octave band sound levels using consumer digital audio recorders.
2. Design and prototype an acoustical sound level monitoring system with multiple acoustic channels for providing array processing and wireless communication capabilities to transmit data summaries and system status.
3. Develop algorithms and software that automatically estimate natural ambient sound levels, removing the effects of transportation and other noise sources. Explore new methods of characterizing natural ambient sound levels, possibly separating biological, transient physical, and background baseline levels. Investigate options for separating the noise from wind flowing past the microphone from the sounds generated by wind flowing over landscape and through vegetation.
4. Investigate software that can automatically identify various types of transportation sound sources. Explore options for estimating the speed of the vehicle, the slant range of its closest point of approach, and possibly its altitude (for aircraft). Explore options for an acoustical system that tracks aircraft noise sources while measuring their noise levels.
5. Utilize noise modeling software to predict geographic patterns of noise exposure.
6. Finalize the design for a public display system that can indicate the noise level generated by passing vehicles, with a flashing indication when the noise level exceeds current NPS regulations (like a radar trailer). Build demonstration units for testing in parks.
7. Develop inexpensive acoustical beacons that can be used to precisely resynchronize data in sound level meters and audio recorders.
8. Investigate options for ultrasound monitoring, and potentially design and construct prototypes.
9. Investigate options for separating sound source signatures, to parse recordings of composites of sounds into representations of what each source would sound like in isolation.
10. Develop and test new power sources for long-term deployment of acoustic monitoring systems.
11. Deploy new environmental sound monitoring systems at NPS park units to assess their performance, reliability, and ease of use, while collecting data that can support Air Tour Management Plans, resource management plans, and NRPC Technical Assistance Requests.
12. Develop software that explores comprehensive comparative analyses, producing data summaries that would be appropriate for a "State of the Parks" report on acoustical environments across the continent.
13. Create graphical presentations that can summarize comparative data from several parks to identify commonalities and highlight contrasting features.
14. Develop innovative graphical presentations and a standardized report format that can produce acoustic monitoring reports that concisely present salient results to resource managers and NPS leadership.
15. Produce acoustic reports for each monitoring effort, and conduct web conference briefings to apprise park unit personnel of the results.

16. Potentially conduct workshops to discuss research results and promote dissemination of new acoustical monitoring tools.

The project will improve existing National Park Service (NPS) acoustical monitoring systems, explore options for more efficient and longer-term data collection, test options for wireless communications systems for periodic status reports from field instruments, develop software tools for more efficient data processing, and devise analytical procedures for more rapid and concise translation of data into reports and graphical presentations. The project will include ongoing acoustical monitoring to expand the NPS inventory of acoustical conditions in park units, to evaluate the performance of current generations of equipment and software, and to provide material for broad comparative analyses of acoustical conditions across the continent.

Outcomes with Completion Dates: 30 June 2012

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