Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Optical sensing to study the effect of anthropogenic light and noise on flying insects

Discipline: Natural
Type of Project: Research
Funding Agency: National Park Service
Other Partners/Cooperators: Montana State University
Effective Dates: 6/1/2013 – 12/31/2014
Funding Amount: $67,827

Investigators and Agency Representative:
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Project Abstract: The Organic Act of 1916 (P.L 64-235, 16 U.S.C. 1, 2-4, as amended by the Redwoods Act of 1978 and the General Authorities Act of 1970) requires the National Park Service to conserve the scenery of park units unimpaired for the enjoyment of future generations. The General Authorities Act speaks of "superb environmental quality" "preserved and managed for the benefit and inspiration of all the people of the United States." Views nocturnal landscapes free from artificial light are important parts of visitor experience.

Artificial light is known to affect the movements and behavior of flying insects (Rich and Longcore 2005), but this phenomenon has not been studied in remote locations that have historically been completely free from artificial light. Energy development in the Great Plains and Intermountain West is introducing bright lights into some of these remote areas. Many ongoing or planned developments are close enough to National Park units that they could affect the nocturnal insect fauna in the park, and all of the other species that are linked to those insects.

To remotely measure the number of flying insects in both natural and human-influenced environments, we will use an advanced remote sensing instrument developed originally for counting foraging honey bees in flight. This instrument is a custom-built Light Detection and Ranging (lidar) instrument that uses real-time Fourier transforms to convert the conventional measurement of scattered power as a function of range to a measurement of scattered power as a function of range and target oscillation frequency (Shaw et al. 2009; Hoffman et al. 2007; Repasky et al. 2006). This version of a lidar system was developed specifically for the application of detecting honey bees in flight, and isolating their back-scatter signature from vegetation and other static or near-static objects, which in this measurement scenario would produce signals at or near a frequency of 0 Hz. The wing-beat modulation lidar instrument builds on earlier technology that detected flying insects through wing-beat modulation of light from the sun or from a local light source (Unwin and Ellington 1979; Moore & Miller 2002).

Outcomes with Completion Dates: December 31, 2014

Keywords: nocturnal landscapes, artificial light, flying insects, NPS- Natural Sounds and Night Skies Division, Montana State University