Monitoring Forest Response to Past and Future Global Change in Greater Yellowstone

Principle Investigators

Andrew Hansen - Ecology Department, Montana State University, Bozeman, MT, 59717, 406 994-6046, hansen@montana.edu, http://www.homepage.montana.edu/~hansen/hansen/lab/.

Lisa Graumlich - Director, Mountain Research Center and Professor, Land Resources and
Environmental Sciences, Montana State University, Bozeman, MT 59717, 406/994-5320, lisa@montana.edu, http://mountains.montana.edu/

Warren Cohen - Ecosystem Processes, PNW Research Station, USDA Forest Service, Corvallis, OR, 97331, 541-750-7322, warren.cohen@orst.edu, http:/www.fsl.orst.edu/larse

Michael Lefsky - Ecosystem Processes, PNW Research Station, USDA Forest Service, Corvallis, OR, 97331, 541-750-7322, lefsky@fsl.orst.edu, http:/www.fsl.orst.edu/larse

Team Members at MSU

Scott Powell – Ph.D. student

Ute Langner – Research Associate

Jeremy Littell – M.S. student

Jeremy Lougee – Research Assistant

Lew Stringer – Research Assistant

Abstract

Have the forests of Greater Yellowstone responded to global change in recent decades? What have been the consequences of past forest change for carbon, fire, and biodiversity?
Can a monitoring strategy be designed to allow early detection of future change?

Understanding past global change provides an important context for designing monitoring protocols to detect future change. New data from the Greater Yellowstone Ecosystem indicate that vegetation change has been dramatic over the last century. Conifer forests have both increased in density and expanded into previously unforested areas. Concurrently, hardwood, shrubland, and grassland habitats have declined. Fire exclusion by humans may explain these forest dynamics. However, pilot dendrochronological studies of tree growth rates suggest climate variability has also contributed to conifer expansion. These vegetation dynamics appear to have important implications for carbon sequestration, fire and risk to humans, and biodiversity. The responsiveness of vegetation to past land use and climate, and the climate changes predicted for the GYE in the future, suggest that the GYE is an important site for monitoring for early detection of global change. The objectives of the this study are:

1. Quantify change in forest cover, density, and composition across the GYE during 1950-2000.
2. Assess the consequences of this change for carbon sequestration and biodiversity.
3. Devise a monitoring strategy to detect future change in forests of the GYE.

We are quantifying change in forest composition and structure over the GYE for 1975-2000 using Landsat imagery calibrated with reference data from aerial photographs and for rapid change transects for 1950-2000 using aerial photographs. The consequences of these changes for carbon accumulation will be quantified by estimating carbon storage for each cover type based on allometric relationships and field data. Habitat functions will be used to estimate change in the abundances of several bird and shrub species. A monitoring strategy will be developed for locations of rapid change and for the GYE as a whole.