

## **Position Description: 2 Ph.D. Students in Vegetation Modeling and Climate Vulnerability Assessment**

Montana State University is seeking 2 Ph.D. students for a NASA Applied Sciences project on vulnerability of biological resources under climate and land use change. The project will use NASA resources to inform climate and land use adaptation across two USDI Landscape Conservation Cooperatives through ecological forecasting, vulnerability assessment, and evaluation of management options. One position will start 8/2011 and the other 7/2012. Tuition, fees, and research stipends will be provided.

### **Duties:**

Position 1 (available 8/15/11): Develop and apply statistical and simulation models of ecosystem types and dominant tree species responses to climate change in the Northern Rockies and Appalachian Mountains.

Position 2 (available 7/1/12): Participate in vulnerability assessments of ecosystem processes and ecosystem types under climate and land use change based on statistical analysis and on evaluation by expert panels.

### **Desired Qualifications:**

M.S. in ecology or related field;  
Training in vegetation, physiological ecosystem, landscape, and/or conservation ecology;  
Experience in simulation modeling, statistical analysis, and/or geographic information systems;  
Demonstrated ability to execute and publish ecological research;  
Experience in working on integrated science teams.

**Project Summary:** Using NASA resources to inform climate and land use adaptation: Ecological forecasting, vulnerability assessment, and evaluation of management options across two USDI Landscape Conservation Cooperatives. Designation of US Department of Interior Landscape Conservation Cooperatives (LCCs) emphasizes the important threat that climate and land use change pose to biological resources in national parks and other federal lands. Developing strategies for management and adaptation in the coming century requires improvements in our ability to forecast biological response under future scenarios, assess spatial variation in the vulnerabilities of biological resources, and design multi-scale management strategies based on vulnerability and management feasibility. The goal of this project is to develop and apply decision support tools that use NASA and other data and models to assess vulnerability of ecosystems and species to climate and land use change and evaluate management options. Our objectives are to:

1. Quantify trends in ecological resources from past to present and under projected future climate and land use scenarios using NASA and other data and models across two LCCs.
2. Assess the vulnerability of ecosystems and illustrative species to climate and land use change by quantifying exposure, sensitivity, adaptive capacity, and uncertainty in and around focal national parks within LCCs.
3. Evaluate management options for the more vulnerable ecosystems and species within these focal parks.

4. Design multi-scale management approaches for vulnerable ecosystems and species to illustrate adaptation strategies under climate and land use change.

5. Facilitate technology transfer of data, methods, and models to federal agencies to allow the decision support tools to be applied more broadly.

The proposed work will build on our successful NASA Applied Sciences project to enhance decision support within the National Park Service Inventory and Monitoring Program. This project will focus on portions of the Great Northern and Appalachian LCCs, both of which support critical biological resources and have already undergone climatic warming. Within a climate adaptation framework recently derived by an interagency team, we will integrate component models and data from the Terrestrial Observation and Prediction System (TOPS) and the SERGoM land use change model to hindcast (2001-2010) and forecast (2010-2100) responses of ecosystems and illustrative species to 36 future scenarios. Ecosystem process indicators will include snow pack, runoff, vegetation phenology, primary productivity, lifeform dynamics, and disturbance events. Biodiversity response will be analyzed with a coarse-filter approach emphasizing land facets, ecological system types, and two illustrative animal species. Correspondence among dynamic models of vegetation lifeform and statistical distribution models of ecological system types and dominant plant species will be used to assess uncertainty. The utility of these coarse filter elements for modeling species will be illustrated with analysis of two high priority species: brook trout and wolverine. Results of these forecasts and expert opinion will be used to assess vulnerability and place indicators into one of three management classes: Low Risk (management not needed); Manageable (management effective and required); and Lost Cause (potentially high risk, but management unlikely to mitigate). For those components rated as Manageable, the team will design spatially and temporally-explicit management strategies to improve resilience and/or adaptation. The decision support framework, ecological forecasting tools, and management strategies derived through this project should help to prioritize future activities within the two case-study LCCs and provide a demonstration that may lead to application nationwide. The timing of this project is critical as our NPS collaborations are now developing an implementation plan for the NPS Climate Change Response Strategy. Our proposed approach has already informed the NPS implementation planning and can serve as a case study for NPS Climate Change Adaptation.

#### **Application Procedures:**

Send a letter of interest, C.V., and the names and contact information of four references by July 15, 2011 for Position 1 and by May 1, 2012 for Position 2 to:

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

Positions are contingent upon funding and will remain open until qualified applicants are recruited.

