MESM 2010 Group Project Proposal: Assessing Fire Regime Change in the Santa Monica Mountains under Climate Change Scenarios: Policy and Management Implications

PROPOSERS

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STATEMENT

The Santa Monica Mountains (SMM) has a large wildland urban interface (WUI) located in a landscape that experiences severe and frequent wildfires. This pattern public/private land ownership creates complex fire management issues ([NPS] 2005). Fire risks are especially high in the SMM which has steep slopes and dense shrubland vegetation intermixed with development. Every fall there are seasonal Santa Ana (SA) winds – strong, dry offshore winds that occur at the end of the long summer drought. The combination of high winds and temperatures, low humidity and dry vegetation creates the conditions for major wildfires. SA occurrences are believed to be increasing[1] significantly due to climate change coinciding with southern California's fall fire season (Miller and Schlegel 2006 and Knox and Scheuring 1991). With a growing population living in the WUI, property losses due to fires in southern California have escalated (Moritz and Stephens 2008). Predictions from future climate change scenarios coupled with an increasing population living in the WUI forecast a destructive trend (Westerling and Bryant 2008).

Fire risk is predicted to increase due to climate change (Moritz and Stephens 2008). Fire risk is a function of climate, geography and available fuel (vegetation) which is affected by climate change. Live fuel moistures levels of 80% and lower have been shown to be a necessary condition for large SA driven wildfires in southern California (Dennison, et al 2008). Increased spring and summer temperatures, combined with changes in rainfall quantity and seasonality have the potential to change the duration and severity of low live fuel moisture levels. Additionally, prolonged periods of low live fuel moisture can lead to dieback in the normally drought-resistant chaparral shrub species. An increase in the dead fuel component of the vegetation will change fire behavior and increase fire intensity and spread rates. The other driver of large fires, the dry SA winds, exhibit remarkable variability in intensity across the complex topography of the SMMs. We propose to combine predictions on future trends in live fuel moisture and maps of geographic variability in SA wind intensity to create fire risk maps to help assess whether current policies and management tools are sufficient under climate change scenarios. If they are not sufficient, what are the economic consequences of inaction and what recommendations can be made to ameliorate this potential disaster in vulnerable areas? The implications for future policy, zoning, and mitigation could aid not only the SMM but also managers of other WUI zones facing increased fire risk.

OBJECTIVES

The objectives of this study are to:

- Evaluate how live fuel will be altered under climate change scenarios, such as seasonal changes in rainfall distribution, increased variability in rainfall and increased average and maximum temperatures that would increase evapotranspiration (Lenihan et al. 2003)
- Evaluate the effects on vegetation, particularly dieback
- Using Wind Wizard, map Santa Ana wind conditions
- Combine overlays of patterns of extreme wind corridors, vegetation type, urban development patterns, data on live fuel moisture and dieback with overlays from FARSITE (Finney 1998) – a fire behavior prediction model – to produce a fire hazard map as guidance for fire management and public information awareness in the SMM
- Analyze possible changes to fire risk under climate change scenarios, if any

[1] Although personal communication to Marti Witter from Alex Hall, UCLA, indicates that Santa Ana occurrences are believed to be decreasing.

- Use created fire risk map to analyze current zoning regulations under different urban development models (Syphard et al. 2006 or Swenson and Franklin 2000)
- Recommend new policies or modifications to existing ones based on changing fire risk
- Review current and recommend new mitigation measures to reduce fire hazards and protect natural resources in the SMM WUI
- Review policy with a precautionary approach taking into account climate model uncertainties and the range of climate change scenarios given by the Intergovernmental Panel on Climate Change (IPCC)

SIGNIFICANCE

An assessment of the fire regime severity under climate change effects on live fuel moisture and variability in SA wind conditions using Wind Wizard would:

- Provide information for immediate management application, as well as the foundation for future evaluations of risk and continuous monitoring over time
- Help prioritize restoration and conservation efforts by the National Park Service and partnership agencies
- Assess potential economic consequences due to inaction
- Place land management policies into a proper future context given IPCC climate change scenarios

This assessment is important because:

- The SMM area is one of significant biodiversity and one of the largest remaining undeveloped natural area in the coastal southern California Mediterranean ecosystem
- The area has a history of wildfire property loss, most recently in 2008, 3 lives lost in 1993 and others seriously injured in 1993 and 1996.
- This will provide local residents and regulatory agencies with better information on areas of high risk, especially sites that may be indefensible, as well as true risk factors that may contribute to structure loss that are currently not well understood by the general public
- This will provide public land management agencies, where incompatible goals of fire hazard reduction and resource protection in a chaparral ecosystem (removing "fuel," vegetation, destroys the ecosystem) creates social conflicts, with the best available information about fire hazards so they can plan optimum mitigation strategies that minimize impacts to natural resources
- Shorter fire return intervals in sensitive areas can decrease biodiversity, putting certain native populations at risk (Kus and Beyers 2005)
- This could provide a possible analytical framework for assessing the value of new models

BACKGROUND

The main driving factors behind fire behavior are fuels, weather and topography. The SMM are an ideal location for this project due to the SA wind events, the large population living within and around the SMM, the characteristics of the chaparral ecosystem, and complex geography contributing to wind patterns. The WUI and an increasing population in southern California make fires a serious issue.

To date, Santa Monica Mountains National Recreation Area (SAMO) has attempted to secure funding for a project that maps the variability of the SA winds. Thus far, they have been unsuccessful. A local National Weather Service fire incident analyst found Wind Wizard helpful on a local fire (Pers comm. to Marti Witter from Richard A. Thompson, richard.a.thompson@noaa.gov, NOAA National Weather Service regarding Gap fire). Additionally the Missoula Fire Sciences Lab that developed Wind Wizard has agreed to help run Wind Wizard to generate wind maps for the SMM. This will be one component to a fire risk map that sources other available data.

Dennison et al. (2008) have used the 80% threshold for their "critical" live fuel moisture but the Los Angeles County fire department continues to use a 60% threshold as their "critical" value. This disconnect potentially has large management implications for fire planning particularly in when to deploy resources. Live fuel moisture is affected by environmental variables such as late spring rain delay, and dry winters (Dennison et al. 2008). Global warming may increase potential live fuel by warming and drying out vegetation.

STAKEHOLDERS

- Mountains Restoration Trust
- Santa Monica Mountains Conservancy
- The Resource Conservation District of the Santa Monica Mountains
- California State Parks
- Adjacent landowners
- Recreational park users
- California Costal Commission
- Santa Monica Mountains FireSAFE Alliance
- Los Angeles County Fire Departments
- Residents of Los Angeles and Ventura Counties

APPROACH AND AVAILABLE DATA

Approach

Southern California firestorms in 2003 and 2007 raised awareness of the dangers of SA winds. These hot, dry SA wind events are a major factor driving large fires in the SMM. Although the geographic variability of SA wind behavior is poorly understood, Wind Wizard, a gridded wind model developed by the Fire, Fuel, and Smoke Science Program of the Rocky Mountain Research Station, has been observed to predict actual on-the-ground conditions during several fires (Pers comm. to Marti Witter from Richard A. Thompson, richard.a.thompson@noaa.gov, NOAA National Weather Service regarding Gap fire). Wind Wizard could be used to model SA wind intensity and direction. This is an assessment tool to predict on-the-ground conditions. (Pers comm. to Marti Witter from Bret Butler, bretwbutler@gmail.com, Missoula Fire Sciences Lab). These conditions could then be used in conjunction with the fire history of the SMM, different climate scenarios, current zoning and policy, existing GIS layers, aerial photographs, live fuel moisture, low and high urban growth scenarios to assess changes in fire frequency and severity. Site visits and stakeholder interviews and feedback will ensure that this information is analyzed in the proper context.

Another factor driving wildland fires is the low live fuel moisture levels of chaparral vegetation that occur at the end of summer and through the fall until the winter rains begin. The critical threshold for live fuel moisture in the facilitation of large fires is approximately 80% (Dennison et al. 2008). Data are available to assess whether there has been a trend in decreased live fuel moisture in the SMM over the past few decades and to predict future changes under global climate change scenarios.

Using FARSITE (Finney 1998), a fire behavior prediction model, we can predict the timing and expected spatial spread of the fires. GIS coverage that represents slope, elevation, vegetation, aspect and canopy cover helps FARSITE make these predictions. In combination with Santa Ana wind maps, live fuel moisture and other existing techniques we can overlay spatial layers to create fire hazard maps which will be used to assess policy and management implications.

Data

- Remote sensing data
- Meteorological data
- SAMO GIS layers (e.g., topography, roads network, vegetation, historic fire data)
- Seedling survivorship and regeneration plot data (*Ceanothus megacarpus*)
- Fuel moisture data and archives (National Live Fuel Moisture Database and County of Los Angeles Fire Department)

DELIVERABLES

A final report and presentation will provide scenarios of possible fire regimes under climate change conditions influenced by Santa Ana winds and live fuel moisture. This assessment will include management and policy recommendations to minimize property and resource losses.

National Park Service

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ANTICIPATED FINANCIAL NEEDS AND SOURCES OF SUPPORT

(See included letter of support from SAMO Chief of Planning Science & Resource Management)

- Modest supervision of the project in coordination with Bren students and faculty
- Possible summer internship for 1 or 2 project members to assess drought dieback
- Occasional travel to SAMO HQ in Thousand Oaks

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Wind Wizard - http://www.firelab.org/content/view/274/350/

United States Department of the Interior

NATIONAL PARK SERVICE
Santa Monica Mountains National Recreation Area
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January 29, 2009

Group Project Selection Committee
Donald Bren School of Environmental Science & Management
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Dear Project Selection Committee,

The National Park Service (NPS) is in full and enthusiastic support of the proposed project "*Assessing Fire Regime Change in the Santa Monica Mountains under Climate Change Scenarios: Policy and Management Implications*". Current global climate change models predict that the Santa Monica Mountains and southern California will experience the most extreme climate change in the United States. In the past decade we have observed significant changes in the Santa Monica Mountains National Recreation Area (SMMNRA) that are consistent with predicted increases in climatic variability. Specifically we have had an increase in the number and severity of droughts, increased variability in the seasonal pattern of rainfall and recent low live fuel moisture levels for more prolonged periods of time. All of these factors have the potential to influence the fire regime of the Santa Monica Mountains.

Because of the extensive wildland-urban interface in the SMMNRA, the NPS is committed to identifying critical fire science needs in its fire management program and community outreach and education efforts. This project addresses two areas that we have identified to be of primary importance: the expected trajectory of live fuel moisture levels with predicted climate change scenarios and geographic variability in Santa Ana winds, our major driver of large wildfires and structure losses.

The NPS would be happy to provide every resource available to us to see that this project is a success. We have already collaborated with the Bren School on other projects, including "*Biology and Management of Non-Native Plant Species in the Santa Monica Mountains National Recreation Area*". These collaborations have been enormously useful to the park. We are eager to work with the Bren School on this project, and are confident that the results will be extremely useful to the park in implementing community-based fire management planning.

Sincerely,

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