Wildfire potential trends under changing climate

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Summary

Tens of thousands of wildfires occur annually in the United States, threatening human life and property. A big challenge for forest researcher and managers is to project wildfire's variability related to the variation and change of atmospheric conditions, including the possible climate change due to the greenhouse effect. Many climate models have projected significant climate change for this century, including the warming and drying trends in many subtropical and mid-latitude regions. Thus, it is likely wildfires will increase in these regions. A global and regional picture of wildfire potential under a changing climate is essential to assessing the impacts of climate change on wildfire and developing forest management options for adaptation and mitigation.

A study project to project future wildfire potential trend has been conducted in the Center for Forest Disturbance Science, US Forest Service / Southern Research Station. Wildfire potential is measured by the Keetch-Byram Drought Index (KBDI). This index is extensively used in the U.S. With higher values of the KBDI, fire becomes more intense due to an increased flammability of soil organic material and burned area becomes larger and period becomes longer due to fast spread of fire. Wildfire potential is divided into

four levels based on KBDI values: low (KBDI below 200), moderate (200-400), high (400-600), and extreme potential (above 600).

This project consists of three phases to project wildfire potential in the globe, the U.S., and the South, respectively. The first phase is completed, the second one is underway, and the last one is planned for the next year. The data used to calculate the KBDI for the first phase were the climate changes projected with HadCM3 and other three global climate models for all four emission scenarios provided by the Data Distribution Centre of the Intergovernmental Panel on Climate Change. The results indicate that future wildfire potential increases significantly in the United States and five other regions (South America, central Asia, southern Europe, southern Africa, and Australia). Relative changes are the largest and smallest in southern Europe and Australia, respectively. The increased fire potential is mainly caused by warming in the U.S., South America, and Australia and by the combination of warming and drying in the other regions. Sensitivity analysis shows that future fire potential depends on many factors such as climate model and emission scenario used for climate change projection. The results suggest dramatic increases in wildfire potential that will require increased future resources and management efforts for disaster prevention and recovery. (See Liu, Stanturf, and Goodrick, 2009 for details.)

The data used to calculate the KBDI for the second phase were the dynamic downscaling of the climate change projected with HadCM3 for the a2 emission scenario. The data were provided by the North America Regional Climate Change Assessment Program

(NARCCAP). The preliminary results indicate that significant increase in wildfire potential is expected in the Rocky Mountains throughout the year and in the South in the summer and fall seasons. In contrast, decrease is expected in the Pacific coast during some seasons. Wildfire potential will increase by one level, from low to moderate or from moderate to high with longer fire seasons in many regions.