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A Global Perspective on Wildfires

In the April 24th issue of *Science,* a multidisciplinary team including USGS scientist Dr. Jon Keeley address the global implications of wildfires and the multitude of influences fire has on ecosystem processes. This team, led by Drs. David Bowman and Jennifer Balch, includes academic scientists from Australia, Brazil, Netherlands, South Africa, United Kingdom, and United States.

This analysis is prompted by the recent surge in the incidence of large, uncontrolled fires that have occurred on most continents, irrespective of national fire-fighting management. It is increasingly evident that these episodic fires have potentially massive effects on biodiversity, human health, and the economy. However, less widely appreciated are the potential fire-climate feedbacks on the entire Earth system that link regional and global patterns and processes. Failure to develop a coordinated and holistic fire science will handicap efforts to adapt to changing fire regimes and manage fire.

Management Implications:

- An integrated perspective on fire and ecosystem feedbacks is needed if we are to adequately capture its influence on future climate changes.
- Understanding global trends in fire activity demands greater understanding of the use of remote sensing technology.
- Mapping of global patterns of fire regimes and trends in fire activity is essential to forecasts of future global change.

Wildire in California chaparral. Photo by U.S. Forest Service.

In recent history, the ongoing transition from subsistence to industrial economies is typified by the conversion of forests into agricultural or pastoral landscapes through the use of fire. Simulations using global vegetation models suggest that forests would at least double in extent in the absence of fire. Despite human use of fire to achieve economic and ecological benefits, fire remains an unreliable tool, often evading control.

Humans and climate both play a role in determining fire patterns and, in turn, fire influences the climate system via the release of carbon. Currently, all sources of fire cause carbon dioxide emissions equal to 50% of those stemming from fossil fuel combustion. However, vegetation re-growth and soil-stored black carbon from

burning are critical carbon dioxide sinks, and could be expanded with targeted management.

Forest fires contribute substantially to greenhouse gasses and associated global warming and this contributes to a feedback process of increasing extreme fire weather, leading to further spikes of carbon emissions. Fire also influences climate by releasing atmospheric aerosols and changing surface albedo. Additionally, fire influences the majority of radiative forcing components and has a substantial positive feedback on the climate system. Improved estimates of the climate forcing of fire must address fire's complex web of interactions with other radiative forcing components and must resolve how fire activity and land cover change have varied through the industrial period.

Bowman, D.M.J.S., J.K. Balch, P. Artaxo, W.J. Bond, J.M. Carlson, M.A. Cochrane, C.M. D'Antonio, R.S. DeFries, J.C. Doyle, S.P. Harrison, F.H. Johnston, J.E. Keeley, M.A. Krawchuk, C.A. Kull, J.B. Marston, M.A. Moritz, I.C. Prentice, C.I. Roos, A.C. Scott, T.W. Swetnam, G.R. van der Werf, and S.J. Pyne. 2009. Fire in the Earth system. Science 324:481–484.

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