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Western Ecological Research Center

Publication Brief for Resource Managers

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Wildland Fire in Ecosystems: Fire and Nonnative Invasive Plants

Where nonnative plant species have invaded wildlands or have potential to invade, fire may influence their abundance and the effects of the nonnative species on native plant communities. USGS scientists and colleagues have contributed chapters to a volume that synthesizes scientific information regarding wildland fire and nonnative invasive plant species, identifies the nonnative invasive species currently of greatest concern in major bioregions of the United States, and describes emerging fire-invasive issues in each bioregion and throughout the nation.

Introduction—In chapter 1, Jane Smith, Kristin Zouhar, Steve Sutherland (Forest Service), and Matt Brooks (USGS) discuss the need to provide better interpretation of science for "bridging the worlds of fire managers and researchers." This volume is the first published synthesis of major fire-invasive plant issues on a national scale. It reviews the scientific literature regarding relationships between fire and nonnative invasive plants in the United States and presents information useful for improving fire and nonnative species management in wildland ecosystems.

Plant Invasions and Fire Regimes—In chapter 3, Matt Brooks (USGS), describes ways in which invasions by nonnative plant species can change fuel conditions and fire regimes, and discusses what can be done to prevent or mitigate these effects. He describes key elements linking fuel conditions with fire regimes that can help in screening plant invaders for their potential effects. Four general phases lead to a shift in fuelbed composition from native to nonnative species, culminating in a self-sustaining invasive plant/fire regime cycle in which nonnatives dominate. Although the information necessary to definitively document that an invasive plant/fire regime cycle has established may be very difficult to obtain, reasonable inferences can be made based on a comparison of fuel and fire behavior characteristics of the invading species and estimated reference conditions in the habitats they are invading.

Management Implications:

- Exclusion of potentially threatening species before they invade and early detection and rapid response to eradicate populations at the very early stages of invasion are the most cost-effective and successful approaches to preventing the establishment of an invasive plant/fire regime cycle.
- Management actions based on current state of knowledge regarding fire and nonnative plant invasions need to be re-evaluated frequently and implemented within an explicitly defined adaptive management framework that can be modified if necessary.
- To achieve long-term control of a nonnative invasive population and/or to favor native species with fire, managers must consider the regeneration strategies, phenology, and site requirements of all species in the management area.
- In planning prescribed fire to control invasive species, managers can consider manipulating any or all aspects of the fire regime.
- In the mixtures of species that characterize many wildland ecosystems, it is difficult to develop a strategy that reduces all nonnatives and favors all native species. Combinations or sequences of treatments may be needed.

***Central Bioregion*—**In chapter 7, Jim Grace (USGS) and Kristin Zouhar (Forest Service) discuss fire and nonnative plant invasions in the Central bioregion, where temperate grasslands predominate and some of the most threatened ecosystems in the world occur. Their discussion treats each formation where individual species seem to be most problematic: northern and central tallgrass prairie, southern tallgrass prairie, northern mixed grass prairie, southern mixedgrass prairie, and the shortgrass steppe. In North America, the widespread use of grasslands for agriculture and livestock grazing, in addition to the effects of urbanization and other human activities, have led to dramatic alterations in their extent and condition. Nonnative plants constitute a major additional threat to conservation, rehabilitation, and restoration of temperate grasslands. A variety of interactions between invading species and fire is possible. In some cases, fire may act as an environmental filter that eliminates or reduces nonnative invaders. In other cases, fire-adapted invaders will be quite impervious to burning and fire may facilitate the establishment and spread of certain nonnative plants. Alternatively, fire exclusion may provide a window of opportunity for the establishment of certain nonnatives that may not be easily displaced once they have established. Both the natural characteristics of a landscape and human-induced modifications can be expected to influence the interactions between invaders and native communities. Also, interactions between fire and invasives can be complicated by additional factors such as grazing and other disturbances.

***Southwest Coastal Bioregion*—**In chapter 9, Rob Klinger (USGS), Robin Wills (National Park Service), and Matt Brooks (USGS) discuss five major vegetation types in this bioregion where the management of both invasive plants and fire are primary concerns for land managers: grassland, chaparral and coastal scrub, mixed evergreen forest, coniferous forest, and wetlands. They examine the role fire has played in promoting invasions, the degree to which invasions have altered fire regimes, and the relative success of fire for managing invasive plants. In particular, the authors focus on the use of fire as an ecosystem "restoration" tool, and the emerging pattern of invasion into burned areas resulting in conflicting management outcomes. They emphasize that many invaders in this bioregion are herbaceous species that create an easily ignited fuelbed and more frequent fires, which often results in the conversion of native shrublands into nonnative grasslands. The pattern has become so pronounced over the last 20–30 years in chaparral and coastal scrub ecosystems that the authors recommend that management burns should not be conducted in these vegetation types unless absolutely necessary. Fire alone is not likely to be successful for managing ecosystems dominated by invasive nonnative plants, but may have a better chance when combined with seeding and planting of native species. Even then, great care must be taken to ensure the management activities do not exacerbate an existing undesirable situation.

***Fire Suppression and Postfire Management Activities*—**In chapter 14, Matt Brooks (USGS) explains how various fire suppression and postfire management activities can increase or decrease the potential for plant invasions following fire. The information in this chapter is designed to help land managers make more informed decisions on integrating invasive plant management into fire suppression and postfire management operations. A conceptual model summarizes the basic processes associated with plant invasions and shows how specific fire management activities can be designed to minimize the potential for invasion.

***Summary and Conclusion*—**The editors conclude the report (chapter 16) by summarizing the patterns (and lack of patterns) currently demonstrated by research regarding fire effects on nonnatives and the use of prescribed fire to reduce invasions, and suggest important questions for future research.

Zouhar, K., J. K. Smith, S. Sutherland, and M. L. Brooks, eds. 2008. Wildland fire in ecosystems: fire and nonnative invasive plants. General Technical Report RMRS-GTR-42-volume 6. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 355 p.

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