

FOCUS ON INVASIVE PLANTS IN THE FIRE EFFECTS INFORMATION SYSTEM

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ABSTRACT

The Fire Effects Information System (FEIS) provides information on the Internet about the biology, ecology, and effects of fire on about 1,000 plant species, animal species, and vegetation types. FEIS summarizes the scientific literature regarding fire effects on most dominant plant species in North America, but the system contains limited information about fire interactions with invasive species and effects of invasive species on fire regimes. To address this problem, 60 nonnative invasive plant species are currently being revised in FEIS or added to the system. In addition, FEIS now has links to Internet sites that contain information on other nonnative invasive species. FEIS increases the accessibility of research results for managers and identifies gaps in scientific knowledge. Managers rely on FEIS to plan post-fire rehabilitation, ecosystem-based management, and ecosystem restoration. Managers also refer to the system for information about distribution, morphology, phenology, habitat requirements, and management issues. Students and members of the public are frequent users of FEIS.

keywords: database, exotic species, fire ecology, fire effects, information management, invasive species, nonnative species, North America, regeneration, succession, weed.

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INTRODUCTION

Scientists and policy makers encourage use of wildland fire to benefit ecosystems and reduce risk of economically and environmentally damaging wildfires (Agee 1993, Whalen 1995, Boyce and Haney 1997). Benefits from fire are compromised, however, if fire contributes to the spread of invasive plant species. Invasive species can alter nutrient cycling patterns and other ecosystem processes, and can displace native plant species and native animals that depend on them (Olson 1999). Some invasive species alter the frequency and severity of fire from historic patterns. Furthermore, the economic impact of invasive species amounts to millions of dollars annually (Hirsch and Leitch 1996, Leitch et al. 1996).

Nonnative invasive species are especially problematic for fire managers because native pathogens and predators are poorly adapted to keep them in check. Control of invasive species in natural areas is difficult and can be costly because of vast areas, complex ecology, topography, hydrology, and soils, and lower land values compared to cropland. Chemical, mechanical, biological, and cultural control methods can reduce invasive species in natural areas, but these methods are difficult to impose because managers must consider potential adverse effects of the treatment on nontarget

organisms and the availability of native plants to fill niches created by the treatment. In addition, long-term monitoring is critical to prevent reinfestation. Managers need current, comprehensive information about interactions between fire and nonnative invasive species to maximize the positive effects and minimize the negative effects of fire, address effects of invasive species on fire behavior, and plan effective monitoring. The Fire Effects Information System (FEIS) is making such information more accessible to managers.

INFORMATION IN FEIS

The Fire Effects Information System originated in 1986 (Fischer 1987, Fischer et al. 1996). It provides literature reviews (Knowledge Base Summaries) of about 1,000 species of plants and animals, as well as selected Küchler (1964) potential natural vegetation types, on the Internet at www.fs.fed.us/database/feis. Most species in FEIS are relatively common or widespread in North America; for example, the system includes most tree species native to the U.S., as documented in Little (1979), and most of the species named in the Society of Range Management cover types (Shiflet 1994) and Küchler (1964) potential natural vegetation types. FEIS includes relatively few nonnative

Table 1. Outline of Knowledge Base Summaries in the Fire Effects Information System (FEIS).

Plant species summary	Wildlife species summary	Küchler type summary ^a
Introductory information	Introductory information	Introductory information
Taxonomy	Taxonomy	Physiognomy
Federal legal status ^b	Federal legal status ^b	Occurrence
Distribution, occurrence	Distribution, occurrence	Description
States, provinces	States, provinces	Climate, soils
Vegetation types ^c	Vegetation types ^c	Vegetation
Botany, ecology	Biology, habitat	Wildlife
Description	Life history	Ecology
Regeneration	Habitat, cover needs	Value, use
Succession	Food habits	Forestry
Seasonal development	Predators	Range
Fire ecology	Management	Wildlife
Adaptations	Fire effects, use	Other
Historic fire regimes	Direct effects	Fire ecology and management
Fire effects	Habitat-related effects	Fuels
Immediate responses	Fire use	Flammability
Post-fire responses	Fire case studies	Fire occurrence
Fire management		Fire management
Fire case studies		Post-fire rehabilitation
Management considerations		
Impacts, control		

^a Küchler (1964) potential natural vegetation type.

^b Examples include threatened or endangered status, noxious weed status.

^c FEIS includes information on forest and range ecosystems (Garrison et al. 1977), Küchler potential natural vegetation types (1964), forest cover types (Eyre 1980), and range cover types (Shiflet 1994).

invasive species because, with a few notable exceptions such as cheatgrass (*Bromus tectorum*), published literature on their relationships with fire tends to be sparse. A program begun in 2001 is increasing the information on nonnative invasive species in FEIS by accessing expertise of field managers as well as published literature.

Scientific information in journal articles, theses, and other publications is often too diffuse or too detailed to help managers. Research on a particular species may be sparse and difficult to locate, or it may be copious and impossible to synthesize in the time available. Either way, it is difficult for managers to use. The Knowledge Base Summaries in FEIS synthesize the knowledge available and identify knowledge gaps, following a consistent outline so users can locate information easily (Table 1). Knowledge Base Summaries describe historic fire regimes, adaptations to fire, primary and secondary effects of fire, and other fire management considerations. If a published resource contains extensive information from a burning program—pre-burn conditions, fire weather, fire behavior, and post-fire response—the Knowledge Base Summary includes a case study describing the project in detail. Knowledge Base Summaries also provide information about the biology and ecology of

a species, its distribution, and management practices.

To prepare a Knowledge Base Summary, writers obtain information from a library and citation database containing more than 40,000 references at the Fire Sciences Laboratory, Missoula, Montana. They obtain additional information from other citation databases and, if needed, from field researchers. If writers cannot find information for a required information category, they identify the knowledge gap in the Knowledge Base Summary. Many summaries include links to information in other botanical and ecological databases on the Internet. Links to the U.S. Department of Agriculture's PLANTS database (<http://plants.usda.gov/>) and the U.S. Geological Survey's tree species range maps (<http://climchange.cr.usgs.gov/data/atlas/little/>), for example, provide distribution information for many species.

INFORMATION ON FIRE AND INVASIVE SPECIES

The FEIS staff began work in 2001 with the Wildland Invasive Species Team of The Nature Conservancy to revise or add 60 nonnative invasive plant species to FEIS by the end of 2003. Species were selected after consultation with coordinators of weed management programs from the regional offices of all U.S.

Table 2. Sixty nonnative invasive species that are being added to or revised in the Fire Effects Information System (FEIS). Each table row refers to a single Knowledge Base Summary. "Revision" refers to species already in FEIS that will be updated; "new" refers to species not previously included in FEIS.

Genus and species ^a to be included in Knowledge Base Summary	Number of species	
	Revision	New
Asiatic tearthumb (<i>Polygonum perfoliatum</i>)		1
Autumn-olive (<i>Elaeagnus umbellata</i>)	1	
Brazilian peppertree (<i>Schinus terebinthifolius</i>)	1	
Broom species (<i>Cytisus scoparius</i> , <i>C. striatus</i> , <i>Genista monspessulana</i> , <i>Spartium junceum</i>)		4
Bull thistle (<i>Cirsium vulgare</i>) [<i>Carduus lanceolatus</i>]	1	
Butter-and-eggs (<i>Linaria vulgaris</i>)		1
Canada thistle (<i>Cirsium arvense</i>)	1	
Cheatgrass [downy brome] (<i>Bromus tectorum</i>)	1	
Chinese lespedeza (<i>Lespedeza cuneata</i>)	1	
Climbing fern species (<i>Lygodium microphyllum</i> , <i>L. japonicum</i>)		2
Common St. Johnswort (<i>Hypericum perforatum</i>)		1
Dalmatian toadflax (<i>Linaria dalmatica</i>) [<i>L. genistifolia</i>]		1
Diffuse knapweed (<i>Centaurea diffusa</i>)	1	
Dyer's woad (<i>Isatis tinctoria</i>)		1
Field bindweed (<i>Convolvulus arvensis</i>)	1	
Garlic mustard (<i>Alliaria petiolata</i>)		1
Giant reed (<i>Arundo donax</i>)	1	
Hoary cress (<i>Cardaria draba</i>)	1	
Honeysuckle species (<i>Lonicera morrowii</i> , <i>L. maackii</i> , <i>L. tatarica</i> , <i>L. xbella</i> , <i>L. fragrantissima</i> , <i>L. xylosteum</i>)		6
Houndstongue [Gypsyflower] (<i>Cynoglossum officinale</i>)		1
Japanese honeysuckle (<i>Lonicera japonica</i>)	1	
Johnson grass (<i>Sorghum halepense</i>)	1	
Kudzu (<i>Pueraria montana</i> var. <i>lobata</i>) [<i>P. lobata</i>]	1	
Melaleuca (<i>Melaleuca quinquenervia</i>)	1	
Multiflora rose (<i>Rosa multiflora</i>)	1	
Nepalese browntop (<i>Microstegium vimineum</i>)		1
Nodding plumeless thistle [Musk thistle] (<i>Carduus nutans</i>) [<i>Carduus thoermeri</i>]	1	
Norway maple (<i>Acer platanoides</i>)		1
Oriental bittersweet (<i>Celastrus orbiculatus</i>)		1
Perennial pepperweed (<i>Lepidium latifolium</i>)	1	
Perennial sowthistle (<i>Sonchus arvensis</i>)	1	
Privet species (<i>Ligustrum vulgare</i> , <i>L. sinense</i> , <i>L. japonicum</i> , <i>L. amurense</i>)		4
Purple loosestrife (<i>Lythrum salicaria</i>)	1	
Reed canarygrass (<i>Phalaris arundinacea</i>)	1	
Rush skeletonweed (<i>Chondrilla juncea</i>)		1
Russian knapweed (<i>Acroptilon repens</i>) [<i>Centaurea repens</i>]	1	
Russian-olive (<i>Elaeagnus angustifolia</i>)		1
Satintail (<i>Imperata cylindrica</i> , <i>I. brasiliensis</i>)		2
Smooth brome (<i>Bromus inermis</i>)	1	
Spotted knapweed (<i>Centaurea maculosa</i>) [<i>C. biebersteinii</i> , <i>C. stoebe</i> spp. <i>micranthos</i>]	1	
Sulfur cinquefoil (<i>Potentilla recta</i>)	1	
Tallowtree [Chinese tallow] (<i>Triadica sebifera</i>) [<i>Sapium sebiferum</i>]		1
Tamarisk species (<i>Tamarix ramosissima</i> , <i>T. chinensis</i> , <i>T. parviflora</i>)	1	2
Tree-of-heaven (<i>Ailanthus altissima</i>)		1
Yellow starthistle (<i>Centaurea solstitialis</i>)	1	

^a Synonyms are listed in brackets.

federal land management agencies and tribal governments. Representatives from these groups nominated 156 species for the project. From this list, 60 species were selected (Table 2), based on the number of nominations received by the species, the breadth of its geographic distribution, the urgency of information need, and the quantity of published literature about the species and fire.

Research on invasive species is accumulating rapidly. However, published research on fire effects for many invasive species remains sparse. Furthermore, as nonnative invasive species move into new ecosystems, existing research may not apply. To supplement published information, FEIS writers obtain unpublished reports from the Wildland and Invasive Species Team and query field researchers and managers. Writers also link FEIS Knowledge Base summaries to Internet sites containing current information on control methods, such as the Weed Control Methods Handbook (<http://tncweeds.ucdavis.edu/handbook.html>). To provide managers with information on invasive species not included in FEIS, the system links to other databases describing the ecology and management of invasive species—for example, the Element Stewardship Abstracts provided by the Nature Conservancy's Wildland Invasive Species Team (<http://tncweeds.ucdavis.edu/esadocs.html>).

CONCLUSION

The Fire Effects Information System provides comprehensive, easily accessible information on fire's interactions with hundreds of plant and animal species in North America. A current project is enhancing the system's information on nonnative invasive species. Readers are urged to visit the system online (www.fs.fed.us/database/feis) and read Knowledge Base Summaries as they are completed. Examples of recently completed summaries include Canada thistle (*Cirsium arvense*), spotted knapweed (*Centaurea maculosa*), and garlic mustard (*Alliaria petiolata*).

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