Finding the Best Science Available on Fire Ecology and Fire Regimes of Northeastern, Great Lakes, and Appalachian Ecosystems

Ilana Abrahamson, *ilanalabrahamson@fs.fed.us and* Robin Innes, *rinnes@fs.fed.us*

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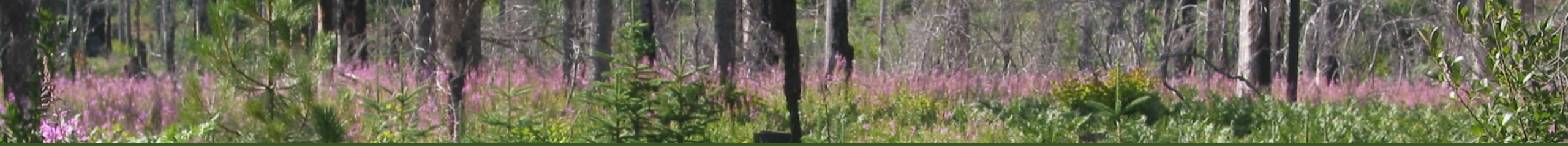
Lake States Fire Science Consortium

NORTH ATLANTIC FIRE SCIENCE EXCHANGE

CONSORTIUM OF APPALACHIAN FIRE MANAGERS & SCIENTISTS



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Rocky Mountain Research Station
Fire, Fuel, and Smoke Science Program
Fire Modeling Institute

Seeking Information on Fire

- How might the use of prescribed fire affect a species?
- How can I find information on historical fire regimes?
- How have fuels changed in the past 100 years?
- How does wildland fire affect nonnative, invasive plants?
- How might climate change affect fire regimes in the future?

The Fire Effects Information System (FEIS)
was designed to help answer these questions and more

Fire Effects Information System (FEIS)

>1,200

Native and nonnative species

Online collection of peer-reviewed syntheses on fire ecology and fire regimes in the United States designed to meet needs of managers

Plants, lichens, and animals

Primary audience

- Fire management
- Fuels management
- General planning
- NEPA documents

www.feis-crs.org/feis/

Synthesis

- Literature review
- Describe patterns or lack of patterns
- Explain what is known, or not known
- Describe implications for management

www.feis-crs.org/feis/

In-text citations

The ability of white mulberry to sprout from the stump or roots suggests that top-killed white mulberry plants may regenerate vegetatively following fire [21,61,136,150].

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Fire Effects Information System (FEIS)

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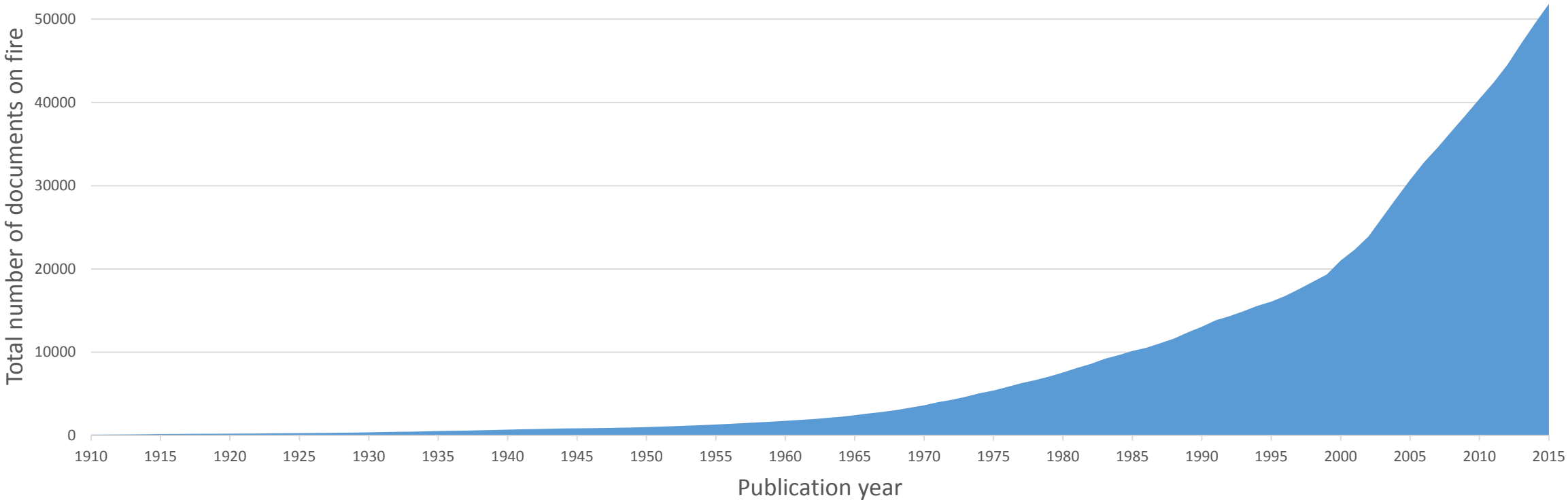

Data from FRAMES Resource Catalog, 2016 July 5

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- Reports

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Pinus rigida

- INTRODUCTORY
- DISTRIBUTION AND OCCURRENCE
- BOTANICAL AND ECOLOGICAL CHARACTERISTICS
- FIRE ECOLOGY
- FIRE EFFECTS
- FIRE CASE STUDY
- MANAGEMENT CONSIDERATIONS
- REFERENCES

INTRODUCTORY

- AUTHORSHIP AND CITATION
- FEIS ABBREVIATION
- NRCS PLANT CODE
- COMMON NAMES
- TAXONOMY
- SYNONYMS
- LIFE FORM
- FEDERAL LEGAL STATUS
- OTHER STATUS

© Tom Palmer, Friends of the Blue Hills.
Photo taken 10 weeks after a late April fire.

AUTHORSHIP AND CITATION:
Gucker, Corey L. 2007. Pinus rigida. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2016, July 5].

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- provide up-to-date information to the management community on historical fire regimes and contemporary changes in fuels and fire regimes,
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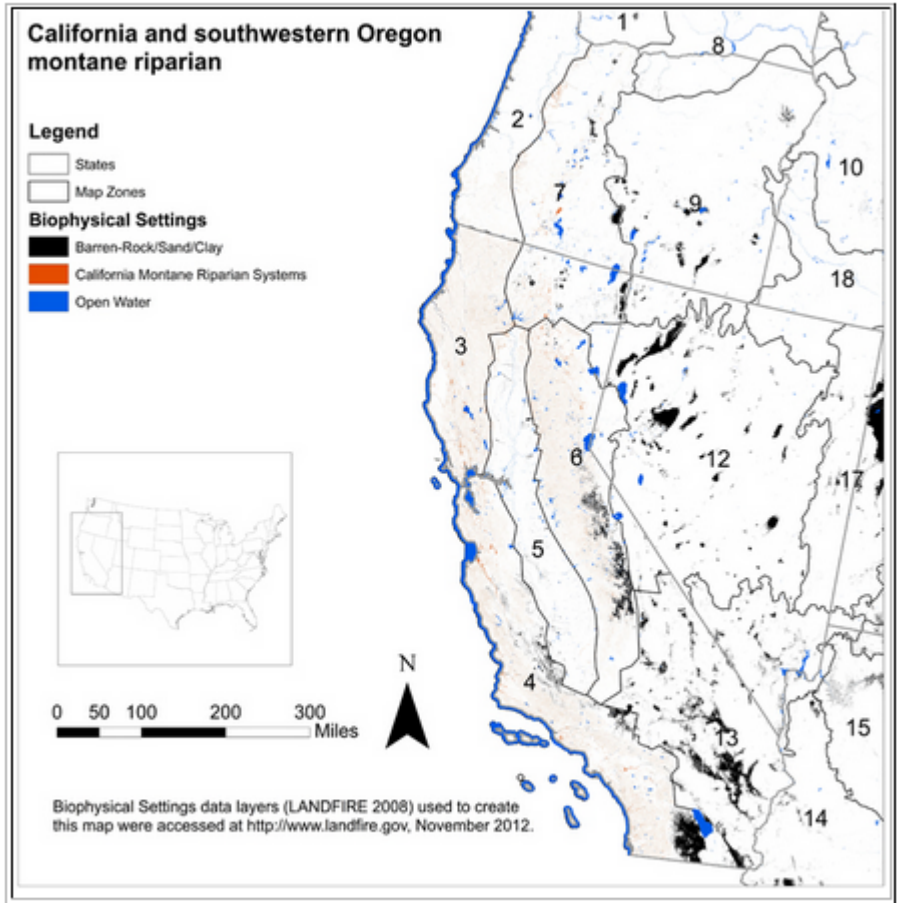

Figure 1. Distribution of California montane riparian communities based on the LANDFIRE Biophysical Settings (BpS) data layer [51]. Numbers indicate LANDFIRE map zones. LANDFIRE did not map every BpS in this group. Click on the map for a larger image and zoom in to see details.

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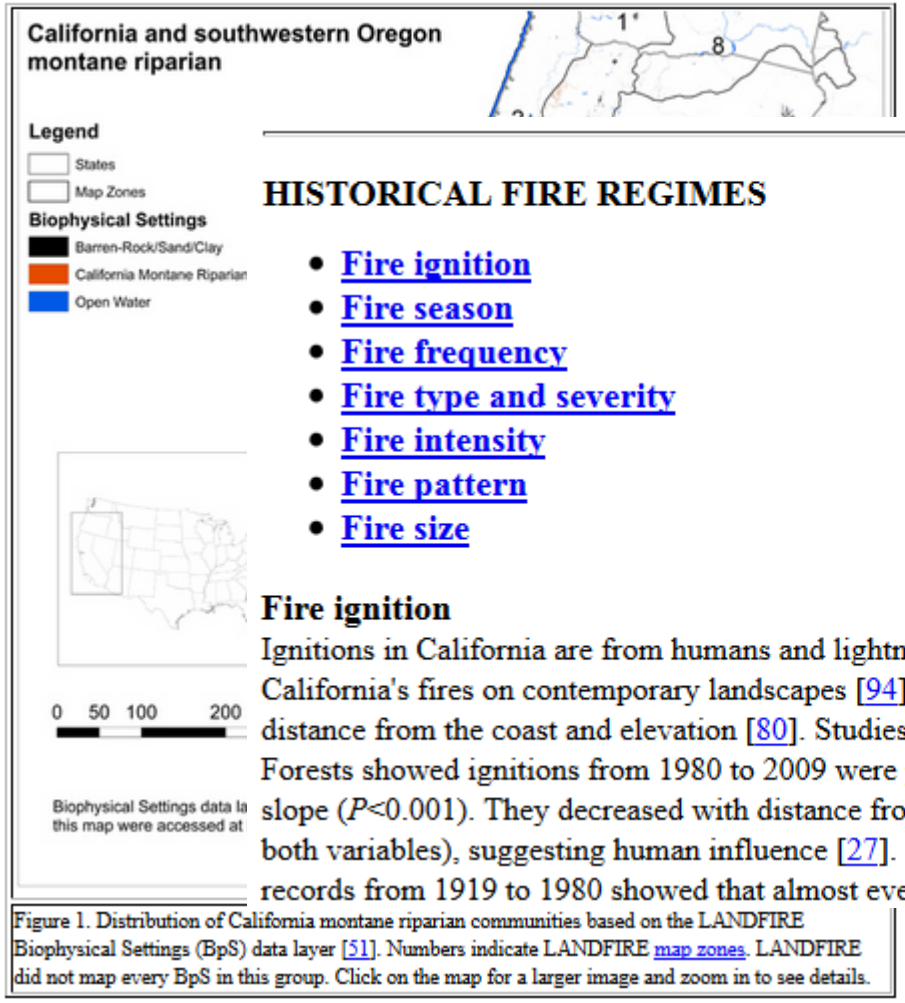

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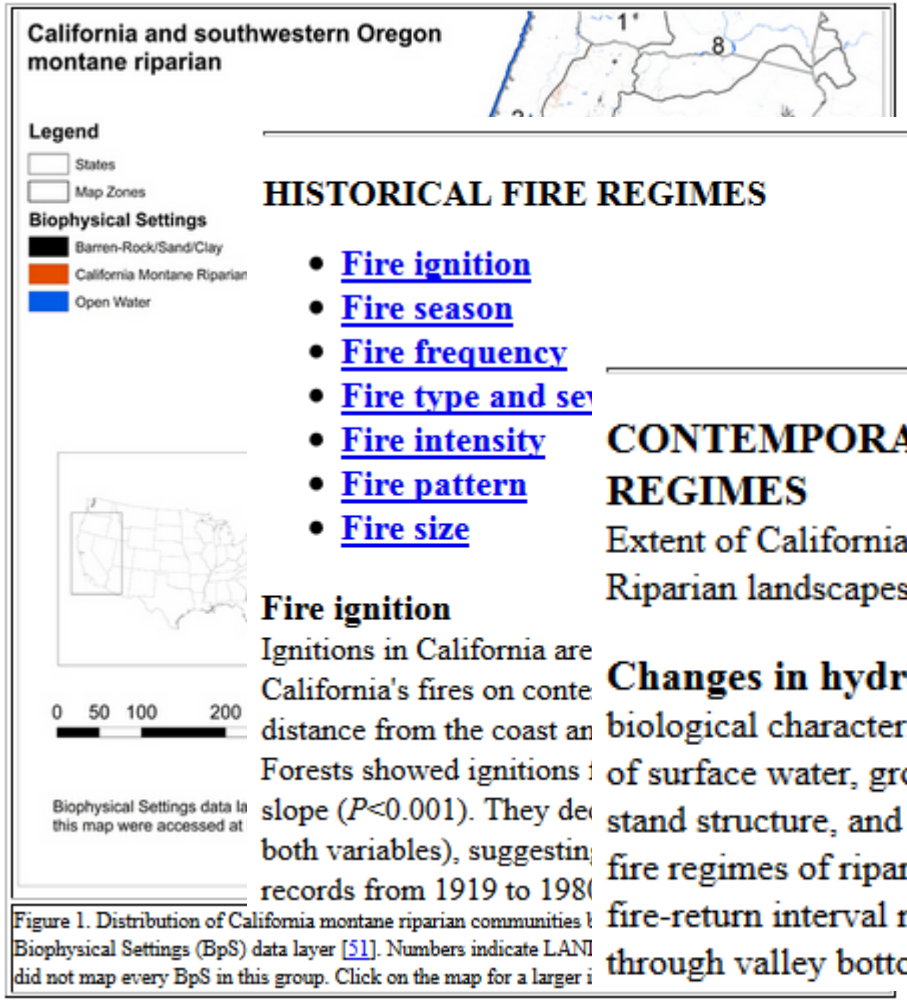
HISTORICAL FIRE REGIMES

- Fire ignition
- Fire season
- Fire frequency
- Fire type and severity
- Fire intensity
- Fire pattern
- Fire size

Fire ignition

Ignitions in California are from humans and lightning [52]. Humans start >80% of California's fires on contemporary landscapes [94]. Lightning ignitions tend to increase with distance from the coast and elevation [80]. Studies across southern California's National Forests showed ignitions from 1980 to 2009 were positively associated with steepness of slope (P<0.001). They decreased with distance from roads and development (P<0.0001 for both variables), suggesting human influence [27]. In the Santa Monica Mountains, fire records from 1919 to 1980 showed that almost every fire was started by humans. Lightning

DISTRIBUTION AND PLANT COMMUNITY COMPOSITION



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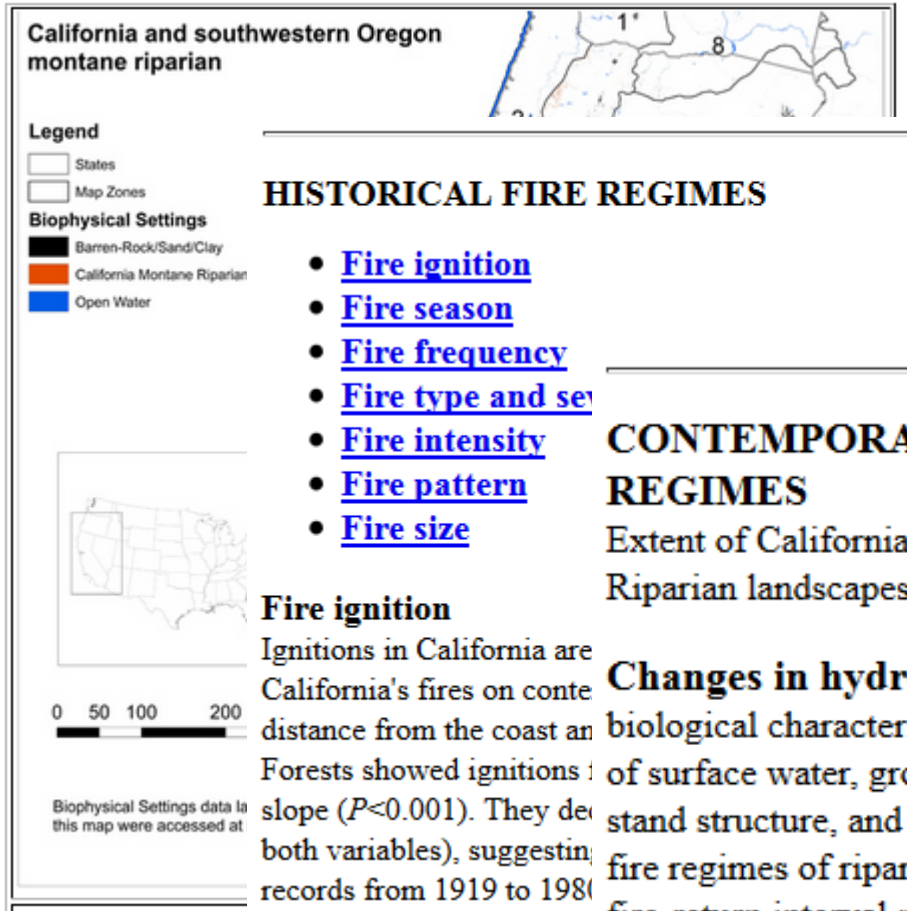
CONTEMPORARY CHANGES IN HYDROLOGY, FUELS, AND FIRE REGIMES

Extent of California's riparian systems is greatly reduced from historical ranges [73,99]. Riparian landscapes are estimated at 2% of their extent 300 years ago [38,73].

Changes in hydrology and fuels: Land use and management have altered physical and biological characteristics of many riparian areas in California. Alterations include lowering of surface water, groundwater, and biotic diversity; and changes in floodplain topography, stand structure, and species composition. These human disturbances can profoundly affect fire regimes of riparian areas [23]. Shaffer and others [76] suggested that although the fire-return interval may not have changed due to altered stream flows, fires probably move through valley bottoms and low-gradient riparian zones differently than they did historically.

DISTRIBUTION AND PLANT COMMUNITY COMPOSITION



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LIMITATIONS OF INFORMATION

Few studies to date (2015) focused on fire regimes within riparian zones of California and southwestern Oregon. Most studies of fire effects and fire regimes do not differentiate between riparian and upland ecosystems [62,94]. More research is needed on fire regimes of riparian areas and relationships between riparian and upland fire regimes [23].

Since the riparian zone serves as a buffer and filter for the aquatic zone, understanding fire effects in riparian ecosystems is critical in determining fire effects on stream ecosystems. Further studies are needed on how riparian vegetation recovers after fire [94]. There is little research on how management activities designed to prevent, suppress, or recover from fire affect riparian vegetation. Studies are needed to guide such management actions [94].

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Appendix A. BpSs covered by this Fire Regime Synthesis

BpSs covered by this Fire Regime Synthesis. Data are derived from LANDFIRE succession modeling. Fire regime groups I-V describe a pattern of fire frequency and severity for historical fire regimes. "NA" refers to BpS models that did not include fire in simulations; for these BpS models, cells for fire interval and percent of fires are blank. Fire interval refers to average historical fire-return interval in years. Percent of fires is listed by severity class: Replacement-severity fires cause >75% kill or top-kill of the upper canopy layer; mixed-severity fires cause 26%-75%; and low-severity fires cause <26%. Terms are defined in the FEIS Glossary

Region	Biophysical Setting name	BpS code	BpS URL	Fire regime group	Fire interval (yr)	% of fires replacement severity	% of fires mixed severity	% of fires low severity
California	California montane riparian systems	0311520	http://www.fs.fed.us/database/feis/pdfs/BpS/0311520.pdf	III	37	60	40	0
California	California montane riparian systems	0411520	http://www.fs.fed.us/database/feis/pdfs/BpS/0411520.pdf	III	75	17	83	0
California	California montane riparian systems	0511520	http://www.fs.fed.us/database/feis/pdfs/BpS/0511520.pdf	III	75	17	83	0
California	California montane riparian systems	0611520	http://www.fs.fed.us/database/feis/pdfs/BpS/0611520.pdf	III	50	56	44	0
California	Rocky Mountain subalpine-upper montane riparian systems	0611600	http://www.fs.fed.us/database/feis/pdfs/BpS/0611600.pdf	III	63	25	0	75
Pacific Northwest	California montane riparian systems	0211520	http://www.fs.fed.us/database/feis/pdfs/BpS/0211520.pdf	III	37	60	40	0
Pacific Northwest	California montane riparian systems	0711520	http://www.fs.fed.us/database/feis/pdfs/BpS/0711520.pdf	III	37	60	40	0

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 0311520** **California Montane Riparian Systems**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field) **Date** 12/20/2005

Modeler 1	Louis Provencher	lprovencher@tnc.org	**Reviewer**
Modeler 2	Don Major	dmajor@tnc.org	**Reviewer**
Modeler 3	John Foster	jfoster@tnc.org	**Reviewer**

Vegetation Type
Wetlands/Riparian

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
SABR2
CUSA3
FRCA12
UMCA
CIFO2
STAL

Map Zone
3

Model Zone
☐ Alaska
☑ California
☐ Great Basin
☐ Great Lakes
☐ Hawaii
☐ Northeast
☐ Northern Plains
☐ N-Cent.Rockies
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

Geographic Range

This ecological system is found mostly in the central and inner northern Coast Ranges of California and Sierra Nevada foothills.

Biophysical Site Description

It includes springs, seeps, and perennial and intermittent streams in serpentine substrates and non-serpentine substrates.

In MZ03, there is less contrast between the riparian areas and the nearby uplands than in other parts of California where the mediterranean climate is more prominent (Schoenherr, 1992).

Vegetation Description

This system often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. The variety of plant associations connected to this system reflects elevation, stream gradient, floodplain width, and flooding events. Dominant trees may include Alnus rhombifolia, Acer negundo, Alnus rubra (in Coast Ranges), Populus fremontii, Salix laevigata, Salix gooddingii, Pseudotsuga menziesii, Platanus racemosa, Quercus agrifolia, and Acer macrophyllum (in central and south coast). Dominant shrubs include Salix exigua and Salix lasiolepis.

At lowest elevations, the riparian areas may contain madrone, tanoak, CA laurel, dogwood, maple and

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U.S. Department of Agriculture, Forest Service, Missoula Fire Sciences Laboratory. 2012. Information from LANDFIRE on fire regimes of Appalachian oak-hickory communities. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/fire_regimes/Appalachian_oak_hickory/all.html [2016, July 5].

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Table 1. Modeled fire intervals and severities in Appalachian oak-hickory communities [3]

Fire interval[1]	Fire severity[2] (% of fires)			Number of Biophysical Settings (BpSs) in each fire regime group					
	Replacement	Mixed	Low	I	II	III	IV	V	NA[3]
2-28 years	0-90	0-21	10-100	22	3	0	0	0	0

[1]Average historical fire-return interval derived from LANDFIRE succession modeling (labeled "MFRI" in LANDFIRE).
[2]Percentage of fires in 3 fire severity classes, derived from LANDFIRE succession modeling. Replacement-severity fires cause >75% kill or top-kill of the upper canopy layer; mixed-severity fires cause 26%-75%; low-severity fires cause <26% [1,2].
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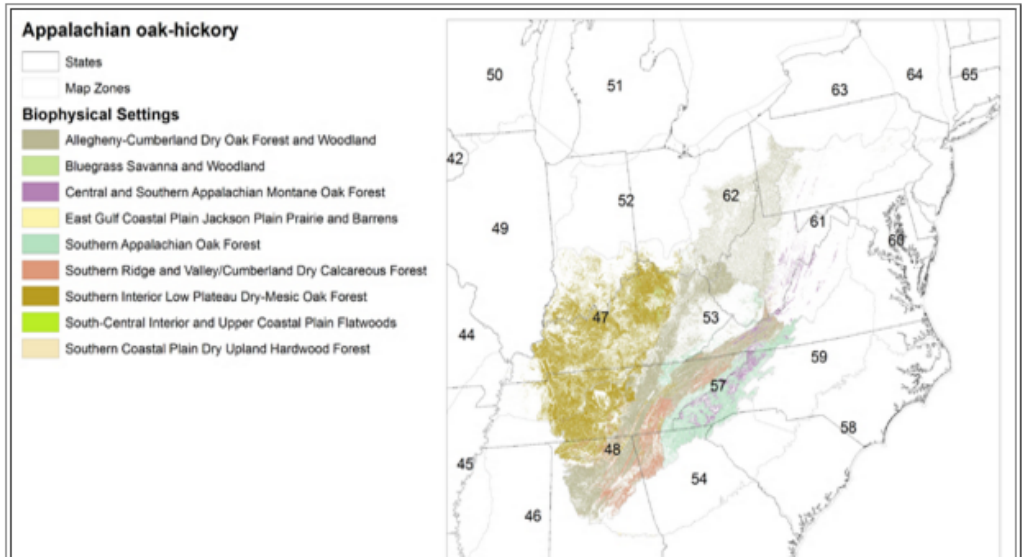

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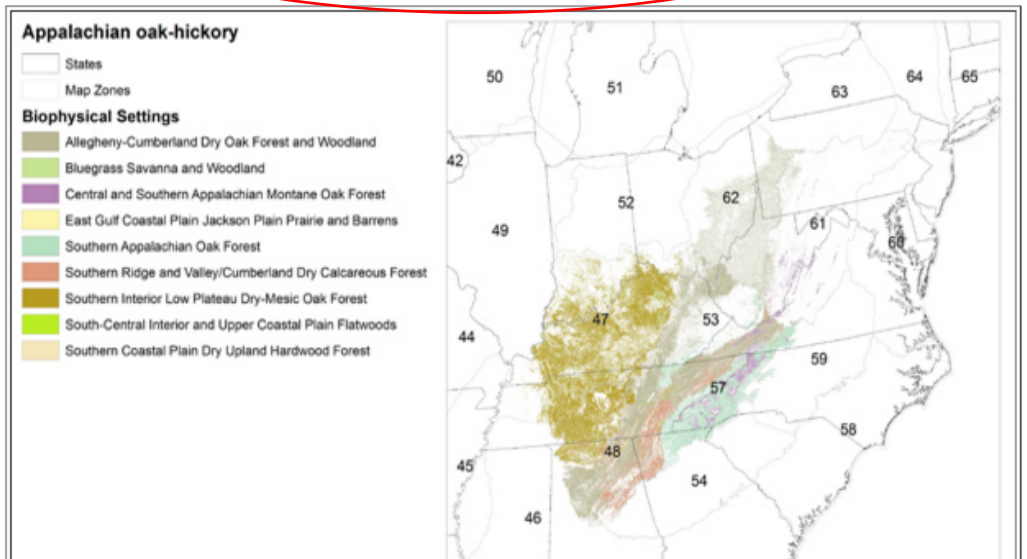

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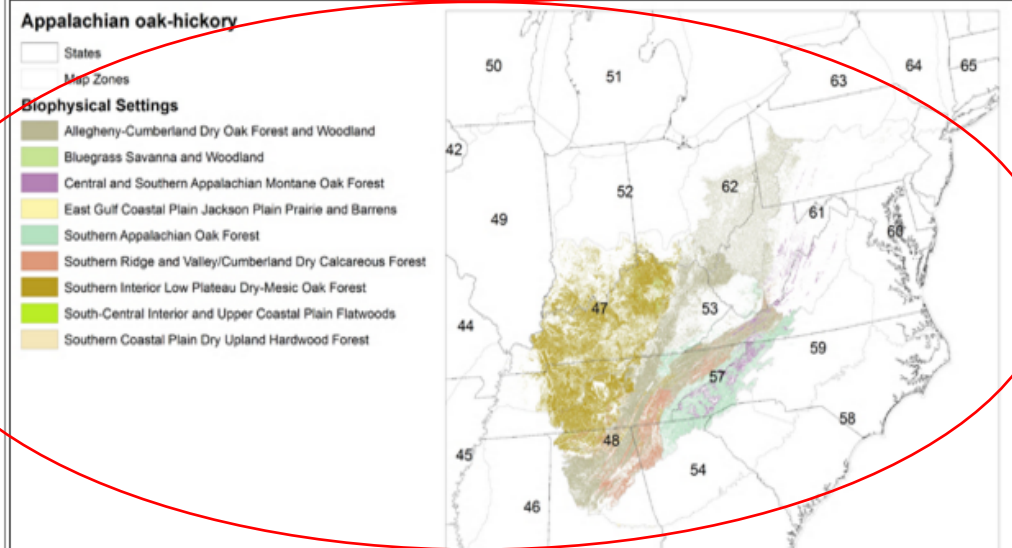

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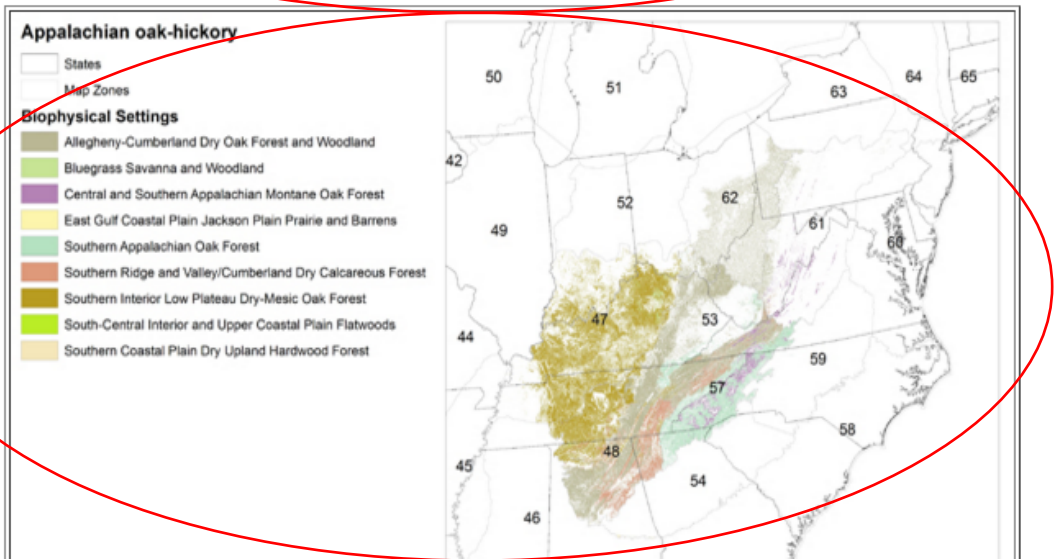
Table 1. Modeled fire intervals and severities in Appalachian oak-hickory communities [3]

Fire interval[1]	Fire severity[2] (% of fires)			Number of Biophysical Settings (BpSs) in each fire regime group					
	Replacement	Mixed	Low	I	II	III	IV	V	NA[3]
2-28 years	0-90	0-21	10-100	22	3	0	0	0	0

[1]Average historical fire-return interval derived from LANDFIRE succession modeling (labeled "MFRI" in LANDFIRE).
[2]Percentage of fires in 3 fire severity classes, derived from LANDFIRE succession modeling. Replacement-severity fires cause >75% kill or top-kill of the upper canopy layer; mixed-severity fires cause 26%-75%; low-severity fires cause <26% [1,2].
[3]NA (not applicable) refers to BpS models that did not include fire in simulations.



LANDFIRE BpS Review

www.landfirereview.org

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Biophysical Settings Review Site

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We Need Your Help!

You Can Contribute to Ecological Knowledge

All ecosystems are dynamic, changing due to growth, succession and disturbances. Modeling large landscapes in the United States requires the collective knowledge of experienced and knowledgeable vegetation and fire experts. In collaboration with hundreds of colleagues, LANDFIRE produced more than 1,000 state-and-transitions models and descriptions — one for every ecosystem (called Biophysical Settings or BpS) mapped by the Program. The result is a major contribution to basic and applied vegetation ecology across the country.

LANDFIRE models and descriptions represent how Biophysical Settings looked and worked prior to major European settlement. These models and descriptions are used in research and play a part in national vegetation mapping and assessment and on-the-ground management across the country. A new phase is underway as LANDFIRE deepens and broadens the science and applicability of those models and descriptions.

All model/description reviews received by July 1, 2016 will be considered for incorporation into the next delivered version of the BpS models and descriptions. However, we will accept reviews at any time thereafter as well and will consider them for incorporation at an appropriate time in the future.

About The Nature Conservancy's LANDFIRE Team

LANDFIRE is a national program whose people and resources are drawn from agencies and organizations across the United States. The Nature Conservancy, a LANDFIRE partner, is leading the BpS review. TNC's LANDFIRE team is located coast to coast—Florida, Illinois, Minnesota, Colorado, Oregon. We run the Conservancy's Conservation Gateway LANDFIRE website and regularly publish bulletins and news.

FEIS Publications

Species Reviews

Fire Regimes

- Syntheses
- Reports

Fire Studies

Research Project Summary: Effects of surface fires in a mixed red and eastern white pine stand in Michigan

- RESEARCH PROJECT SUMMARY CITATION
- STUDY LOCATION
- PLOT DESCRIPTION
- PREFIRE PLANT COMMUNITY
- PLANT PHENOLOGY
- FIRE SEASON/SEVERITY CLASSIFICATION
- FIRE DESCRIPTION
- FIRE EFFECTS ON PLANT COMMUNITY
- FIRE MANAGEMENT IMPLICATIONS
- REFERENCES

RESEARCH PROJECT SUMMARY CITATION:
Gucker, Corey L, compiler. 2005. Research Project Summary: Effects of surface fires in a mixed red and eastern white pine stand in Michigan. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/research_project_summaries/Neumann01/all.html [2016, July 5].

Source: Unless otherwise indicated, the information in this Research Project Summary comes from the following paper:

Neumann, David D.; Dickmann, Donald I. 2001. Surface burning in a mature stand of Pinus resinosa and Pinus strobus in Michigan: effects on understory vegetation. International Journal of Wildland Fire. 10: 91-101.

STUDY LOCATION:
Prescription fires burned in Compartment 7 of the W. K. Kellogg Experimental Forest (42° 22' N, 85° 20' W) of Kalamazoo County in Michigan's southwestern lower peninsula.

SITE DESCRIPTION:
Burning occurred in a 4-ha red pine (*Pinus resinosa*) and eastern white pine (*P. strobus*) plantation established in 1932. The plantation was on a hillside sloping in an east to west direction; only 1 ha was level. Trees had been thinned periodically since 1950. Soils were well-drained, fine to coarse, sandy loams [4].

PREFIRE PLANT COMMUNITY:
The study site is in the following vegetation classifications:

FRES10 White-red-jack pine [2]
K095 Great Lakes pine forest [3]
SAF 15 Red pine [1]
SAF 20 White pine-northern red oak-red maple

Prior to the fires, the average density of red pine was 131 trees/ha, dbh ranged from 16 to 40 cm, and average basal area was 29 m^2/ha. The average density of white pine trees was 93/ha, dbh measurements ranged from 20 to 60 cm, and basal area averaged

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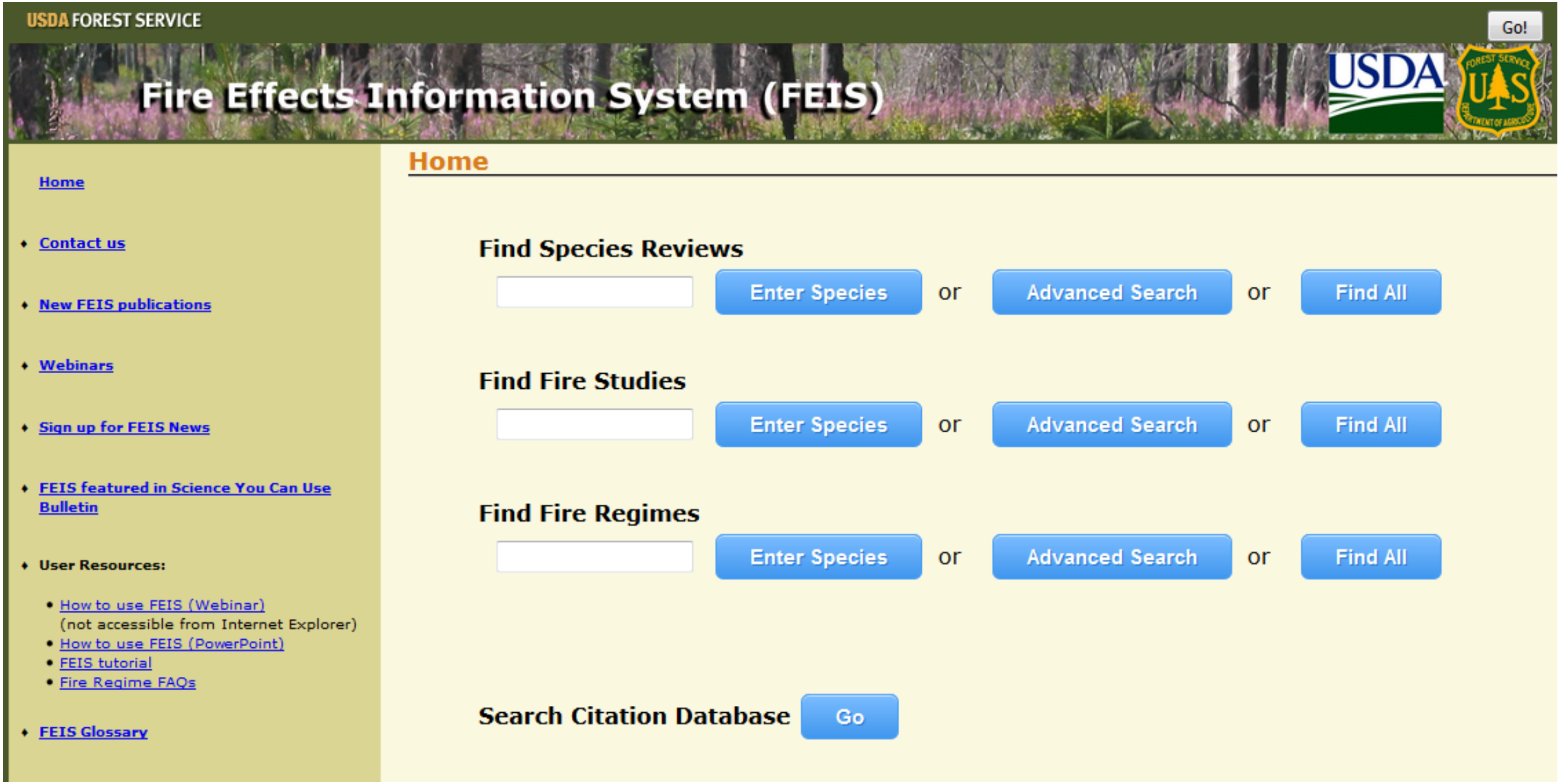
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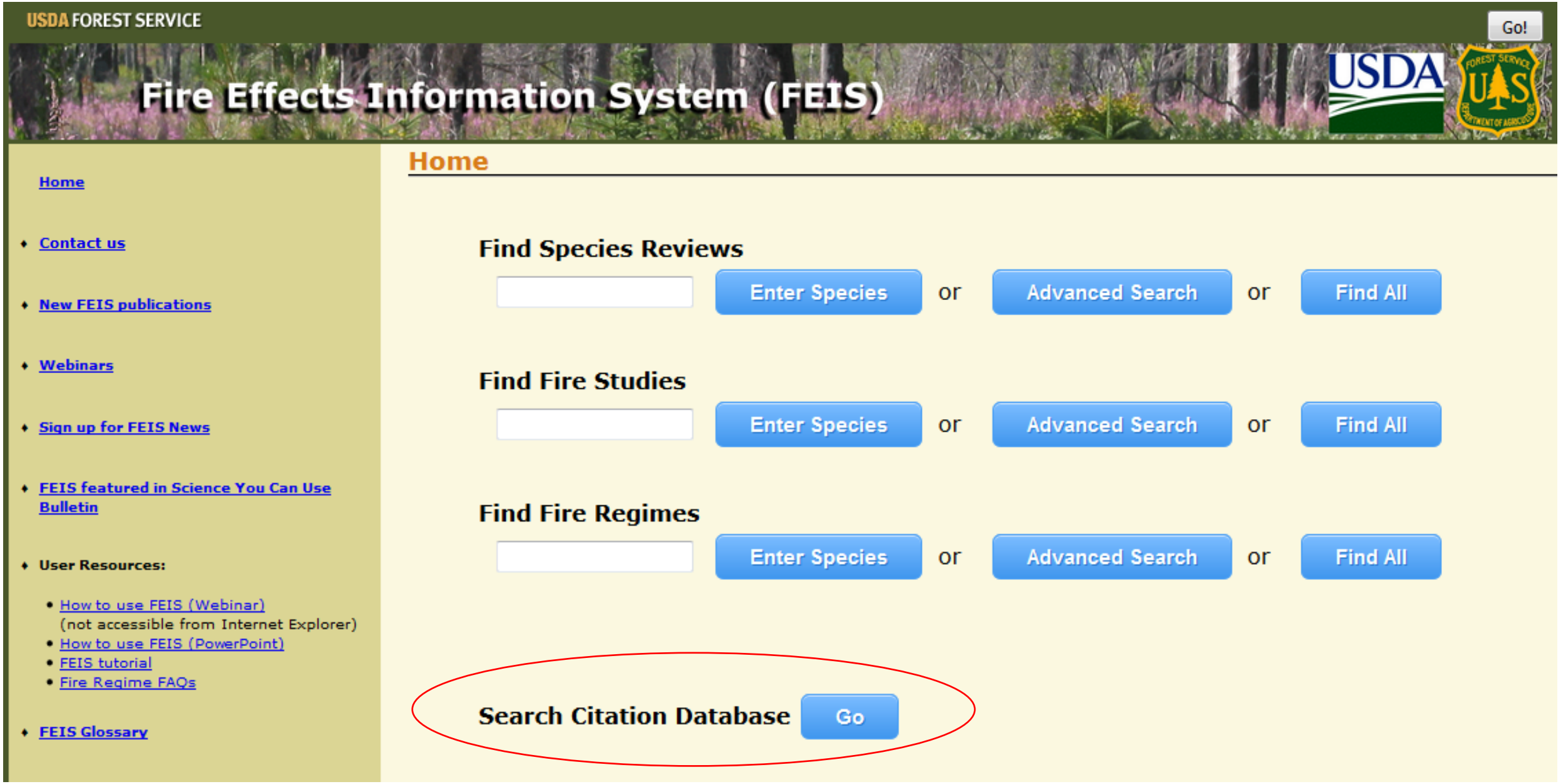
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Welcome to the CRS Home Page!

The Citation Retrieval System (CRS) is the literature database for the Fire Effects Library, which is located at the Missoula Fire Sciences Laboratory and serves the Fire Effects Information System (FEIS). CRS contains references on the distribution, biology, ecology, and fire responses of organisms in North America. The system contains more than 58,000 citations. You are welcome to search CRS to find citations! Please note that the Missoula Fire Lab is not a copying service or a lending library.

Contact CRS staff for help with complex searches.

Oct 13, 2015
13:35:15

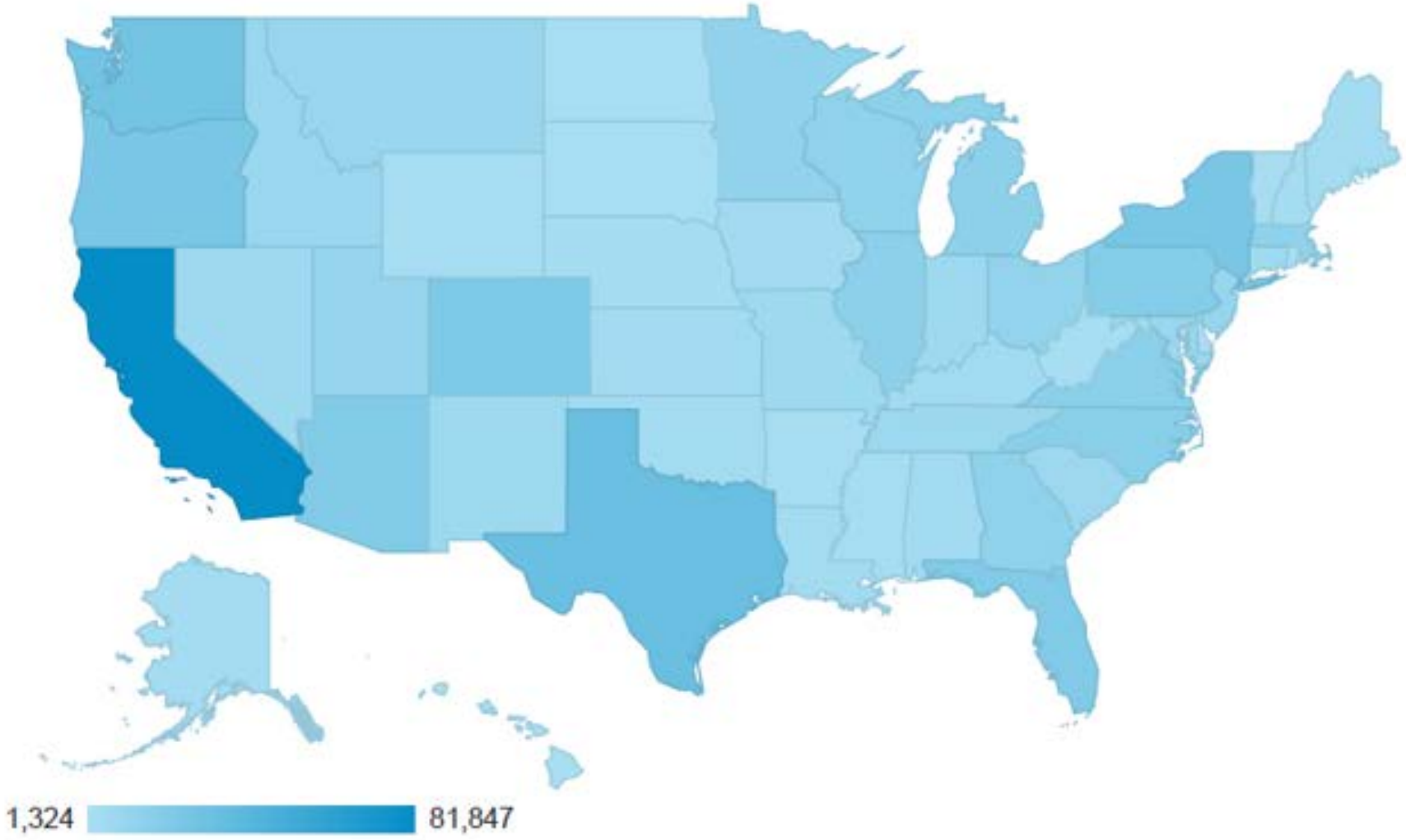
CRS 3 (Build 111) by SEM LLC

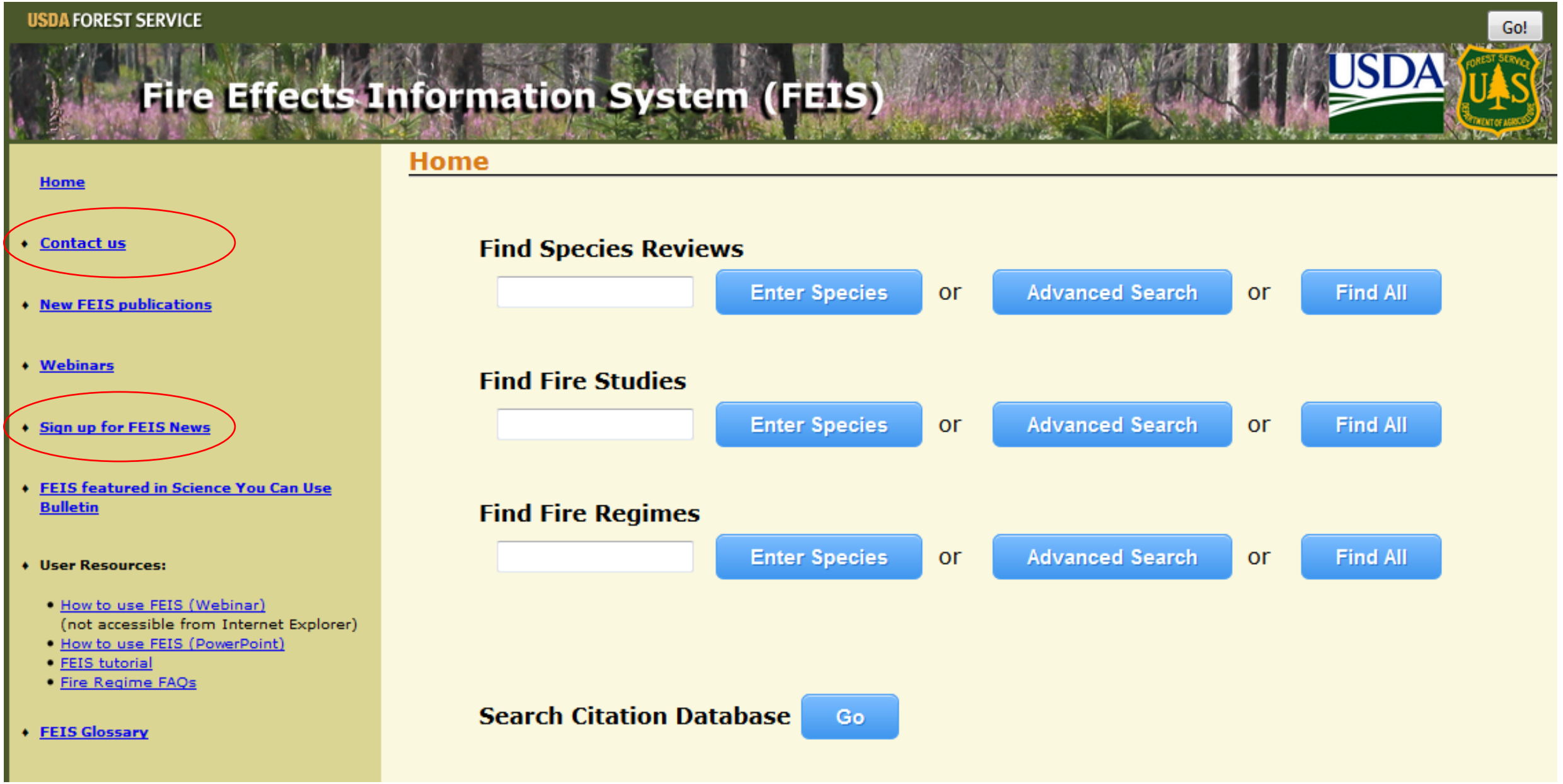
Seeking Information on Fire

- How might the use of prescribed fire affect a species? Species Reviews & Fire Studies
- How can I find information on historical fire regimes? Fire Regime Reports & Syntheses
- How have fuels changed in the past 100 years? Fire Regime Syntheses
- How does wildland fire affect nonnative invasive plants? Species Reviews & Fire Studies
- How might climate change affect fire regimes in the future? Fire Regime Syntheses

The Fire Effects Information System (FEIS)
can help answer these questions and many more!

Number of visits to FEIS by state in 2015

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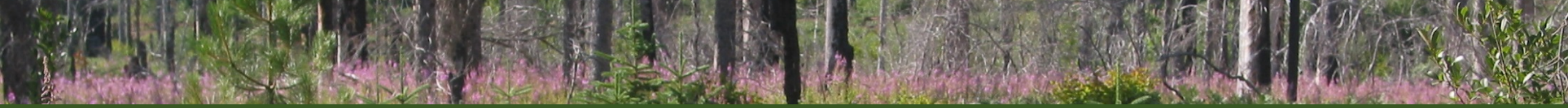

Fire Effects Information System (FEIS)

www.feis-crs.org/feis/

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Robin Innes, *rinnes@fs.fed.us*

Thank you!