Final Report
Joint Fire Science Program
Project 98-1-5-02

Fire Ecology Information for California

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Summary of Project Accomplishments

Fire is a major process in California ecosystems. Land owners, land managers and scientists require better access and synthesis to understand the role of fire and to make more informed fire and fuels restoration and management decisions. This project provides an unprecedented level of information, synthesis and access to fire information and research statewide. This designed set of integrated projects provides the basic information tools to support fire management and the study and teaching of fire ecology in California.

The web accessible, searchable bibliography (deliverable 1) provides a tool for conducting comprehensive literature searches and categorizes the references by a number of ecological and vegetation classification systems. This database makes literature searches much more efficient and effective. It was used as a basic search and synthesis tool to improve development information in the Manual of California Vegetation, Fire in California Ecosystems text, and stands alone as an important tool for students, researchers and managers.

The revision of the Manual of California Vegetation (deliverable 2) is a major accomplishment in that it incorporates fire regimes and fire effects on species into the basic definitions of all of the states ecosystems. The vegetative classification system serves as the basic ecosystem structure for the Fire in California Ecosystems text and fully incorporates fire ecology into vegetation ecology statewide. The bioregional workshops that were held to develop the fire regimes and fire effects information represented an unprecedented level of cooperation between vegetation and fire ecologists

from a wide array of organizations. Information from the workshops provides an wealth of information on the interactions of fire and vegetation in the diversity of California vegetation.

The Fire in California Ecosystems text (deliverable 3) provides the first comprehensive treatment of fire as an ecological process statewide. The list of authors assembled to accomplish this task represents a new level of cooperation and overall expertise. The text defines a new fire regime classification system that is designed to assess changes to fire regimes and understand their biological implications. This system is used in the Manual of California Vegetation and is applied to all of the bioregions in the state to describe dynamic fire-ecosystem interactions. This book has been expanded from a basic fire ecology text to be the standard fire ecology reference for the state bioregions and for a number of management issues.

The internet web page (deliverable 4) provides users with access to all of the information from this project. It also served as an information source to facilitate the communications within the projects and to conduct reviews of the draft texts and information from workshops. This website has further developed into the website for the Association for Fire Ecology and now houses numerous applications covering a variety of fire ecology issues internationally in addition to the California fire ecology information sources from this project.

The Fire Effects Information System continues to be the primary source of synthesized species level information. This project provided a consolidated list of species that were needed in the information base by an interagency group of land managers. An effort on the part of many cooperators to improve the coverage of plants on this list continues. Information from FEIS and the newly added or updated species (deliverable 5) has contributed greatly to the development of the MCV and Fire in California Ecosystems books.

The primary objective of this project is to provide managers, scientists and students in the field of fire ecology with readily accessible and useable synthesized information and to improve access to that information. This project provides a great deal of literature synthesis and improves access to the information through written references, on line databases, and books. The deliverables from this project are the basic building blocks providing a strong foundation to the newly developing field of fire ecology in California.

Deliverable 1) An annotated bibliography of fire ecology literature for California and associated Cross-walk tables by all vegetation and ecosystem classifications used.

An extensive search of electronic databases, scientific literature and other references cited in relevant published and unpublished papers has been completed and used to create a Bibliography for Fire Ecology in California. This Bibliography includes a cross-walk of the literature to major vegetation and ecosystem classifications currently used in California. Annotations were made documenting the vegetation and ecosystem types for which the studies provided information. This information was designed into an automated search program to allow users to search for fire ecology literature by a number of vegetation and ecosystems classification systems including;

- Ecological Subregions
- The Manual of California Vegetation
- The Jepson Manual
- Terrestrial Vegetation of California
- United States Forest Service Ecoregions
- Wildlife Habitat Relationship
- VegClass.

Literature is also searchable by:

- Author
- Title
- Subject and
- Year

Currently 1,191 References are included in this searchable database. This database is located with other information for this project at http://www.ice.ucdavis.edu/cafe/tab_info_biblio.html

Proposed	Delivered

An annotated bibliography of fire ecology literature for California and associated Cross-walk tables by all vegetation and ecosystem classifications used	On line bibliography with the annotations designed into search criteria. The bibliography is searchable by author, title, subject, year, and the seven different vegetation and ecosystem classifications available for California. There are currently 1,191 references in this database.
Other deliverables provided that were not proposed	**This is available on line and is searchable electronically at http://www.ice.ucdavis.edu/cafe/tab_info_biblio.html**

Deliverable 2) Revised manual of California Vegetation including information on fire ecology for each alliance

The Manual of California Vegetation (MCV) has been revised to refine and update the classification of California plant communities at the alliance level. Keys to the alliances and descriptions of each alliance are revised from the original MCV. The descriptions now include fire regime information for over 300 alliances. Tabular information is included detailing fire effects and life history information that influences the species adaptability to different fire regimes for the important and characteristic plant species. This book takes the unprecedented step of defining fire interactions of each alliance and all of the major plant species in California.

To develop and synthesize the fire regime and species-fire interaction information for each alliance, a series of five bioregional expert workshops was held in 2000 and 2002. In the workshops the bioregional experts reviewed each draft alliance concept and description, developed a consensus description of the fire regime based on the structure developed in the Fire in California Ecosystems text (deliverable 3 of this project), and determined the fire conditions in which the important and characteristic species could persist and maintain themselves. This information was synthesized into tables and incorporated into the text by the authors. Workshop dates, locations, participants, draft results, and a list of the alliances covered are listed on the website (deliverable 4). Review of the workshop draft tables was also conducted using the website. A more detailed descriptions of the workshops is available in the final report of the JFSP project 01-3-3-30.

http://www.ice.ucdavis.edu/cafe/tab_mcv.html

This revised text is nearing completion and alliances have been peer reviewed. The California Native Plant Society has agreed to publish the book. Final publication of the book is anticipated for early 2006. Copies will be provided to the JFSP when printing is complete.

Proposed	Delivered

Hold the workshops to collect, review and synthesize fire regime information for California vegetation.	• The first three workshops were held and detailed information is available on http://www.ice.ucdavis.edu/cafe/tab_mcv_wsinfo.html The final two workshops were funded by JFSP project 1-3-3-30.
Revised manual of Calfornia Vegetation including information on fire ecology for each alliance.	• Revised manual of Calfornia Vegetation including information on fire ecology for each alliance has been written and peer reviewed. • The California Native Plant Society has agreed to publish the book. • Final publication is scheduled for early 2006. • Copies will be provided to JFSP when printed. • This project was also partially funded by JFSP project 1-3-3-30.

Proposed	Delivered
Revised manual of Calfornia Vegetation including information on fire ecology for each alliance.	• Revised manual of Calfornia Vegetation including information on fire ecology for each alliance. • The California Native Plant Society has agreed to publish the book.

Deliverable 3) A text on fire ecology of California ecosystems

A text was developed entitled "Fire in California Ecosystems" edited by Neil G. Sugihara, Jan W. van Wagtendonk, JoAnn Fites-Kaufman, Kevin E. Shaffer, and Andrea E. Thode. Each chapter is authored by an authority or authorities on that particular topic, issue or bioregion. This text includes a total of 24 chapters by 35 authors (886 pages of text in the final draft), 214 figures and maps, 4 appendices, front material (including title page, dedication, acknowledgements, preface, table of contents), 20 sidebars, numerous text boxes, over a thousand references and a glossary. The authors are a widely diverse group of subject matter experts from throughout California, and includes most of the widely recognized authorities on fire ecology.

The text includes three parts. Part I) Introduction to Fire Ecology includes chapters that are designed as a textbook on fire ecology for California. It defines the perspective of California ecosystems used in the rest of the book and describes fire as a process. Chapters describe how weather and climate influence fires and fire regimes, fire as a physical and ecological process including a new concept of fire regimes, interactions of fire with the soil, water, and air components of the physical environment and plants and animals. This foundation in fire ecology provides the basis for understanding fire's varying role in the bioregions of California and the issues confronting fire in today's society.

Part II) History and Ecology of Fire in California Bioregions describes nine bioregions and their fire regimes, beginning in the humid northwest and ending in the arid southeast. Each bioregion is covered in a separate chapter with treatments of climate, historic fire, ecological zones, past and present fire regimes and contemporary fire management issues. The bioregions include:

- North Coast
- Klamath Mountains
- Southern Cascades
- Northeastern Plateau
- Sierra Nevada
- Central Valley
- Central Coast

- South Coast
- Southeastern Desert

Part III) Fire Management Issues in California Ecosystems addresses several issues Californians must face if they are to continue live in a fire-prone landscape. Since fire has been a dynamic force in these ecosystems and will continue to be so in the future we must reconcile this ecological fact with need for human society to coexist with fire. Part III provides historical overviews of many important issues, details of the current status of the issues and projections to the future. It includes the following chapters:

- Use of Fire by Native Americans
- Fire Management and Policy Since European Settlement
- Fire and Fuel Management
- Fire, Watershed Resources and Aquatic Ecosystems
- Fire and Air Resources
- Fire and Invasive Plant Species
- Fire and At-Risk Species
- The Future of Fire in California

This text has been peer reviewed, reviewed by several committees, accepted for publication and is currently in production at the University of California Press, Berkeley, CA. Final publication of the book is anticipated for early 2006. Copies will be provided to the JFSP when printing is complete.

Proposed	Delivered
A text on fire ecology of California ecosystems.	**A text was developed entitled "Fire in California Ecosystems" edited by Neil G. Sugihara, Jan W. van Wagtendonk, JoAnn Fites-Kaufman, Kevin E. Shaffer, and Andrea E. Thode. Each chapter is authored by an authority or authorities on that particular topic, issue or bioregion. This text includes a total of 24 chapters by 35 authors (886 pages of text in the final draft), 214 figures and maps, 4 appendices, front material (including title page, dedication, acknowledgements, preface, table of contents), 20 sidebars,**

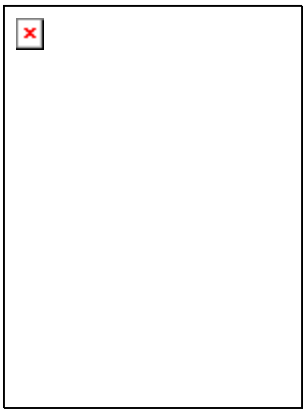
	numerous text boxes, over a thousand references and a glossary.
Other deliverables not proposed	**Part II of this text were added to the text and include treatments of fire as a process within each bioregion.**
	Part III of this text includes 8 chapters on fire management issues in California.

Deliverable 4) An information base in the form of an internet web page that contains fundamental fire ecology, restoration and management information.

An internet web page was developed to provide access to the products in this project in addition to other fire ecology information. Separate tabs are set up to organize the parts of this project. It contains the searchable fire ecology literature database, links to the Fire Effects Information System, pages documenting the workshops for the revision of the Manual of California Vegetation, and information on the development of the Fire in California Ecosystems text. This website contains fundamental fire ecology, restoration and management information and is a major resource for managers, scientists and others interested in fire information for California.

http://www.ice.ucdavis.edu/cafe/tab_info_main.html

Information Resources



The following projects are funded in part by the Joint Fire Science Program.

Fire Ecology Bibliography:

An extensive search has been done of electronic databases, scientific literature and other references cited in relevant published and unpublished papers to create a Bibliography for Fire Ecology in California. This Bibliography includes a cross-walk of the literature to major vegetation and ecosystem classifications currently used in California.

Manual of California Vegetation Update:

In 1995, Drs. John Sawyer and Todd Keeler-Wolf published A Manual of

California Vegetation (Manual). The book was the result of a multi-agency effort to develop a comprehensive and widely accepted classification system for California vegetation. The Manual is a key reference used by ecologists, botanists, and biologists working for many different federal and state government agencies, private businesses, and conservation organizations throughout California. Drs. Sawyer and Keeler-Wolf are currently revising the Manual to make it compatible with the U.S. National Vegetation Classification and to include information on the effects that various disturbances, particularly fire, have on California vegetation.

Fire Ecology Text:

Fire and Vegetation Interactions in California Ecosystems

Through the development of a California Fire Ecology Text, CAFE hopes to consolidate and synthesize information in the field of fire ecology. The vision is the text will help to provide consistent interpretations and projections in the field of fire ecology, integrate science and management perspectives, and solidify fire ecology as a coherent discipline in California. The text is a collaborative effort and include sections written by scientists, land managers, and regulators.

Fire Effects Information System

Currently, the U.S. Forest Service's Missoula Fire Lab maintains an electronic database and web site called the Fire Effects Information System (FEIS). FEIS contains fire effects information for individual plant and animal species and is intended to be a comprehensive, synthesized reference for the effects of fire on individual species.

CAFE has proposed updating and adding to the FEIS approximately 400 species of plants and animals found in California, with over 170 being high-priority species. The first phase of this project has been funded and CAFE is currently working with the U.S. Forest Service to select the initial species to be updated and added to the FEIS. The current list of these species is included below.

Since this website was established for this project, it has expanded to become the website for the Association for Fire Ecology and in addition to this project, includes the on line journal Fire Ecology, conference and symposium information, proceedings from the AFE conferences, section information, links to related internet sites.

http://web1.spatial.wwu.edu/~afe/

Proposed	Delivered
An information base in the form of an internet web page that contains fundamental fire ecology, restoration and management information.	• An information base in the form of an internet web page that contains fundamental fire ecology, restoration and management information.

Other deliverables not proposed	• Expansion of the web page to become the Association for Fire Ecology website. • Includes a wide array of fire ecology literature, information sources and links

Deliverable 5) Updated U.S. Fire Effects Information System (FEIS) to include additional key California plant species

A prioritized list of California species to be included in FEIS was developed in a cooperative effort led by the California Department of Fish and Game and including the USDA Forest Service, National Park Service, California Department of Parks and Recreation, Bureau of Land Management and the University of California Davis. The list includes 145 plant and 27 animal species that have importance in fire ecology and land management. This list was then posted and is available at:

http://www.ice.ucdavis.edu/cafe/tab_feis.html

This list has served to prioritize the updates and additions funded by this project and several other sources. Thirty-one plant and species from this list have been updated or added since the initiation of this project.

Proposed	Delivered
Update Fire Effects Information System (FEIS) to include additional key California plant species	• A list of 145 plant species to be included in FEIS was developed in an interagency process. • 74 species were already included prior to the proposal • 31 species have been updated through various funding sources • The list is still being used to prioritize species that are added for California

Other deliverables not proposed	A list of 27 priority animal species for inclusion in FEIS was also developed. Funding has not yet been available for additions of these species.