FIRE HISTORY DATABASE
OF THE WESTERN UNITED STATES

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INTERAGENCY AGREEMENT DW12934530
US Environmental Protection Agency, USDA Forest Service, University of Washington

September 1995

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FINAL REPORT

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INTERAGENCY AGREEMENT
Environmental Protection Agency: DW12934530
USDA Forest Service, Pacific Northwest Research Station: 93-0300
University of Washington, College of Forest Resources: 61-2239

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CONTENTS

INTRODUCTION

Human activities are changing the chemical composition of the atmosphere at an unprecedented rate, which may lead to significant changes in climate (Bolin and others 1986; Houghton and others 1990, 1992). These climatic changes could directly alter fire frequency, extent and severity by changing the amount, distribution and seasonality of precipitation and other factors that influence fire (Clark 1990; Flannigan and Van Wagner 1991). Climate may also change the rate of forest production, mortality and decomposition which will change the amount and distribution of fuel, hence indirectly alter fire regimes (Clark 1990). In addition, changes in climate could alter the global distribution of forest life-zones (Emanuel and others 1985; Leverenz and Lev 1987; Smith and others 1992). The rate at which forest communities adjust to climate change will be controlled in part by disturbance processes, primarily fire and land use practices (Overpeck and others 1990). Fire is the dominant natural disturbance in many parts of the western United States (Pyne 1982; Agee 1993) where steep topographic and climatic gradients result in a great variety of fire regimes. A continental-scale fire frequency model is being developed by the National Center for Atmospheric Research (Bergengren, NCAR, Boulder, CO) as an essential component of a broad-scale vegetation model used to predict the response of vegetation of global climate change. The database reported here contains existing tree-ring reconstructions of past forest fire regimes in the western continental United States (exclusive of Alaska) that can be used to calibrate and verify this and other fire models.

Fire frequency in forested areas can be reconstructed by dating the annual ring in which fire scars form and/or estimating the year of origin of stands that regenerate after fire (e.g. Barrett and Arno 1988, Sheppard and others 1988). The annual rings are either dated dendrochronologically using prepared samples (by crossdating; Stokes and Smiley 1968) or by ring-counting, in the field or laboratory, using minimally prepared samples. Fire extent is estimated from the number and spatial distribution of trees or sites recording fire in a given year (e.g. Agee and others 1990; Swetnam and Dieterich 1985; Baisan and Swetnam 1990) or by using landscape-scale age structure models (Johnson and van Wagner 1985). Numerous fire histories, reconstructed from tree-rings for small portions of the western United States, are available from both published and unpublished sources. These reconstructions cover a wide variety of vegetation types and topographic settings.

OBJECTIVES

The objective of this project was to create a database of existing published and unpublished tree-ring reconstructions of fire regimes in forested areas, before circa 1900, west of 100^{o}W in the continental United States, exclusive of Alaska. The database includes only information that is provided in the studies or site information that can be gathered with minimal effort from other sources. Site locations and fire regimes are mapped (appendices E through G) but not interpolated.

The studies included in the database are restricted to tree-ring reconstructions of fire history and the information extracted includes citations to the data sources, site information, estimated fire regimes, and information on individual fire events (when readily available). Appendix A is a detailed description of the fields in each of the four database files and appendices B through D contain the contents of the database files.

Fire regimes vary greatly across short distances in the western United States, so that a reconstruction of fire history over a small area may not represent the history of a larger area. Therefore, we extracted information on the size of the study area and the amount of fire evidence (number of trees scarred and/or number of tree origin dates) used in computing the fire regimes to allow the user to gauge the applicability of each reconstruction to larger areas.

DATA SOURCES

One hundred and sixteen fire history studies (Appendix B) covering 623 sites were identified by searching the extensive literature and data collections of the personnel involved in this work and by keyword searching of the International Bibliography of Wildland Fire (International Association of Wildland Fire 1993) and the bibliography of the International Tree-Ring Data Bank (ITRDB 1992). 87 of the 116 studies are published, 19 are unpublished theses or dissertations and 10 are unpublished reports. The reconstruction of fire history was the primary purpose of 84 of the 116 studies. The remaining studies reconstructed fire history as part of multipurpose studies, e.g. studies of forest development or the interaction of fire with insects and/or fungi.

THE FIRE HISTORY DATABASE

1) Amount of fire history information.

a) *Evidence of fire*. At 41% of the sites, fire history was reconstructed using both fire scars and stand origin dates; at 9% of the sites only stand origin dates were used; and at the remaining 50% of the sites only fire scars were used. The number of trees used to estimate the reported fire regimes by site ranged from 1 to 3500 with an average of 29 per site. The number of fires used to estimate these same fire regimes ranged from 0 to 68 with an average of 9 per site.

b) *Dating method*. Most studies dated fires by counting rings on minimally-prepared samples, some of these studies adjusted fire dates by matching patterns of fire years between samples. Ring widths were dendrochronologically crossdated at only 19% of the sites.

c) *Period of record*. The longest fire histories in the database date to before the year 400, however, the majority of the reconstructions date only to the 1600's (87% of sites). Very few studies reported fire regimes during more than one time period (e.g. by century; <5% of sites).

d) *Size of study area*. The size of the study area was given or determined from maps for 60% of the sites. The size of these sites ranged from 0 (for point frequencies) to 492,500 ha with an average of 5751 ha.

e) *Information on individual fires*. Most studies gave some information about individual fires (72%), however, very few studies gave the extent of individual fires (8% of individual fires). 40% of the studies included the number of trees used to reconstruct the individual fires (average of 3 trees per fire with a range from 1 to 80).

2) <u>Site characteristics.</u>

a) *Geographic distribution*. The database includes fire history reconstructions from 12 western states plus several studies from Minnesota and one from Kansas (figure 1).

Figure 1. Location of sites included in the Fire History Database. (See Appendix E for site location maps labeled with reference/site number, by state).

b) *Distribution by Küchler (1964) class.* The study sites in the database were classified according to Küchler's (1964) potential natural vegetation type (figure 2, table A3). Because many of the studies provided neither the site size nor the area over which the reconstructions could reasonably be extrapolated, the percentage of sites is used here as a crude indication of land area sampled. Over 50% of the sites were sampled in just three Küchler classes: redwood, Douglas-fir and western spruce-fir. Because it is based on tree-ring reconstructions, this database considers only forested areas, however 60% of the combined land area of the states represented in this database is non-forested.

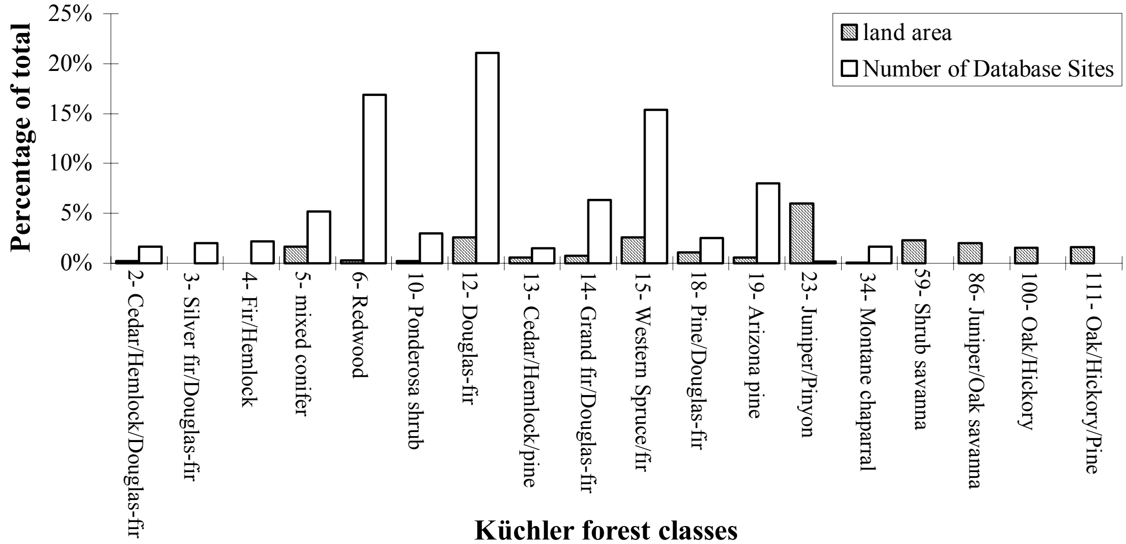

Figure 2. Distribution of study sites among selected potential natural vegetation types in relation to the total land area occupied by that vegetation type in the western United States. Percentage of a) total land area in the western United States and b) number of sites in the database (623 total), by Küchler class. See table A3 for a complete listing of the potential natural vegetation types used in the database.

c) *Distribution by elevation.* The elevation range of the study sites included in the database is 15 to 3658 m with an average of 1528 m (figure 3).

d) *Distribution by slope* (figure 4). At the sites for which slope was given, twice as many sites were sampled at slopes of 11-40% as were sampled in any other slope class.

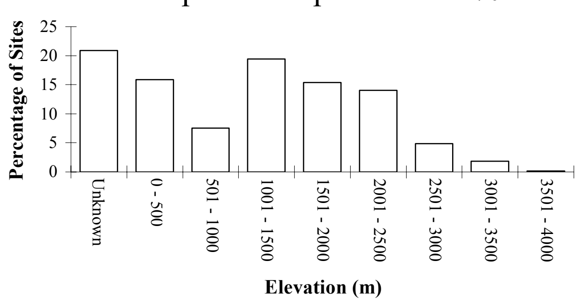

Figure 3. Percentage of sites in the database (623 sites total) by elevational classes.

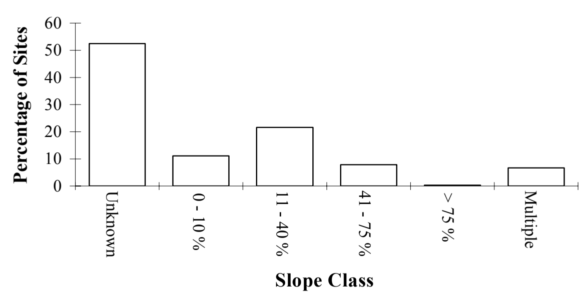

Figure 4. Percentage of sites in the database by slope class (623 sites total).

e) *Distribution by aspect.* The aspects reported in most studies were assumed to be microsite features of the study areas so a comparison of this information with total land area in various aspect classes is probably not meaningful. At the microsite scale reported in the database, 31% of the sites were sampled on south aspects (SE to SW) and 21% were sampled on north aspects (NE to NW).

3) Fire history.

a) *Fire frequency.* Fire frequency can be computed at a single point, based on information from one or several trees, or it may be computed over an area, based on information from many trees (see table A5 for explanation of methods for computing fire frequency; Agee 1993). The frequency obtained is obviously highly dependent on the size of the area included in the computation and therefore fire frequency must be stratified by method of computation for inter-site comparisons to be meaningful. In the database, fire frequency was input to the database as it was reported in each study. Most fire frequencies were computed as a composite fire interval (55% of sites). Fire frequency was computed as a mean fire return interval at 5% of the sites, as a natural fire rotation at 10% of the sites and as a point frequency at 24% of the sites. Frequency was computed using landscape-scale age structure models such as van Wagner (also known as negative exponential) or Weibull distributions at less than 1% of the sites. Stratifying the sites in the database by method of frequency computation would leave too few sites in each method-category, therefore, inter-site comparisons of fire history are made here on the basis of fire regime and fire severity classes.

b) *Fire regime and severity classes.* Fire severity is the effect of fire on trees (Agee 1993). For the database, we qualitatively defined high severity fire regimes as those for which most fires kill a majority of the trees and low severity fire regimes as those for which most fires do not kill a majority of the trees. Almost half of the sites have moderate severity fire regimes (last row table 1). 77% of the sites are in Heinselman's regimes 2 and 3 (last column table 1; see table A4 for a description of the Heinselman classes). The Heinselman classification incorporates both frequency and severity - in general, severity increases with increasing Heinselman class number. It is therefore not surprising that severity and Heinselman class are correlated in the database (table 1).

LIMITATIONS OF THE DATABASE

Although the symbols on the maps in appendices F and G give an impression of uniformity, there is tremendous variation in the amount and kind of information represented by each symbol. Under the limited scope of this project, we did not re-analyze the fire history reconstructions to make the symbols represent uniform data; therefore, detailed inter-site comparisons of this database are not always meaningful. Before drawing conclusions about regional patterns, the user should carefully review the information in the database, especially the number of trees and fires which were used to reconstruct each fire regime.

Table 1. Number of sites by fire regime and severity class (605 sites total).

Heinselman classes*	LOW	MODERATE	HIGH	Percent
	Severity			
0				
1	39	48		14%
2	158	67		37%
3	2	173	66	40%
4		3	28	5%
5		6	11	3%
6			4	1%
percent	33%	49%	18%	

* See table A4 for a description of Heinselman's classes.

The various methodologies used (e.g. point versus area frequencies [Agee 1993]) make intersite comparisons difficult unless similar techniques and presentation styles were used. Furthermore, many of the studies have coarse dating resolution, as dendrochronological crossdating was not used. The presence of crossdating is noted in the file FHREGIME.DB (field number 9). Where fire return intervals exceed roughly 25 years, this may not seriously affect intrasite fire frequency estimates, but it clearly precludes comparisons between sites. Signatures of climatic control at landscape to regional scales will not be possible without accurate crossdating.

RECOMMENDATIONS FOR FUTURE REPORTING OF FIRE HISTORIES

In assembling this database, we found that many studies did not report what we considered to be critical information for interpreting the results. We recommend that future studies report all the items we have included in this database. Items that are commonly omitted include:

a) size of study area and size of plots w/in the study area
b) number of trees used to reconstruct each fire
c) number of fires reconstructed
d) clear site and location information
e) actual fire dates and/or untransformed fire intervals
f) intra-annular placement of scars
g) clear reference to the source of any plant association classifications

UPDATES AND ONLINE AVAILABILITY

The database is available through the Oregon State University Forest Science Data Bank (FSDB. For users with access to the World Wide Web, the address is

http://www.fsl.orst.edu

Users without access can contact the FSDB at the following address:

FSDB
Forestry Sciences Laboratory
3200 SW Jefferson Way
Corvallis, OR 97331
ATTN: Gody Spycher or Don Henshaw.

Regular updates to the database are not currently planned, however occasional updates may be made.

ACKNOWLEDGMENTS

Significant contributions to this report were made by several people. We appreciate the assistance of George King, George Lienkaemper who manipulated and presented the geographical data; and Nicole Amato who assisted in extracting data from the studies. We also thank Stephen F. Arno, Charles W. Hendricks, George King and Thomas W. Swetnam for helpful reviews of the draft report.

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APPENDIX A: DESCRIPTIONS OF DATABASE FILES

This appendix contains detailed descriptions of the Fire History Database computer files. This relational database is contained in four Paradox files (release 3.0; Borland International Inc.). Table A1 provides the structure of these four files - descriptions of each field are given in the sections which follow. The site, reference and fire files are related by the "Reference/site number" field. Except for the reference file (FHREF.DB), the database entries are made with capital letters to facilitate searching. The symbol "-1" indicates no data in both the numeric and alphanumeric fields.

FHREF.DB - citation to sources

Whenever possible, data was extracted from a full report, dissertation or thesis because they usually contain more information than the versions published in journals.

1) Reference number - a unique number is assigned to each of the references. If there are two versions of a reference (e.g. a thesis and a journal article), both versions are cited in the database with the same reference number.
2) Authors - the authors names as given in the reference
3) Title
4) Citation
5) Year of publication
6) Objectives - of the study, in the author's words, if possible

FHSITE.DB -site information (-1 indicates no data)

1) Reference/site number - a combination of the reference and site numbers; e.g. the second site from the fortieth reference has a reference/site number of 4002.

2) State - the two letter postal code

3) Albers-E - Site location based on the Albers equal-area conic projection. This information is provided for those users who cannot easily map latitude and longitude since site locations in the Albers projection can be mapped on simple scatter plots.

4) Albers-N

5) Longitude - of the site location in degrees and fractions of a degree.

6) Latitude - of the site location in degrees and fractions of a degree.

7) Aspect - nominal designation (e.g. N, NNW) includes F for flat sites (< 10% slope) and M for sites with multiple aspect classes; maximum of three characters in this field.

Table A1. Structure of the Fire History Database Paradox files, giving the exact field names. N indicates a numeric field, A indicates an alphanumeric field followed by the number of characters.

Citation to sources, in file FHREF.DB

1	Reference number	N
2	Authors	A100
3	Title	A170
4	Citation	A200
5	Year of publication	N
6	Objectives	A200

Site information, in file FHSITE.DB

1	Reference/site number	N
2	State	A2
3	Albers-E	N
4	Albers-N	N
5	Latitude	N
6	Longitude	N
7	Aspect	A3
8	Slope class	N
9	Elevation - low	N
10	Elevation - high	N
11	Year - start	N
12	Year - end	N
13	Total area reconstructed	N
14	Plant association	A19
15	Community dominant	A14
16	Kuchler classification	N
17	Site name	A32

Individual fire information, in file FHFIRE.DB

1	Reference/site number	N
2	Year of fire	N
3	Start year	N
4	End year	N
5	Extent (ha)	N
6	Number of trees	N

Fire regime information, in file FHREGIME.DB

1	Reference/site number	N
2	Regime years - start	N
3	Regime years - end	N
4	Regime - severity	A8
5	Regime - characteristics	N
6	Fire frequency	N
7	Frequency computation	A12
8	Fire evidence	A12
9	Crossdated?	A3
10	Number of trees	N
11	Number of fires	N

FHSITE.DB -site information (cont.)

8) Slope class:

1	<10%
2	10-39%
3	40-75%
4	>75%
5	sites with multiple slope classes

9) Elevation - low - the lower end of the range of elevation covered by the site, in meters.

10) Elevation - high - the upper end of the range of elevation covered by the site, in meters.

11) Years - start - the starting year of the range of years for which fire history was reconstructed at the site. This is not always the same as the start year in the regime file because the regime may be reported for different time periods at the same site.

12) Years - end - the ending year of the range of years for which fire history was reconstructed at the site. This is not always the same as the ending year in the regime file because the regime may be reported for different time periods at the same site. Also, whenever possible, regimes are reported before 1900. For example, if fire history at a site was reconstructed for the period 1400 to 1985, the range of years in the site file will be 1400-1985 but the range of years in the regime file will be 1400-1900.

13) Total area reconstructed - total area of the site in hectares.

14) Plant association - as provided in each study, generally entered as the four letter species code (first two letters of genus plus first two letters of species). See table A2 for a complete list of codes used in the database.

15) Community dominant - as provided in each study; generally entered as a four letter species code (first two letters of genus plus first two letters of species). See table A2 for a complete list of codes used in the database.

16) Kuchler classification - Vegetation was classified into Küchler's (1964) potential natural vegetation types. Table A3 contains a complete list of the numeric codes used in the database.

17) Site name - either the name of the site as indicated by the author of the report; "entire area" if there is only one site or some other logical identifier

Table A2. Abbreviations used in plant association and community dominant fields.

	Abbr.	Common name	Scientific name
	ABAM	Pacific silver fir	*Abies amabilis*
	ABCO	white fir	*Abies concolor*
	ABGR	grand fir	*Abies grandis*
	ABLA	subalpine fir	*Abies lasiocarpa*
	ABMA	Shasta red fir	*Abies magnifica var shastensis*
	ACCI	vine maple	*Acer circinatum*
	ACGR	big-toothed maple	*Acer grandidentatum*
	ACMA	bigleaf maple	*Acer macrophyllum*
	ACSA	sugar maple	*Acer saccharum*
	ADFA	chamise	*Adenostoma fasciculatum*
	AGIN	beardless bluebunch wheatgrass	*Agropyron inerme*
	AGSP	bluebunch wheatgrass	*Agropyron spicatum*
	ARGL	eastwood manzanita	*Arctostaphylos glandulosa*
	ARTR	big sagebrush	*Artemisia tridentata*
	BEAQ	tall Oregongrape	*Berberis aquifolium*
	BENE	Oregongrape	*Berberis nervosa*
	CADE	incense cedar	*Calocedrus decurrens*
	CAGE	elk sedge	*Carex geyeri*
	CARU	pinegrass	*Calamagrostis rubescens*
	CEIN	coast whitethorn	*Ceanothus incanus*
	CEVE	snowbrush ceanothus	*Ceanothus velutinus*
	CHUM	western prince's pine	*Chimaphila umbellata*
	CLUN	queencup beadlily	*Clintonia uniflora*
	COOC	western goldthread	*Coptis occidentalis*
	CUAR	Arizona cypress	*Cupressus arizonica*
	FAGR	beech	*Fagus grandifolia*
	FEID	Idaho fescue	*Festuca idahoensis*
*	GRAS	unidentified grass species	
	HODI	creambush oceanspray	*Holodiscus discolor*
	JUOC	western juniper	*Juniperus occidentalis*
	LAOC	western larch	*Larix occidentalis*
	LIBO	twinflower	*Linnaea borealis*
	LUHI	smooth wood-rush	*Luzula hitchcockii*
	MUEM	bullgrass	*Muhlenbergia emersleyi*
*	MULT	more than one species	
*	PASP	unidentified boxwood species	
	PAMY	Oregon boxwood	*Pachistima myrsinites*
	PHMA	mallow ninebark	*Physocarpus malvaceus*
	PIAL	whitebark pine	*Pinus albicaulis*
	PIBA	jack pine	*Pinus banksiana*
*	PIBL	foxtail pine	*Pinus balfouriana*
	PICE	Mexican pinyon	*Pinus cembroides*
	PICO	lodgepole pine	*Pinus contorta*
*	PICU	coulter pine	*Pinus coulteri*

(cont.)

FHSITE.DB -site information (cont.)

Table A2. Abbreviations used in plant association and community dominant fields (cont.)

	Abbr.	Common name	Scientific name
	PIEN	Engelmann spruce	*Picea engelmannii*
	PIFL	limber pine	*Pinus flexilis*
	PIJE	Jeffrey pine	*Pinus jeffreyi*
	PILA	sugar pine	*Pinus lambertiana*
	PIMO	western white pine	*Pinus monticola*
	PIMU	bishop pine	*Pinus muricata*
	PIPO	ponderosa pine	*Pinus ponderosa*
	PIPU	blue spruce	*Picea pungens*
	PIRE	eastern red pine	*Pinus resinosa*
	POIN	Chisos bluegrass	*Poa involuta*
	POTR	quaking aspen	*Populus tremuloides*
	PSME	Douglas-fir	*Pseudotsuga menziesii*
	PUTR	bitterbrush	*Purshia tridentata*
	QUCH	canyon live oak	*Quercus chrysolepis*
	QUDO	blue oak	*Quercus douglasii*
	QUGA	Oregon white oak	*Quercus garryana*
*	QUGM	Gambel oak	*Quercus gambelii*
	QUMA	bur oak	*Quercus macrocarpa*
	SECA	groundsel	*Senecio cardamine*
	SEGI	giant sequoia	*Sequoiadendron giganteum*
	SESE	coast redwood	*Sequoia sempervirens*
	SPBE	birchleaf spiraea	*Spiraea betulifolia*
	THPL	western redcedar	*Thuja plicata*
	TIAM	basswood	*Tilia americana*
	TSCA	eastern hemlock	*Tsuga canadensis*
	TSHE	western hemlock	*Tsuga heterophylla*
	TSME	mountain hemlock	*Tsuga mertensiana*
	VAGL	mountain huckleberry	*Vaccinium globulare*
	VAME	big huckleberry	*Vaccinium membranaceum*
	VASC	grouse huckleberry	*Vaccinium scoparium*
	WHMO	whipple vine	*Whipplea modesta*
	XETE	common beargrass	*Xerophyllum tenax*

* abbreviation in this database differs from common practice of using first two letters of genera plus first two letters of species

FHSITE.DB -site information (cont.)

Table A3. Potential natural vegetation types used in the Fire History Database (from Küchler, 1964).

Number	Potential Natural Vegetation	Number	Potential Natural Vegetation
1	Spruce-Cedar-Hemlock Forest	25	Alder-Ash Forest
2	Cedar-Hemlock-Douglas Fir Forest	26	Oregon Oakwoods
3	Silver Fir-Douglas Fir Forest	28	Mosaic of #2 and #26
4	Fir-Hemlock Forest	29	California Mixed Evergreen Forest
5	Mixed Conifer Forest	30	California Oakwoods
6	Redwood Forest	31	Oak-Juniper Woodland
7	Red Fir Forest	33	Chaparral
8	Lodgepole Pine-Subalpine Forest	34	Montane chaparral
10	Ponderosa Shrub Forest	38	Great Basin Sagebrush
11	Western Ponderosa Forest	40	Saltbush-Greasewood
12	Douglas Fir Forest	50	Fescue-Wheatgrass
13	Cedar-Hemlock-Pine Forest	51	Wheatgrass-Bluegrass
14	Grand Fir-Douglas Fir Forest	52	Alpine Meadows and Barren
15	Western Spruce-Fir Forest	55	Sagebrush Steppe
16	Eastern Ponderosa Forest	59	Trans-Pecos Shrub Savanna
18	Pine/Douglas Fir Forest	81	Oak Savanna
19	Arizona Pine Forest	86	Juniper-Oak Savanna
20	Spruce-Fir-Douglas Fir Forest	95	Great Lakes Pine Forest
23	Juniper-Pinyon Woodland	99	Maple-Basswood Forest
24	Juniper Steppe Woodland		

FHFIRE.DB - individual fire information (-1 indicates no data)

1) Reference/site number - a combination of the reference and site numbers; e.g. the second site from the fortieth reference has a reference/site number of 4002.

2) Year of fire - if the fire date is given as a range of dates, this is the mid-point of that range.

3) Start year - of a range of dates, if given. This year could be from a range given by the author or one computed from an uncertainty given by the author (e.g. 1745 ± 3 years becomes 1742 to 1748 in the database).

4) End year - of a range of dates, if given. This year could be from a range given by the author or one computed from an uncertainty given by the author (e.g. 1745 ± 3 years becomes 1742 to 1748 in the database).

5) Extent (ha) - of the fire in hectares

6) Number of trees - used to reconstruct the individual fire.

FHREGIME.DB -fire regimes information (-1 indicates no data)

1) Reference/site number - a combination of the reference and site numbers; e.g. the second site from the fortieth reference has a reference/site number of 4002.

2) Regime years - start - the starting year for the period during which the fire regime is calculated. This is not always the same as the start year in the site file because the regime may be reported for different time periods at the same site.

3) Regime years - end - the ending year of the range of years for which the regime is reported. This is not always the same as the end year in the site file because the regime may be reported for different time periods at the same site. Also, whenever possible, regimes are reported before 1900. For example, if fire history at a site was reconstructed for the period 1400 to 1985, the range of years in the site file will be 1400-1985 but the range of years in the regime file will be 1400-1900.

4) Regime - severity - Fire severity is the effect of fire on trees (Agee 1993). For the database, we qualitatively defined high severity fire regimes as those for which most fires kill a majority of the trees and low severity fire regimes as those for which most fires do not kill a majority of the trees. (HIGH, MOD, or LOW).

5) Regime - characteristics - classification of the fire regime based on characteristics of its frequency and severity, after Heinselman (1973; table A4).

Table A4. Classification of fire regime based on frequency and severity characteristics (Heinselman 1973).

Fire regime number	Description of the regime
0	No natural fire (or very little)
1	Infrequent light surface fires (more than 25 year intervals)
2	Frequent light surface fires (1-25 year return intervals)
3	Infrequent, severe surface fires (more than 25 year return intervals)
4	Short return interval crown fires (25-100 year return intervals)
5	Long return interval crown fires + severe surface fires (100-300 yr return intervals)
6	Very long return interval crown fires+severe surface fires (> 300 yr return intervals)

6) Fire frequency - Fire frequency either as computed in the study or as can be easily computed from the data given. If fire frequency was provided as a composite fire interval over an area larger than approximately 40 ha, the fire frequency is not included in the database (Arno and Petersen 1983).

FHREGIME.DB -fire regimes information (cont.)

7) Frequency computation - the method used to compute the fire regime. Fire frequency can be computed at a single point, based on information from one or several trees, or it may be computed over an area, based on information from many trees (table A5; also Agee 1993). The frequency obtained is obviously highly dependent on the size of the area included in the computation and therefore fire frequency must be stratified by method of computation for inter-site comparisons to be meaningful. In the database, fire frequency is reported as it was computed by the author of each study.

Table A5. Methods used to compute fire frequency.

Method of estimation	Abbreviation	Description
natural fire rotation	NFR	Time in years required to burn an area equal to the area of interest (Heinselman 1973).
point interval	P	Average fire return interval in years from one or several adjacent trees and also for averages of MFRIs.
composite fire interval	CFI( )	Average fire return interval in years based on all trees from within the area indicated within the parentheses.
mean fire return interval	MFRI	Average of point intervals.
van Wagner	VW	Fire frequency calculated from statistical distribution of stand ages assuming uniform flammability by stand age. Also known as negative exponential distribution.
Weibull	W	Fire frequency calculated from statistical distribution of stand ages where flammability can vary with stand age.

8) Fire evidence - used to reconstruct fire - SCAR = fire scars only; ORIGIN = date of establishment of stands of early seral trees only; BOTH = both fire scars and stand origin dates dates

9) Crossdated? - YES or NO. YES applies if ring-widths were dendrochronologically crossdated but not if fire dates were "crossdated" by adjusting fire dates so that fire intervals match between samples.

10) Number of trees - used to determine the fire regime.

11) Number of fires - used to determine the fire regime.

APPENDIX B: CONTENTS OF THE REFERENCE FILE (FHREF.DB)

Number in first column is the reference number.

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APPENDIX C: LISTING OF THE SITE FILE (FHSITE.DB)

(-1 indicates no data)

APPENDIX D: LISTING OF THE REGIME FILE (FHREGIME.DB)

(-1 indicates no data)

APPENDIX E: MAPS OF SITE LOCATION BY STATE

The locations of the sites in the database are mapped on the following pages by state. The data labels are the combined reference and site numbers (e.g. the second site from the fortieth reference has a reference/site number of 4002). (See also figure 1 above for site locations mapped for the entire western U.S. without reference/site number labels).

APPENDIX F: MAPS OF FIRE REGIME (SEVERITY) BY STATE

The maps in this appendix display fire regimes based on fire severity.

Explanation of map symbols:

-1	No data
1	Low severity
2	Moderate severity
3	High severity

APPENDIX G: MAPS OF FIRE REGIME (CHARACTERISTICS) BY STATE

The maps in this appendix display fire regimes based on frequency and severity characteristics (Heinselman 1973).

Explanation of map symbols:

Fire regime number	Description of the regime
-1	No data
0	No natural fire (or very little)
1	Infrequent light surface fires (more than 25 year intervals)
2	Frequent light surface fires (1-25 year return intervals)
3	Infrequent, severe surface fires (more than 25 year return intervals)
4	Short return interval crown fires (25-100 year return intervals)
5	Long return interval crown fires + severe surface fires (100-300 yr return intervals)
6	Very long return interval crown fires+severe surface fires (> 300 yr return intervals)