International Multiproxy Paleo-fire Database (IMPD) Tree-Ring Based Fire History File Names and Formats

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This file details fire history tree event-based file names and formats. For general information about paleo-fire data, see our Introduction to Fire History Reconstruction and the International Multiproxy Paleo-fire Database (IMPD) homepage at, respectively:

https://www.ncei.noaa.gov/pub/data/paleo/firehistory/impd_data_intro.pdf
https://www.ncei.noaa.gov/products/paleoclimatology/fire-history

I. International Multiproxy Paleo-fire Database (IMPD) File Naming Conventions

All IMPD data sites all have data and documentation (metadata) files, and supplemental files that begin with the site's eight-character unique IMPD Code, which is assigned by an IMPD Data Manager.

In addition, all IMPD data sites have associated metadata in standard formats, including JSON (Javascript Object Notation), ISO 19115 (International Organization for Standardization), and DIF (Directory Interchange Format).

A. Filenames and Extensions for IMPD Files

Filenames:
The first two characters represent the two letter International Organization for Standardization (ISO) country code (https://en.wikipedia.org/wiki/List_of_ISO_3166_country_codes).
The next three characters represent the site code, and the last three characters are a sequential numeric index used to uniquely identify files for sites with replicate studies, or those with duplicate country and site codes.

The name of each Tree-Ring Fire Event File will be the eight-character IMPD code. The name of each documentation (metadata) file will be the IMPD code, or the IMPD code followed by '-noaa'. The name of each supplemental file will have the eight-character IMPD code prepended to the beginning of the filename provided by the contributor.

Extensions:

- Tree-Ring Fire Event data files all have an extension of "fhx"
- Establishment data files all have an extension of "dat"
- Related documentation (additional metadata information) files for both have the extension of "txt"
- Supplemental information files have an extension standard for their data type, e.g, "csv", "pdf", "png"

B. Filenames and Extensions for Standard Format Metadata Files

The metadata for every IMPD site is output to several standard metadata formats, including JSON, ISO 19115, and DIF. These are located on the IMPD website at the following locations:

- JSON: https://www.ncei.noaa.gov/pub/data/metadata/published/paleo/json/
- ISO: https://www.ncei.noaa.gov/pub/data/metadata/published/paleo/iso/xml/
- DIF: https://www.ncei.noaa.gov/pub/data/metadata/published/paleo/dif/xml/

The filename of each metadata file begins with "noaa-fire-", followed by an integer representing the numeric IMPD Site identifier. Links to these files are available from the results of the Fire History Data Search Graphical User Interface (https://www.ncei.noaa.gov/paleo-search/?dataTypeId=12) and Application Programming Interface (https://www.ncei.noaa.gov/access/paleo-search/api). The extension for JSON files is "json", and the extension for ISO and DIF files is "xml". The JSON format contains the most complete metadata and is the format returned by the API.

II. Tree-Ring Fire Event File Format

The Tree-Ring Fire Event files are provided in the FHX (fire history exchange format).

Open Access programs have been developed are available to create read and use the Fire History Exchange Format (FHX) files.

- burnr (pronounced "burner"), available in the R programing language (https://cran.r-project.org/package=burnr). Help for users is available from the web links to the software. For a burnr demo, visit: https://doi.org/10.5281/zenodo.7117417

- Fire History analysis and Exploration System (FHAES, https://www.frames.gov/fhaes/home). Help for users is available at: (https://www.ltrr.arizona.edu/~ellisqm/outgoing/kyle/FHAES_Documentation.pdf). To create FHX files, we recommend using the data entry module in FHAES.

The structure of an FHX data file is as follows. Note that line numbers listed refer to those in the example file in Appendix A, but in practice vary due to the variable line length of the comments section:

- The first 30 lines contain the site information. Each line is labeled, and should be self-explanatory.

- Line 31 begins the comments section, which is variable in length and can be up to 80 lines long, and is accompanied by line 32 which marks the end of the comments section.

- Line 33 is blank, and line 34 reads either "FHX2 FORMAT" or "FIRE2 FORMAT" to indicate that the file is an FHX2 file.

- Line 35 contains the starting year for the data matrix, the number of trees included in the matrix, and the number of characters used for the sample codes. For example, the line "1400 5 8" indicates that the data begin in 1400, that data are included for 5 trees, and that their sample codes are 8 characters long.

- The next several lines contain the sample codes, with each tree labeled vertically in a single column.

- The number of lines is variable according to the number given in line 35, but they are followed by an additional, blank line. This is demonstrated by lines 36 through 44 in the example file (See Appendix A).

- The remaining lines contain the data matrix. Each sample is represented by a column, while each row contains the fire history information for the year. The fire history

information is represented using a single designated symbol (See Appendix B) to describe each feature.

III. Establishment Data File Format

All data files are UTF-8 encoded text files, and each data file contains two sections: a Comments section and a Data section. The Comments section includes site information, sampling methods, publications, etc., and all Comment lines begin with a pound sign (#). The Data section begins with a listing of the variables. Each variable is listed with a sequential integer, which corresponds to the position of the data value for that variable in the data section. The data then follow in tabular format.

IV. Fire Scar and Establishment Metadata File Format

The Tree-ring Fire Event and Establishment metadata (documentation) files are UTF-8 encoded text files that contain data and additional information provided by the investigator, e.g., identification, site information, provenance, species measured, sample storage location.

V. Supplemental Data File Format

Supplemental files are provided by the contributor or the IMPD. These files contain additional data pertinent to the study including individual tree information and fire history chronology charts. The format of the file will be appropriate for the type of data it contains. The content of the file will be described in the site metadata (documentation) file described above.

Appendix A. Fire History Exchange Format (FHX) Sample File

Example Tree-Ring Fire Event, Fire Scar Dates FHX2 data file. The name of this file would be "ussam001.fhx". Note: line numbers are for explanatory purposes only and are not included in the actual data files.

```
--------------------------------------------------------------------------
 1 Name of site   : Sample
 2 Site code      : SAM
 3 Collection date:
 4 Collectors     :
 5 Crossdaters    :
 6 Number samples :
 7 Species name   :
 8 Common name    :
 9 Habitat type   :
10 Country        : United States
11 State          :
12 County         :
13 Park/Monument  :
14 National Forest:
15 Ranger district:
16 Township       :
17 Range          :
18 Section        :
19 Quarter section:
20 UTM easting    :
21 UTM northing   :
22 Latitude       :
23 Longitude      :
24 Topographic map:
25 Lowest elev    :
26 Highest elev   :
27 Slope          :
28 Aspect         :
29 Area sampled   :
30 Substrate type :
31 Begin comments BELOW this line:
32 End comments ABOVE this line.
33
34 FHX2 FORMAT
35 1400 5 8
36 SSSSS
37 AAAAA
38 MMMMM
39 PPPPP
40 LLLLL
41 EEEEE
42 00000
43 12345
44
45 ....[ 1400
46 ...{. 1401
47 .[{.. 1402
48 {L..D 1403
49 .|..| 1404
50 UE.EU 1405
51 ||.|| 1406
52 ||u|| 1407
--------------------------------------------------------------------------
```

Appendix B. Fire History Exchange Format (FHX) Codes

Symbols used in the FHX data format and their explanations:

Symbol	Meaning
[	left square bracket: pith date, the very inside date possible on the tree
]	right square bracket: bark date, the very outside date possible on the tree
{	left curly bracket: the innermost date possible on the tree - pith is not present
}	right curly bracket: the outermost date possible on the tree - bark is not present
.	a period: a "null" year - a dated tree ring for which no information on fire history is available, e.g., the ring formed prior to the initial scarring event
|	a vertical line (or "pipe" symbol): a "recorder" year - a dated tree ring that formed after the initial scarring event, but contains no scar
D,d	a fire scar (uppercase) or injury (lowercase) situated in the dormant position, between the previous year's latewood and the current year's earlywood
E,e	a fire scar (uppercase) or injury (lowercase) situated in the early (one-third) portion of the earlywood
M,m	a fire scar (uppercase) or injury (lowercase) situated in the middle (one-third) portion of the earlywood
L,l	a fire scar (uppercase) or injury (lowercase) situated in the latter (one-third) portion of the earlywood
A,a	a fire scar (uppercase) or injury (lowercase) situated in the latewood
U,u	a fire scar or injury for which the position could not be determined