Wildfire Management Database, 2023

Introduction

Within the public land management field, databases are used extensively to gather a variety of data, encompassing vast scopes that include various disciplinary fields ranging from forestry to land distribution. Given this large scope – and the often very large scopes within subfields – this project has been limited to focusing on one specific topic: wildfire management within forests managed by professional forestry organizations. By and large, this model was based on methodologies and literature concerning the United States Forest Service, or international agencies that serve similar functions.

Despite the limited scope, a wealth of data is still required to properly manage wildfires within a forest setting. This includes, but is not limited to, personnel, equipment, and resources data; data involving the forest setting and adjacent landscapes; and historical data concerning fire disturbances within the region. Many of this information is already available to some degree in several well-curated databases maintained by a variety of organizations, such as the North American Forest Database (NAFD) (Smith et al. 1), Hazardous Fuel Treatments Reduction databases (*Hazardous Fuel*), and the Fire Occurrence Database (FOD) (Short).

Despite the wide use and availability of databases within professional forestry organizations, there do still exist data management problems. First and foremost is that most, especially within the United States, often operate under a mixture of old and new legislation, and with or for various levels of governance that may operate in conflicting manners (Timberlake at al. 1292-1294). This often creates issues when it comes to interagency data sharing as there may be no data standardization on the national – or international – level. Additionally, this often creates issues when attempting to import data from national databases into regional or local databases that are attempting to take a holistic approach to solve problems.

Additional data management problems within this field are that of missing data. As forest service’s transition from historical fire exclusion policies to the modern resilient approach, they find that information needed – such as biomass density, wildland urban interface, and solar radiation (Sari, 357) – is either missing from current regional databases - and requires assessments to acquire - or needs to be imported from governmental or non-governmental sources. As said before, if regional databases are not standardized to related national databases, this will increase the budget and time to update existing structures.

The database created during this project seeks to address many of the issues that regional or local managers of forests may come across when undergoing wildfire management efforts. The database attempts to aggregate all necessary information regarding risks factors and available resources in a format that will allow regional or local professional forestry personnel to make informed decisions regarding wildfire containment efforts more efficiently. This is done by not only including interdisciplinary information relevant to the wildfire containment process, but also by standardizing metadata and methodologies with relevant national, international, and specific organizational databases. Additionally, this database seeks to be as flexible as possible, to account for changing circumstances during a wildfire – where command structures are dependent on size and location – and the fact that many endeavors involved in wildfire planning and management are often conducted by more than one agency.

User Requirements

This database requires intensive interagency and organizational cooperation and data sharing. Regular data updates are required from several governmental and non-governmental sources, and this data must be maintained regularly by administrative staff within the U.S. Forest Service. The primary end users for this database are fire management personnel at the local to regional levels and is intended to promote efficiency in fire management decisions.

Business Rules

The U.S. Forest Service seeks to track information concerning relevant parties involved in wildfire management; firefighting resources; forest units; select wildlife data; and fires.

1. A party is an organization that either manages a forest unit or is involved to some extent in the wildfire management process. A party must be classified as either a government or non-government organization and cannot simultaneously be both. Common attributes shared by all parties: Party ID (Identifier) and Party Name. A party may have one coordinating unit or multiple. For each coordinating unit, the following attributes are to be recorded: Coordinating Unit Name, Coordinating Unit Contact, Coordinating Unit Phone Number, and Coordinating Unit Contact Email.

2. Both non-government and government organizations have one unique attribute. Non-government organizations should have an Organization Classification attribute, while government organizations should have a Level of Governance attribute. Abbreviations for these organizations are non govt organization and govt organization, respectively.

3. A non-government organization manages or provides firefighting resources for a wildfire management effort via contract. A non-government organization may not have any active contracts at a given time or may have several. A contract must include at least one firefighting resource, but a firefighting resource may or may not be provided via contract. If a non-government organization is contracted, the following must be recorded: Contract ID (Identifier), Contract Type, Contract Start Data, Contract End Date. Optionally, a contract subtype may be recorded (“Forest Service Contracting”).

4. A government organization may or may not manage any firefighting resources. Conversely, firefighting resources may or may not be provided by governmental organizations.

5. A firefighting resource may be classified as, at most, one of the following: Road, Facility, Supply, Equipment, and Personnel. Common attributes shared by all firefighting resources: Resource ID (Identifier), and Resource Code.

6. All types of firefighting resources have unique attributes.

a. Roads should have the following attributes: Road Designation, Road Classification, Road Maintenance Level, Road Traffic Service Level, Road Status (“Road Terminology”).

b. Facilities should have the following attributes: Facility Name, Facility Type, Facility Address, Facility Use, and Facility Front Desk Phone Number. Additionally, the facility’s regular and holiday operation times should be recorded.

c. Supplies should have the following attributes: Supply Type, Supply Quantity, Supply Quantity Units, Supply Source, and Supply Location.

d. Equipment should have the following attributes: Serial No., Equipment Code, Equipment Description, Equipment Cost, and Equipment Operational Status.

e. Personnel should have the following attributes: Personnel Name, Personnel Position, Personnel Base of Operations, Personnel Phone Number, and Personnel Email. Additionally, the personnels’ fire season, off-season, and holiday availabilities should be annotated.

7. Personnel must be supervised by at most one supervisor. Personnel may be supervisors for any number of employees or may not be supervisors at all. A Supervisor ID should be recorded in each instance.

8. Personnel may be classified as one or more of the following groups of interest: Fire Personnel, Certified Personnel, and USFS Employees. Fire Personnel are those personnel directly involved in the containment of wildfires or the management of fire control assets and procedures. Certified personnel are those personnel who have received a specialized certification or license that is not related to fire containment. For example, medical professionals or heavy equipment operators. Excluded from this category are individuals who hold solely a non-commercial Class C and/or Class M Driver’s License (or equivalent).

9. All personnel groups have unique attributes:

a. Fire Personnel should have the following attributes: NWCG Qualification(s), NWCG Qualification Date(s), Years of Experience, and Rank (*Forest Service Standard*). For non-standard ranks, equivalent USFS rank should be annotated.

b. Certified Personnel should have the following attributes: Certification(s) and Completed Training Program(s). For reach certification and completed training program, the date of certification or completion of a training program should be annotated. Certified personnel may or may not have one or more specialized licenses. A license is only applicable to one certified personnel. The following information must be recorded regarding each license: License ID (identifier), License Type, License Issuing Authority, License Status, and License Issuance Date. Optionally a License Renewal Date and License Expiration Date may be recorded.

c. USFS Employees should have the following attributes: Employee ID, Organizational Unit Number (Administrative Region Code, Administrative Forest Code, Administrative District Code), Pay Grade, Status, and Employee Address.

10. A forest unit is defined as any “land with trees higher than 5 m and a canopy cover of more than 10%, or trees able to reach these thresholds in situ” (Smith et al. 5). Data to be recorded includes the following: Forest Unit Code (Identifier), Parent Forest Name, Ownership Code, Land Suitability Class Code, Distance to Roads (minimal, km), Average Precipitation (ft.), Vegetation Type (dominant), Biomass Density (Mg/ha), Fuel Model Code (“Fire and Fuels”, D-1), Elevation (m), Distance to Settlements (minimal, in km), Isothermality, Average Temperature (F), Distance to Power Lines (minimal, km), Precipitation Seasonality, and Imperviousness (Sari, 362-366). Additionally, the Forest Service keeps records of a forest unit’s temperature (F), precipitation (in.), and wind speed (mph) on at least a daily basis. When taken, this data should include the date and time the measurements were taken.

11. A forest unit may or may not receive, or have received, fuel treatments. A fuel treatment may not ever be used in a forest unit or may be used in many.

12. A fuel treatment is any mechanism used to reduce fuels within a forest unit, such as prescribed burnings or mechanical thinning. The following attributes are required for each fuel treatment: Fuel Treatment ID (identifier), Activity Code, and Activity (*Hazardous Fuel*).

13. When a forest receives fuel treatment, the service should be recorded. Each fuel treatment service should be identified by a unique identifier, a fuel service ID. Additionally, the Service Status, Percentage of Units Completed, Fuel Treatment Start Date, and Fuel Treatment End Date should be recorded for each service (*Hazardous Fuel*).

14. A forest unit must be managed by at least one party. A party may or may not manage any forest units.

15. A forest unit may or may not contain any firefighting resources. Conversely, a firefighting resource may or may not be present within any number of forest units. .

16. Biota refers to all forms of life. For this database, biota must be classified as, at most, one of the following: Invasive plant infestations or protected wildlife. Common attributes shared by all biotas include Biota Code (Identifier), Scientific Name, and Common Name.

17. All biota groups have unique attributes and/or relationships:

a. An invasive plant may be present in no forest units, or within multiple. Conversely a forest unit may have none, or multiple invasive plant species within it. If an infestation exists within a forest unit the following attributes should be recorded: Infestation ID (identifier), Total Area Infested (km), and Infested Area Percentage (“Current Invasive Plants”). Abbreviation for invasive plant infestation is Inv. Plant Infest.

b. A protected wildlife species may or may not make a habitat within a forest unit or may occupy multiple forest units. Conversely, a forest unit may contain no protected wildlife species, or multiple. All protected wildlife instances should have their protection status annotated. If a protected wildlife species resides in a forest unit, the population density should be recorded.

18. A fire disturbance is defined as any non-prescribed fires or prescribed fires that have exceeded intended range for fuel treatment. All fire disturbances require the following attributes: Fire ID (Identifier), Fire Name, Fire Code, Discovery Date, Discovery Time, NWCG Cause Classification, NWCG General Cause (“NWCG”), Medial Latitude, Medial Longitude, Fire Status, and Fire Distribution Radius (in km).

19. A fire disturbance may affect any number of forest units, or not affect any. Conversely a forest unit may experience many or no forest disturbances. If a fire disturbance does affect a forest unit, then the percentage area affected should be recorded.

20. A party may manage the combatting of multiple wildfires, or none. A firefighting resource may be used in fighting multiple fires, or none. A fire disturbance must be contained using at least one firefighting resource with at least one party managing the containment procedure. Data recorded during these events include procedure date, procedure time, and procedure cost.

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