

## Watch Duty

<https://www.watchduty.org/how-it-works/overview>

Watch Duty is a mobile application offering the user access to real-time wildfire alerts, fire perimeters, air quality monitoring, and other important wildfire information across 11 western US states. It is publicly available and accessible via mobile devices or a web browser.

### Important Details

- Data for the app is sent in via an armada of volunteers consisting of **60+** firefighters, dispatchers, and first responders
- Radio scanners, satellites, 911 dispatch center calls, and other sources of info are pushed to the team via an automated monitoring system through **Slack** (<https://slack.com/>)
- The teams running the app await for on-scene personnel to give an official report on the conditions before notifying the affected public via the Watch Duty app
- Watch Duty's reporters follow a strict code of conduct when notifying the public: <https://www.watchduty.org/how-it-works/code-of-conduct>

## National Interagency Fire Center

<https://www.nifc.gov/fire-information/statistics/wildfires>

A command hub based in Boise, Idaho where crews of aircraft, engines, and equipment are mobilized quickly across the United States. This corporation has documented data of US wildfires dating as far back as 1983. This information is open to the public and free to download.

### Important Details

- Fire Information Maps - <https://www.nifc.gov/fire-information/maps>
- Situation Report Data - <https://www.nifc.gov/nicc-files/sitreprt.pdf>
- InciWeb, public incident information management system - <https://inciweb.wildfire.gov/>
- National fire statistics - <https://www.nifc.gov/fire-information/statistics>
- NIFC Open Data Site: <https://data-nifc.opendata.arcgis.com/>

## Canadian Science Publishing

<https://cdnscepub.com/doi/full/10.1139/er-2020-0019>

A review of machine learning applications in wildfire science and management including an overview of ML methods most commonly used in wildfire science and problem domains most commonly addressed (ex: fire detection, perimeter and severity mapping, susceptibility). The article provides an overview of previous publications and a solid context for historical wildfire science with ML technology (less cutting edge).

## **Technosylva Wildfire Science**

<https://technosylva.com/products/>

<https://technosylva.com/products/wildfire-analyst/firesim/>

Offers a variety of wildfire science products, of which FireSim (real-time wildfire spread predictions to support wildfire response and suppression) seems the most similar to our project. This site markets its tools and it seems unlikely that we'd learn much about the specifics of their models or data, but it is an example of the kind of technology that is currently available in the field.

## **Machine Learning for Wildfire Classification**

<https://www.sciencedirect.com/science/article/pii/S2666592122000373>

- Dense data-driven ( $D^3$ ) approach using ML models
  - Blackbox / eXplainable: deep learning, decision tree, stochastic gradient descent, extreme gradient boosted trees, logistic regression
  - Symbolic: genetic algorithms
- Trained on 2 databases covering 1 million North American and European wildfires from 1992—2015
- Wildfires most common in regions with droughts and lightning storms
- Fire triangle: components to begin a wildfire
  - Heat source
  - Fuel
  - Oxygen
- 3 approaches to wildfire prediction:
  - Physics-based: simulation complexity, requires computationally intensive software and models / formulas
  - Statistical: benefits from more technologies but can require manipulation to fit data to methods
  - ML: good for complex/high dimensional data and scaling, leverages new advances and user-friendly software
- Blackbox models require programming, reflects user's coding experience / familiarity with algorithm / software

- Combining blackbox with genetic algorithm generates predictions fitted into expressions / maps that can be used in spreadsheets without having to derive from new models multiple times
- Database complying by National Wildfire Coordinating Group (NWCG)
  - <https://www.nwcg.gov>
  - US data from 1992-2020  
<https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6>
- Classification task, ML models labeling examined fire data, predicting sizes
- D<sup>3</sup> approach relies on data of correctly identified fires to train models
  - 80% accuracy on deep learning / decision tree / genetic algorithms
- Use to develop support tools for decision making, e.g. predict size of wildfires to prioritize which ones to contain or find potential sources
  - Derive equation-tools from symbolic / explainable ML
  - Beneficial for resource allocation
- ML algorithms adaptable and get better with more data over time
  - Adding more attributes to datasets helps, especially first responder resources in the area, local infrastructure / risks, etc.

## **ALERTWildfire**

<https://www.alertwildfire.org>

- Universities of Nevada and Oregon providing firespotting tools to aid firefighters / first responders
- Camera network, region maps
- Pan-Tilt-Zoom (PTZ) fire camera infrastructure
- Objectives:
  - Locate/confirm fires
  - Scale fire resources
  - Monitor fires
  - Provide situational awareness for evacuation
  - Monitor contained fires from start to finish (watching for flare-ups)

## **NASA: FIRMS**

<https://firms.modaps.eosdis.nasa.gov/>

The Fire Information for Resource Management System (FIRMS) distributes Near Real-Time active fire data utilizing MODIS and VIIRS instruments aboard their satellites. Globally, this data is available within 3 hours of satellite observation, but available real-time for the US and Canada.

Other Information:

- Active fire/thermal anomalies may be from fire, hot smoke, agriculture or other sources.
- Cloud cover may obscure active fire detections.
- US/Canada Service: <https://firms.modaps.eosdis.nasa.gov/usfs/web-services/>

API Reference: <https://firms.modaps.eosdis.nasa.gov/api/>

## **Ambee Forest Fire API**

<https://www.getambee.com/api/fire>

Ambee's Climate Intelligence Platform allows for tracking and planning around real-time forest fires. This API can provide air quality and weather parameters (and others. Refer to the site for those).

Other Information:

- Limited to 100 API records (actions?)/day
- Contains Historical data like others to help create insight to possible future fires.
- Data is collected through ground sensors and earth observation satellites.
- They have an application that provides environmental summaries and allows for predictions for planning, (air) pollution, and weather changes (kind of like a normal weather app but better...).

Other Links:

- Webhooks: <https://www.getambee.com/webhooks-real-time-environmental-alerts>
- API Documentation: <https://docs.ambeedata.com/>

## **LandFire**

<https://www.landfire.gov>

This is a tool that was developed to provide information on types of vegetation and status about them throughout the united states. Information goes back very far. Lots of data for information ranging all the way back to 2001. Info also given about fire's and fuel. Map and information will be very helpful to set up the back end of the simulation to simulate where areas are filled with dangerous or at risk vegetation and how fire would react to the vegetation present.

- Uses VDDT (Vegetation Dynamics Development Tool)

- VDDT is a public domain network that provides a framework for quantifying the rate and effects of succession and disturbance on a landscape
  - “VDDT allows for rapid gaming and testing of the sensitivity of the ecosystem to alternative assumptions. It thus provides a means for learning and communication.”
- Provides detailed vegetation maps of west coast and some of the central states
- Has information about Hawaii and Alaska As Well.

## **Fire Enterprise Geospacial Portal**

<https://egp.nwcg.gov/egp/About.aspx>

This tool was created to manage data related to fire incidents. It was created to improve and display analysis of data to support wildland fire management decisions. It contains 5 tools, starting with a fire globe, dashboard tools, situation analysis, fire data, FLIGHT api that displays aviation use and cost.

### **Data Used**

- IRWIN (Integrated Reporting of Wildland Fire Information)
- ICS209
- WFDSS (Wildland Fire Decision Support System)
- WIMS (Weather Information Management System)

Gives situational information surrounding ongoing fires. The information includes fire perimeter, weather, fire detections, currently assigned resources and available other resources.

## **WFDSS (Wildland Fire Decision Support System)**

[https://wfdss.usgs.gov/wfdss/WFDSS\\_Home.shtml](https://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml)

WFDSS is a government support system that combines historical data and current data to put all information in one spot to allow first responders to make quick informed decisions.

### **Data Used**

- Interagency Fire Perimeter History
- WFIGS (Wildland fire locations, wildland fire perimeters full history)