The Fires Intelligence Matrix:

Daily Fire Information and Analysis of Fire Threats, Management Considerations, Behavior, and Environment

Authors: Ben Gannon (benjamin.gannon@usda.gov) and Rick Stratton (richard.stratton@usda.gov), USDA Forest Service, Fire and Aviation Management, Strategic Analytics Branch
Last updated: 07/15/2024

Purpose

The Fires Intelligence Matrix is a daily analysis of the current wildfire threats, management considerations, behavior, and environment intended to inform regional and national analysts about ongoing wildfires and provide consistent metrics to facilitate inter-fire comparisons. The Fires Intelligence Matrix relies on authoritative spatial data from the Wildland Fire Interagency Geospatial Services (WFIGS) Group on current wildfire extents (also called "perimeters") and point locations. Wildfire extents are buffered by 1-mi (1,600-m) and then spatially intersected with datasets mapping values at risk, firefighting opportunity and safety indices, wildfire behavior, and fire weather, danger, and climate to create a table (or "matrix") of the incident-level summary characteristics.

Methods

Timing

The Fires Intelligence Matrix analysis is completed daily at approximately 0900 Mountain Time during the summer fire season. Given the dynamic nature of some input data, results can vary for the same data sources extracted at different times. The results are distributed every Monday, Wednesday, and Friday to reduce information overload. Results for other days can be requested from the Strategic Analytics Branch (SAB) as needed.

Wildfire Extents

Wildfire extents are represented using a combination of the Wildland Fire Interagency Geospatial Services (WFIGS) Group current wildfire perimeter and location layers. Several filters are applied to the raw data to identify uncontained and uncontrolled wildfires (**Table 1**). Both WFIGS data layers are filtered to CONUS due to limited availability of the summary data layers in Alaska, Hawaii, and US Territories. A separate Alaska-specific assessment with slightly different attributes is available upon request. Both layers are filtered using a combination of attributes to remove wildfires that are fully contained or controlled. Incidents coded as prescribed fires are removed from both layers and complexes are removed from the locations layer. Many small wildfires are reported in the locations data that are never attributed with subsequent containment or control statuses. We remove any locations with a

discovery date more than 14-days ago under the assumption that these would have been mapped in the perimeters layer if they grew and are still burning. We also remove any location points that are already represented in the perimeters based on their IRWINIDs. Location points are converted into circular polygons approximating the reported fire size using the appropriate buffer radii. Relevant attribute field names are standardized, and the two layers are merged into a single layer.

Table 1: Filters applied to WFIGS current fire layers.

Layer	Filters
WFIGS Perimeters (Polygons)	• CONUS extent • Incident type is not "RX" • No reported containment date • No reported control date • Containment percent not 100
WFIGS Locations (Points)	• CONUS extent • Incident type is not "RX" or "CX" • No reported containment date • No reported control date • Containment percent not 100 • Discovery date in last 14 days

Approximating Wildfire Exposure and Threats

Determining the area and associated resources and assets that are exposed to or threatened by wildfire requires nuanced information for each incident that is difficult to capture in a national level assessment. In this assessment, we simply use the current wildfire extent plus a 1-mi (1,600-m) buffer to approximate the area and associated values that are exposed to or threatened by each fire.

Summary Attributes

The summary attributes were selected to characterize current wildfire threats, management considerations, behavior, and environment (**Table 2**). Data will be periodically updated as new versions become available.

Table 2: Summary attributes included in the Fires Intelligence Matrix.

Wildfire Characteristics from the Wildland Fire Interagency Geospatial Services Group		
Field	**Description**	**Source**
Fire Name	Fire name	WFIGS current perimeters or location points, https://data-nifc.opendata.arcgis.com/
Unique ID	Unique fire ID	
State	State	
Complex	Complex name	
GACC	Geographic area	
Disc. Date	Discovery date	
Cause	Fire cause	
Jurisdiction	Jurisdiction	
Owner	Primary landowner	

Containment %	Percent containment	
Total Personnel	Total personnel assigned to incident	
Est. Cost to Date	Estimated incident costs to date	
Mgmt. Complexity	Management complexity	
Mgmt. Strategy: Full supp. %	Percent full suppression management strategy	
Mgmt. Strategy: Confine %	Percent confine management strategy	
Mgmt. Strategy: Point/zone %	Percent point or zone protection management strategy	
Source	Either WFIGS Perimeters or WFIGS Points	
Area (ac)	Area in acres	

Threats

Field	Description	Source
Housing Units	Housing unit count	Wildfire Risk to Communities 2.0 2024
Buildings	Microsoft or state building count	Microsoft Bing, https://github.com/Microsoft/USBuildingFootprints; R6 2023 structures for OR and WA; MT 2023 structures https://msl.mt.gov/geoinfo/msdi/structures_and_addresses/
Population	Population count	Wildfire Risk to Communities 2.0 2024
Major Roads (mi)	Major road miles (HERE functional categories 1-4)	HERE roads 2020 via HIFLD secure, https://gii.dhs.gov/hifld/data/secure/
Historic Blds. & Structures	Historic building and structure count	NPS National Registry of Historic Places 2023, https://irma.nps.gov/DataStore/Reference/Profile/2210280
Communication Sites	Communication site count	Homeland Infrastructure Foundation Level Data (HIFLD) 2023
Emergency Service Sites	Emergency service site count	
Hospitals	Hospital count	
Natural Gas Pipeline (mi)	Natural gas pipeline length in miles	
Oil and Gas Wells	Oil and gas well count	
Power Plants	Power plant count	
Electric Transmission Substations	Electric transmission substation count	
Electric Transmission Line (mi)	Electric transmission line length in miles	
Source Water Protection Area (ac)	Source Water Protection Area in acres	EPA Office of Groundwater and Drinking Water (OGWDW) 2023, Drinking Water Protection Division (DWIDD)
Total cNVC	Total cNVC sum (loss only, everything but ecosystem function)	SAB CONUS Quantitative Wildfire Risk Assessment 2024
Assets cNVC	People and property + Critical infrastructure + Historic building and structure cNVC sum	

Assets & Water cNVC	People and property + Critical infrastructure + Historic building and structure + Drinking water cNVC sum	
People & Property cNVC	People and property cNVC sum	
Critical Infrastructure cNVC	Critical infrastructure cNVC sum	
Historic cNVC	Historic building and structure cNVC sum	
Drinking Water cNVC	Drinking water cNVC sum	
Potential Timber cNVC	Potential timber cNVC sum	
Ecosystem Function cNVC	Ecosystem function cNVC sum	

Management Considerations

Field	Description	Source
SDI	Suppression Difficulty Index (SDI) mean	SAB Risk Management Assistance Analytics 2024
PCL	Potential Control Location Suitability (PCL) mean	
Snag Hazard	Snag hazard mean (1 = low, 2 = moderate, 3 = high, 4 = extreme)	
Ground Evac. Time (hr)	Ground evacuation time mean in hours	
Prior wildfire (ac)	Prior wildfire acres (2014-2023)	Interagency fire records 2014-2023
Prior fuel trt. (ac)	Prior fuel treatment acres (2014-2023)	Interagency fuel treatment records 2014-2023

Behavior

Field	Description	Source
Observed (Obs.) FRP Last 7 Days	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire over last 7 days	NASA Fire Information for Resource Management System, https://firms.modaps.eosdis.nasa.gov/
Obs. FRP Day -1	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire 1 day ago	
Obs. FRP Day -2	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire 2 days ago	
Obs. FRP Day -3	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire 3 days ago	
Obs. FRP Day -4	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire 4 days ago	
Obs. FRP Day -5	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire 5 days ago	

Obs. FRP Day -6	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire 6 days ago	
Obs. FRP Day -7	Total fire radiative power in megawatts for all MODIS and VIIRS fire detections within 1-km of fire 7 days ago	
Environment		
Field	**Description**	**Source**
US Drought Monitor	US Drought Monitor Code (None, Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, Exceptional Drought)	US Drought Monitor via Wildland Fire Assessment System, https://www.drought.gov/data-maps-tools/us-drought-monitor, https://www.wfas.net/, and https://wildfiresafe.fs.usda.gov/
Keetch-Byram Drought Index (KBDI)	Keetch-Byram Drought Index (0 = completely saturated, 800 = maximum drought)	State Climate Office of North Carolina, https://products.climate.ncsu.edu/fwip/
Observed (Obs.) Precip. Last 7 Days	Total precipitation in inches over last 7 days	NOAA Quantitative Precipitation Estimates, https://water.weather.gov/precip/index.php
Obs. Precip. Day -1	Total precipitation in inches 1 day ago	
Obs. Precip. Day -2	Total precipitation in inches 2 days ago	
Obs. Precip. Day -3	Total precipitation in inches 3 days ago	
Obs. Precip. Day -4	Total precipitation in inches 4 days ago	
Obs. Precip. Day -5	Total precipitation in inches 5 days ago	
Obs. Precip. Day -6	Total precipitation in inches 6 days ago	
Obs. Precip. Day -7	Total precipitation in inches 7 days ago	
Forecasted (For.) Precip. Next 7 Days	Total precipitation in inches forecasted for next 7 days	NOAA Quantitative Precipitation Forecasts, https://www.wpc.ncep.noaa.gov/qpf/day1-7.shtml
For. Precip. Day 1	Total precipitation in inches forecasted for day 1 (today)	
For. Precip. Day 2	Total precipitation in inches forecasted for day 2 (tomorrow)	
For. Precip. Day 3	Total precipitation in inches forecasted for day 3	
For. Precip. Day 4	Total precipitation in inches forecasted for day 4	
For. Precip. Day 5	Total precipitation in inches forecasted for day 5	
For. Precip. Day 6	Total precipitation in inches forecasted for day 6	
For. Precip. Day 7	Total precipitation in inches forecasted for day 7	
Forecasted (For.) SFDI Day 1	Severe Fire Danger Index (SFDI) forecasted for day 1 (today)	Wildland Fire Assessment System, https://www.wfas.net/ and WildfireSafe, https://wildfiresafe.fs.usda.gov/
For. SFDI Day 2	Severe Fire Danger Index (SFDI) forecasted for day 2 (tomorrow)	

For. SFDI Day 3	Severe Fire Danger Index (SFDI) forecasted for day 3
For. SFDI Day 4	Severe Fire Danger Index (SFDI) forecasted for day 4
For. SFDI Day 5	Severe Fire Danger Index (SFDI) forecasted for day 5
For. SFDI Day 6	Severe Fire Danger Index (SFDI) forecasted for day 6
For. SFDI Day 7	Severe Fire Danger Index (SFDI) forecasted for day 7
Forecasted (For.) ERC Per. Day 1	Energy Release Component (ERC) percentile forecasted for day 1 (today)
For. ERC Per. Day 2	Energy Release Component (ERC) percentile forecasted for day 2 (tomorrow)
For. ERC Per. Day 3	Energy Release Component (ERC) percentile forecasted for day 3
For. ERC Per. Day 4	Energy Release Component (ERC) percentile forecasted for day 4
For. ERC Per. Day 5	Energy Release Component (ERC) percentile forecasted for day 5
For. ERC Per. Day 6	Energy Release Component (ERC) percentile forecasted for day 6
For. ERC Per. Day 7	Energy Release Component (ERC) percentile forecasted for day 7
Forecasted (For.) BI Per. Day 1	Burning Index (BI) percentile forecasted for day 1 (today)
For. BI Per. Day 2	Burning Index (BI) percentile forecasted for day 2 (tomorrow)
For. BI Per. Day 3	Burning Index (BI) percentile forecasted for day 3
For. BI Per. Day 4	Burning Index (BI) percentile forecasted for day 4
For. BI Per. Day 5	Burning Index (BI) percentile forecasted for day 5
For. BI Per. Day 6	Burning Index (BI) percentile forecasted for day 6
For. BI Per. Day 7	Burning Index (BI) percentile forecasted for day 7

Distribution

The Fires Intelligence Matrix is available on the Risk Management Assistance (RMA) Dashboard maintained by the SAB.

Intended Uses and Limitations

The Fires Intelligence Matrix is intended to inform regional and national analysts about ongoing wildfires and provide consistent metrics to facilitate inter-fire comparisons. The Fires Intelligence

Matrix should complement but not replace traditional intelligence gathering efforts. Given the simple buffering and spatial intersection methods, the results should be viewed as a first approximation of cumulative exposure and threat over the full duration of the incident. Potential uses include:
- building awareness of emerging incidents,
- rapid access to values at risk exposed to or threatened by wildfires,
- assessing management opportunities and challenges,
- tracking indicators of fire behavior and environment to anticipate fire growth or cessation,
- assist with populating the Incident Status Summary Report (ICS-209), and
- inter-fire comparisons to prioritize effort and resources.

The Fires Intelligence Matrix relies on other data systems to represent wildfire extents and provide summary attribute data. We strive to deliver complete, accurate, and timely information, but we cannot guarantee the performance of other data systems, so it is the user's responsibility to inspect the data to confirm that it is sufficient for their intended use(s). A non-exhaustive list of known or anticipated limitation is described in **Table 3**.

Table 3: Known or anticipated limitations of the Fires Intelligence Matrix.

Limitation
Any spatial, duplication, or attribute errors in WFIGS will carry forward into the Fires Intelligence Matrix. If you notice issues, please report them to the responsible data manager(s) to improve the quality of WFIGS. The WFIGS location points are filtered to remove fires already present in the WFIGS perimeters based on IRWINID, but IRWINIDs are not always correct. It is recommended that you inspect the data for duplication issues before use.
Some characteristics, such as cost, may be missing from incident level attributes because they are reported at the complex level.
Some long duration, large wildfires may persist in the dataset after they have stopped actively burning depending on containment objectives and progress. The full fire extent plus a 1-mi (1,600-m) buffer zone is used for all GIS data extraction. It is important to recognize that values inventoried within this area may not all be currently threatened by active fire – they should be thought of the cumulative totals exposed to or threatened over the full duration of the incident. The observed fire behavior information can help to filter out large but inactive wildfires if appropriate for your use.
Interior unburned islands are rarely mapped within wildfires. This means that there could be well mitigated or successfully defended communities, neighborhoods, or infrastructure sites that show up as exposed to or threatened by fire in our analysis.
The 1-mi (1,600-m) buffer zone used to approximate values threatened by fire beyond the current extent is imperfect – it may overestimate threats for small fires with limited growth potential and it may underestimate threats for large fires with significant growth potential. A simple buffer also does not capture the directionality of potential fire growth.
If dynamic summary data that comes from other systems is unavailable at the time of our analysis, the associated matrix columns will be blank for the day.

Feedback and Use Cases

We welcome feedback on the Fires Intelligence Matrix and reports on your use cases to improve its utility to the fire management community. Please direct your communications to Ben Gannon (benjamin.gannon@usda.gov) and Rick Stratton (richard.stratton@usda.gov) in the Strategic Analytics Branch. When suggesting new attributes for the Fire Intelligence Matrix, please consider that they should have broad appeal to the fire management community and accessible spatial data with CONUS-wide, all-lands coverage.