



Weighted Overlay

The factors contributing to the risk of fire in Marquette County are numerous, but not all pose the same amount of risk. Vegetation, human activity, and industry all have their risks, but do not affect the landscape in the same way.

Weighted Overlay is a spatial analysis approach used to solve multi-criteria problems, such as mapping the many factors which contribute to the risk of fire in Marquette County. This ArcGIS tool uses a common scale of values across a series of geographic inputs to determine which factors contribute to a higher or lower risk of fire in a certain point across the defined geographic area.

In this case, we rated each fire risk source from 0-100, with 0 being the least and 100 being the most risk of fire. These values all carry the same weight across each input. These fire risk sources were grouped into categories, and the Weighted Overlay weights these categories differently depending on the risk posed.

Parts of Weighted Overlay for Marquette County Fire Risk

Category	Subcategory	Description	Weight
Vegetation		Current vegetation, related to fuel hazard	50
Risk of fire		Opportunities for fires to start	30
	Structures	All buildings, including outbuildings, buffered by 1/2 mile	40
	Trails	Recreational trails, both motorized and non-motorized (quarter mile buffer)	5
	Wildfire history	DNR wildfires with 1/2 mile buffer, 2007-21	20
	Roads	All roads (quarter mile buffer)	20
	Recreation sites	Boat launches, campgrounds, and other recreation sites, 1/2 mile buffer	15
Fire preparedness		Ability to respond to fires and escape	10
	Fire stations	All areas within 3 miles of a fire station	40
	Water sources	Water sources for firefighting, including municipal systems, dry hydrants, and tanks, 1/2 mile buffer	40
	Escape routes	All roads (quarter mile buffer)	20
Infrastructure at risk		Critical infrastructure that could burn	10
	Utilities	Natural gas lines, electric transmission lines (quarter mile buffer)	20
	Railroads	Railroads (quarter or half mile buffer)	25
	Sensitive facilities	Fire stations, township and city halls, schools, DNR facilities, 1/2 mile buffer	35
	Escape routes	State roads (quarter mile buffer)	20

The four main categories are “Vegetation”, “Risk of fire”, “Fire preparedness”, and “Infrastructure at risk”. Except for “Vegetation”, these are all comprised of several subcategory factors with various weights themselves.

“Vegetation” uses [LANDFIRE Fuel Vegetation Type](#) 2021 data. LANDFIRE is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations. They provide high-quality geospatial data that describe vegetation, wildland fuel, and ecological fire regimes. The Fuel Vegetation Type layer describes a combination of existing vegetation type and human and natural disturbance levels.

“Risk of fire” includes inputs which may themselves act as sources of fire, such as structures, roads, trails, and recreational sites. To compensate for the human tendency to roam around, we gave the structures a half-mile radius circular buffer zone, and the roads and trails a quarter-mile radius buffer zone. Previous wildfires were given a half-mile radius circular buffer zone.

“Fire preparedness” is a group which acts as a dampener. This includes areas which are relatively safer than others due to their proximity to water sources, fire stations, and escape routes (state roads). The state road escape routes also function as firebreaks, being wide paved roads.

“Infrastructure at risk” are sites which are in particular need of defense, such as utilities, railroads, state roads, and emergency response coordination sites.