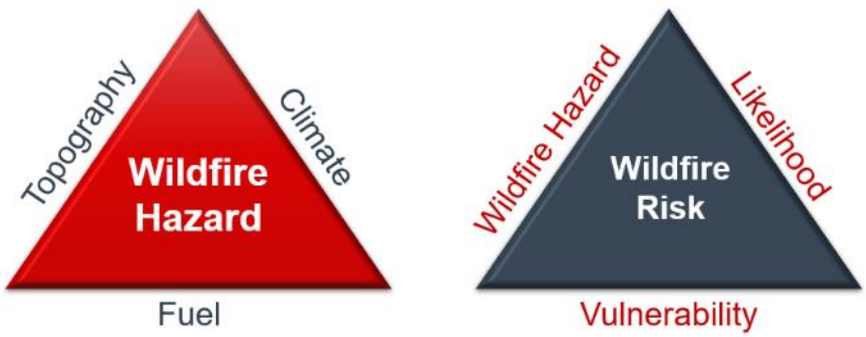
3 Nevada County Wildfire Risk Assessment

A Wildfire Risk Assessment (WRA) was conducted for the Plan Area using the Interagency Fuel Treatment Decision Support System (IFTDSS) program (USDOI and USDA 2024). The assessment was conducted in two basic stages: the initial stage modeled wildfire hazard, and the second stage modeled wildfire risk. Wildfire hazard represents the existing wildfire environment and potential wildfire behavior. Wildfire risk is the intersection of wildfire hazard, identified assets and high value resources, and the resulting potential impact on those assets and resources.

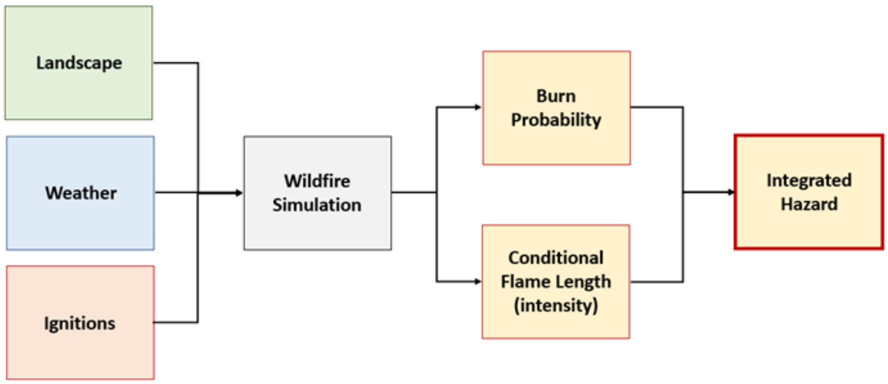


Wildfire Hazard and Wildfire Risk variables

This section summarizes the WRA and includes a discussion of data sets, assumptions, model inputs, and model results. The model results can be used to identify and prioritize vegetation management/fuel reduction project locations intended to reduce wildfire risk. A more detailed discussion of the WRA methodology and results is included in Appendix B.

3.1 Wildfire Hazard Assessment

A Landscape Burn Probability analysis was performed in the IFTDSS software application to evaluate wildfire hazards in the Plan Area. The final product of the hazard assessment is Integrated Hazard, which is produced by simulating a wildfire in a given area under specific weather conditions in order to determine the intensity and burn probability of a fire.



Integrated Hazard process flowchart

The 2022 LANDFIRE data set (embedded in the IFTDSS application) was used to represent the terrain (elevation, slope, and aspect) and the vegetation/fuel for each Forecast Zone (FZ). Landscape Burn Probability was run at the County scale and for each of the four FZs under three different weather scenarios to capture the unique fire environment across the County, resulting in 15 total simulations for the Plan Area. Fire scenarios and model inputs were developed based on available weather data, historical trends, and recommendations from the TAC. The three weather scenarios are described below:

Fuel-Driven Fire: Weather inputs were critical fire weather conditions (97th percentile) but with prevailing wind direction and diurnal (daily pattern) wind speeds. Fuel and topography were the primary drivers of fire behavior and fire growth was predominantly driven by fuel type, density, condition, and moisture. Wind speeds in these types of fires tended to be lower, and the terrain had a significant influence on fire behavior. Such conditions could occur at any time of the year but were at critical condition in summer.

Wind-Driven Fire: Weather inputs were critical fire weather conditions (97th percentile) but with strong downslope winds from the north/northeast bringing low relative humidity, warm air, and high wind speeds (based on FireFamily Plus analysis). Fire under these conditions was expected to be driven by extreme wind speed and wind gusts and resulted in rapid-fire growth, extreme rates of spread, long-range spotting, and extreme fire behavior. Such conditions typically occur in late summer/early fall.

Wind-Driven Fire (Addendum): A second wind-driven scenario was run with the same inputs as the initial wind-driven fire scenario with the only change being the input wind direction. For this scenario, the wind direction was set to "gridded" to capture the influence of terrain on wind speed and direction.

In IFTDSS, wildfire hazard is represented by the Integrated Hazard output. Integrated Hazard is an analysis process that combines two important measures—burn probability and conditional flame length—into a single model output layer in a geographic information system/mapping format. The following summarizes the Integrated Hazard process.

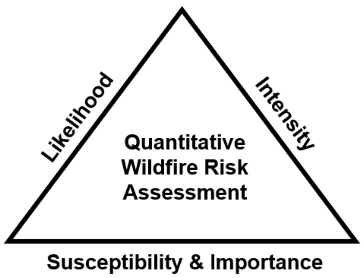
Burn Probability represents the likelihood that a given location would burn, considering the model inputs used. Burn probability is related to the size of fires that occur on a given landscape, where larger fires produce higher burn probabilities than smaller fires and is a function of wildfire spread rate and wildfire duration. The modeling results for burn probability are displayed with seven distinct classes (Appendix B).

Conditional Flame Length is an estimate of the mean flame length for all the fires that burn a given point on the landscape during a model run. It is typically lower than the traditional flame length value because it accounts for heading, flanking, and backing fires and is the mean of the three types of fires. The modeling results for conditional flame length are displayed with eight distinct classes (Appendix B).

Integrated Hazard is quantified and categorized in IFTDSS using the burn probability and the conditional flame length results for an analysis area. This model evaluates the results from the burn probability (probability of a fire occurring at a specific point under a specified set of conditions) and conditional flame length (intensity at a specific point given a fire occurs) analyses described above. Unlike traditional wildfire hazard modeling the Integrated Hazard is comparative and prioritizes the results based on the most hazardous location in the analysis area. Integrated Hazard is categorized into seven distinct classes (Appendix B).

3.2 Wildfire Risk Assessment

Following the hazard assessment, a Quantitative Wildfire Risk Assessment (QWRA) was conducted to evaluate wildfire risk for the Plan Area. A QWRA characterizes the predicted benefits and threats from a wildfire on values across a landscape. Results from a QWRA can be used to identify and prioritize potential vegetation treatment areas.



QWRA variables

The QWRA considers both the threats and benefits of wildfire. Some resources may benefit from fire (e.g., fire-dependent plant species and landscapes that have departed from the historical fire regime) and others may be threatened by fire (e.g., communities). The QWRA first looks at the level of exposure of the High Value Resources and Assets (HVRA) to wildfire by comparing the burn probability, conditional flame length, and Integrated Hazard outputs with the HVRAs across the analysis area (See Section 2.7.3 and Table 16 for a description of HVRAs utilized in the QWRA). The order of importance for the HVRAs was determined by the results from the Community Wildfire Protection Plan (CWPP) survey, community outreach, the Project Team, and the TAC. The analysis then calculates the likelihood of a fire occurring and the susceptibility of the HVRA to the potential intensity of a fire to determine risk. The QWRA was run for each Forecast Zone (FZ) for each fire scenario.

Table 16. Primary and Sub-HVRAs Selected in Order of Importance for the Wildfire Risk Assessment

Primary HVRA Order	Sub-HVRA Order
1. Community Lifelines	1. Communities

NEVADA COUNTY CALIFORNIA

Table 16. Primary and Sub-HVRAs Selected in Order of Importance for the Wildfire Risk Assessment

Primary HVRA Order	Sub-HVRA Order
	2. Critical Water Infrastructure, Critical Transportation Infrastructure, and Critical Power/Communication Infrastructure 3. Vulnerable Populations
2. Community Health	1. Hospital and Shelter Facilities 2. High Wildfire Smoke Potential 3. Soil Vulnerability and Solid Waste Management Facilities 4. Hazardous Waste Sites
3. Natural Resources	1. Watersheds 2. Outdoor Recreation Resources and Areas with High Climate Resilience 3. Significant Species 4. Oak Woodlands
4. Economic Resources	1. Government Buildings 2. Historic and Cultural Districts 3. Recreation Resources

The first step of the QWRA is to conduct an Exposure Analysis of the HVRAs. The Exposure Analysis examines the intersection between wildfire hazard and the HVRAs. The QWRA then combines the HVRAs with the Exposure Analysis and the Landscape Burn Probability outputs and results in two model outputs: the Conditional Weighted Net Value Change (CwNVC) and the Expected Weighted Net Value Change (EwNVC), defined below.

CwNVC is a product of fire intensity, susceptibility, and importance. It highlights the likely effects of fire on HVRAs with the assumption that a fire will or has occurred. CwNVC aids in planning scenarios where the presence of fire is assumed, and the goal is to understand the anticipated threats and benefits of fire.

EwNVC analyzes the likelihood of a fire occurring and the effect on HVRAs. The expected weighted value is a product of the CwNVC and burn probability. It determines the risk to the HVRA by intersecting the wildfire hazard with the likelihood of occurrence and the potential impact on the HVRA. EwNVC is used for planning scenarios where the likelihood of a fire occurring needs to be considered (as opposed to CwNVC, which assumes a fire will occur).

Because EwNVC is a product of CwNVC and burn probability, it is best used for planning scenarios where the likelihood of a fire occurring needs to be considered. EwNVC can be used to determine where best to treat fuels or allow for unplanned ignitions. EwNVC is calculated for every pixel[5] in the analysis area. Positive values indicate that fire benefits[6] an HVRA and negative values indicate that fire adversely

5 A **pixel** (short for "picture element") is the smallest unit of a digital image or graphic that can be displayed and represented on a digital display. In this context, a pixel represents a mapped area on the ground surface measuring 30 square meters.

6 An increase in the value of an HVRA due to fire (e.g., low intensity fire that only consumes small trees and ladder fuels and therefore improves overall forest health conditions).

affects[7] an HVRA. When no HVRAs are present to be impacted by a wildfire results of the EwNVC are considered to be No Impact. Results from the QWRA are both comparative and probabilistic.

3.3 Summary of Risk Assessment Results

3.3.1 County Scale

Wildfire risk considers the intersection between the wildfire hazard, the likelihood of a fire occurring, and the vulnerability of the High Value Resources and Asset (HVRA) at risk of being impacted by a wildfire. Wildfire risk is also directly influenced by what a community considers to be important to protect from wildfire. The Quantitative Wildfire Risk Assessment (QWRA) is able to identify and prioritize potential fuel treatment areas based on what is determined as being valuable. It is important to note that the results from the QWRA are not the final results of the wildfire risk modeling process. Further, the QWRA accounts for the predicted benefits and threats from a fire on multiple, often, overlapping values across the landscape. This was done for the three fire scenarios, (1) fuel-driven, (2) wind-driven, and (3) wind-driven (addendum), for each FZ, and each primary HVRA.

Fuel-Driven Scenario

In the fuel-driven scenario, across each HVRA, 70,777 acres (7%) of the County are classified as Non-Burnable and 11,631 acres (1%) of the County are considered Burnable but Not Burned. In the Community Lifelines risk assessment, 41,474 acres (4%) of the County experienced No Impact, which was the lowest of all the Primary-HVRAs. The highest No Impact classification is in the Economic Resource risk assessment. In each Primary-HVRA risk assessment, the majority of pixels that are impacted by a potential wildfire are classified as being either High Priority or Very High Priority Risk and range from 4% to 21% of the burnable pixels. The Natural Resources Primary HVRA risk assessment is the only risk assessment to indicate a potential benefit from a wildfire occurring. However, this benefit is less than the potential risk. Generally, where high levels of risk occur is driven by where the HVRAs are located. See Table 12 and Figures 22, 24, 26, and 28 of Appendix B, Wildfire Risk Assessment for a tabular categorization of the acreages and visual representations of those categories in map form.

Wind-Driven Scenarios

In the wind-driven scenario, the number of acres classified as Non-Burnable is the same as it is in the fuel-driven scenario. In the wind-driven scenario, 1% (6,750 acres) are classified as Burnable but Not Burned. The Primary-HVRA with the least acres classified as No Impact is the Community Lifelines Primary-HVRA and Economic Resources has the most acres classified as No Impact. Within each Primary-HVRA, the majority of pixels that are burnable are either classified as High or Very High Priority Risk and range from 6% to 22%. Again, the Primary-HVRA Natural Resources is the only Primary-HVRA to have areas classified as experiencing a potential benefit from wildfire. Once again, where the High and Very High Priority Risk classifications occur is directly related to where the HVRAs are. See Table 13 and Figures 23, 25, 27, and 29 of the Wildfire Risk Assessment and Table 2 and Addendum Figures in the

[7] A decrease in the value of an HVRA due to fire (e.g., fire that destroys a structure).

Wildfire Risk Assessment 2024 Addendum (Appendix B) for a tabular categorization of the acreages and visual representations of those categories in map form.

Discussion of the Results

The results between the fuel-drive scenario and the wind-driven scenario for the County-scale WRA are very similar. There are minimal differences in the number of pixels that are considered to be either High or Very High Priority in the two fire scenarios per the HVRA risk assessments. Further, the analysis focused on the combination of pixels that are classified as either High or Very High Priority Risk. By considering the High and Very High Priority Risk results together, the scope of the risk analysis is not overly narrow. This also allows for more areas to be considered for potential wildfire risk reduction activities. Further, where these pixels tend to occur is consistent between the two fire scenarios. When there is a change in the pixels classified as either High or Very High Priority Risk, they tend to merely swap classification meaning that High became Very High or vice versa. This is largely because the locations of High or Very High Priority Risk classification are driven by where the HVRAs are as well as the results from the Integrated Hazard. Because the locations of the HVRAs are static between the two scenarios (meaning that the HVRAs occurred in the same locations in both the fuel-driven scenario and the wind-driven scenario), this accounts for much of the similarity between the two results. Therefore, unlike the Integrated Hazard results, the risk assessment results are not as affected by the change in the fire scenarios.

In the fuel-driven and wind-driven risk assessments of Community Lifelines, the High and Very High Priority Risks occur adjacent to the communities and in areas that are identified as Very High Priority Hazards in the Hazard Assessment. The locations are generally consistent across the risk assessments per HVRA and FZ. For instance, the Community Health risk assessment has pixels classified as High or Very High Priority Risk that are located around communities with some concentrated areas in the Higgins/Penn Valley FZ and in the Tahoe National Forest (TNF) FZ. This pattern is true in both the fuel-driven and wind-driven scenarios for Community Health.

In the Natural Resources risk assessment, there are some more notable changes in the distribution of the results. However, areas are generally shifting between being classified as High or Very High Priority Risk between the two scenarios. Because High and Very High Priority Risks are being considered together, this is not considered to be significant.

The Economic Resource HVRA follows the same pattern as the other HVRAs. There is very little change in the number of pixels classified as High or Very High Priority Risk and minimal change in the location of these pixels. The main difference with the Economic Resources risk assessment is that the majority of the landscape is not impacted. This indicates that it is very difficult to meaningfully separate Economic Resources from the related HVRA of Natural Resources in a rural environment. In an urban environment, there is typically a clear delineation between the community's economic epicenter and the wildland areas. However, this is not the case in Nevada County. In Nevada County, the economy is directly tied to the environment itself. The main driver of the economy in Nevada County is tourism, especially recreation-based tourism, which is directly tied to the natural environment, meaning that the County’s main economic resource is the environment itself. Therefore, it is not possible to separate economic resources in a meaningful way, as they are components of all the HVRAs. Further, as a result, the Economic Resources HVRA is very vulnerable to wildfire given that any impact on the other identified HVRAs also has the potential to impact the Economic Resources in Nevada County. For these reasons, the results from the Economic Resources risk assessments are not further analyzed in the WRA beyond the County scale discussion of the risk assessments.

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