The Risk of Fire to Riparian Conservation Areas

Abstract

There are many riparian areas in California that are set aside for conservation in land allocations called "riparian conservation areas". Wildfires can heavily impact the land and riparian areas it consumes. The purpose of this project is to analyze how many hectares of riparian conservation areas are threatened by wildfire in the Sierra National Forest. Data layers were used to calculate the total area of Sierra National Forest, riparian conservation areas, and hazard zones. Overall, the majority of riparian conservation areas are at risk and further action will be required to further maintain the conservation goals. Further studies on preventative measures will need to be conducted to see how the riparian conservation areas can be kept safe.

Introduction

California has many intricate networks of streams and rivers. Riparian conservation areas (RCAs) are "land allocations that are managed to maintain or restore the structure and function of aquatic riparian and meadow ecosystems" (USDA Forest Service 2006). With climate change, years of fire suppression, and drought, wildfires have "rapidly increased over the last two decades" (Westerling 2016). While fire was once applied to riparian ecosystems by indigenous peoples and studies have shown that it will result in "higher overall richness and in native species" (Hankins 2013) they were prescribed and controlled. Wildfires are a different case entirely. Intense heat from wildfires can impact riparian areas from "changes in soil moisture, structure, and infiltration can accelerate surface runoff, erosion, sediment transport, and deposition" (Adams et al. 2004).

The Tree Mortality Task Force has collected and released data about tree mortality, the hazards they possess, and how high of a fire threat they are (CAL FIRE n.d.). They are split into two categories: Tier 1 and Tier 2. Tier 1 represents a "direct threat to public safety" whereas Tier 2 represents risk to forest health (CAL FIRE n.d.). The forest service has compiled data of RCAs throughout California and released it to the public. I am interested in seeing how many hectares of RCAs are at risk for fire in the Sierra National Forest (Figure 1) and whether the amount is significant enough to require further action. A combination of data from the Tree Mortality Task Force and forest service can help in answering these questions.



Figure 1. Locator map of Sierra National Forest within the state of California

Methods

Before any actions were made, a preliminary outline with a basic corresponding flowchart (figure 2) was created to aid in organization and anticipation of the project needs. The outline is as follows:

- 1. Create a new folder and project work flow structure
- 2. Acquire data from the Forest Service, Cal Fire, and anywhere else needed
 - a. California state counties
 - b. National forest boundaries within California
 - c. Hazard zones for fire within California
 - d. Riparian conservation areas within California
- 3. Ensure all files are working and within the same projection and fix those that are not
- Add national forest boundaries within California and create/export layer of only Sierra National Forest
- Clip "riparian conservation areas", "tier 1 hazards", and "tier 2 hazards" to "Sierra National Forest" layer
- 6. Dissolve "riparian conservation areas" to make it easier to calculate the total hectares
- 7. Dissolve "tier 1 hazard zones" to make it easier to calculate the total hectares
- 8. Dissolve "tier 2 hazard zones" to make it easier to calculate the total hectares



Figure 2. Flow chart of GIS analysis process

Once these were made, the folder system was created and the California counties were found from the California open data portal. The forest boundaries and riparian conservation areas were located at the forest service "region 5" data portal. The hazard zones was created by the Tree Mortality Task force and was found on the Cal Fire data reports and deliverables website. The forest boundaries and California counties needed to be converted to the "NAD_1983_California_Teale_Albers" projection before continuing. The "project" tool was used to convert these shapefiles.

To begin the analysis, the "Sierra National Forest" boundary was selected from the forest boundaries and exported to a new layer. The riparian conservation areas, tier 1 hazard zones, and tier 2 hazard zones were then clipped to this new "Sierra National Forest" layer using the "clip" tool. The "dissolve" tool was then applied to the "riparian conservation areas", "tier 1 hazard zones", "tier 2 hazard zones", individually, to make it easier to find the total area. For these and the "sierra national park" layers, three new fields were added: "area", "acres", and "hectares". The "calculate geometry" tool was used to find the total area in square meters. Then, the "field calculator" tool was used to convert square meters to acres, and again from acres to hectares (Table 1).

Table 1. Conversion formulas

Square Meters to Acres	Acres to Hectares
[Area] * 0.000247105	[Acres] * 0.404686

Results

After clipping the layers, the areas that will be affected by fire within the Sierra National Forest can be seen in figure 2. It can also be seen that RCAs make up approximately 51% of the Sierra National Forest (Figure 3). After calculations, the amount of these RCAs that are in a tier 1 hazard zone are 5% while 81% are in tier 2 hazard zones (Table 2). These findings suggest that a majority of RCAs are at risk for wildfire (Figure 4).

Table 2. Total area in hectares

SNF (hectares)	RCA's (hectares)	Tier 1 (hectares)	Tier 2 (hectares)
574172.327473	290575.821753	13184	234954.104586



Figure 2. Areas at risk for fire in the Sierra National Forest



Figure 3. All the riparian conservation areas within the Sierra National Forest



Figure 4. All of the riparian conservation areas at risk for fire within the Sierra National Forest

Conclusions

This final project was very thought provoking and interesting. Researching and finding all the data, it was realized how much effort goes into analyzing and classifying data. With RCAs being land that is allotted for conservation reasons, it was wondered how much of these areas are in fire hazard zones.

Although only 5% of RCAs are in tier 1 hazard zones in the Sierra National Forest, these hazard zones are only designated for being a "direct threat to public safety" (CAL FIRE n.d.) and is a relatively small number. Unfortunately, 81% of RCAs are in tier 2 hazard zones, which are risks to forest health (CAL FIRE n.d.). This is a significant number that should be taken seriously; a vast majority of the RCAs are at risk. Acknowledging this, precautionary steps (such as fuel reduction and/or prescribed burns) should be taken to ensure the safety of these conservation areas. Further studies can be done to see how effective these steps will be in protecting these areas.

Acknowledgements

Dataset Name	Description	Spatial Reference System/Projection	Data Source	Link to Data Source	
CA_Counties_TIGER	Counties of	***WGS_1984_Web_Mercator	CA OPEN Data	California Data	
2016.shp	California	_Auxilary_Sphere	Portal	Portal	
Administrative_fore st_boundaries	Boundaries of National Parks	***GCS_North_American_198 3	U.S. Forest Service Enterprise Data	<u>USDA Extract</u> Data Tool	
Snv.gdb	Geodatabase of Sierra Nevada Forest Plan	NAD_1983_California_Teale_Al bers	USDA Region 5 Data	Forest Planning <u>& Monitoring</u> <u>Datasets</u>	
HighHazardZones18 _1.gdb	Geodatabase of High Hazard Zones	NAD_1983_California_Teale_Al bers	Tree Mortality Task Force	Task Force Maps and GIS Data	
***spatial projection converted to "NAD_1983_California_Teale_Albers"					

Table 1. Datasets used for analyzing and creating maps

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