Using Historical Vegetation Surveys to Guide Future Restoration on 1st 48 Fuel Break Project in the Mad River Ranger District.

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Mad River Ranger District Employees:

Foresters Rayma Cooley, and Shirley Rech, Wildlife Biologiigst Krista Smith, Ranger Dan Dill, ~~Fuels~~ Nancy Curran, Kevin Reese, and the Fire Department. Thank you for this opportunity.

Honorable mention goes to my colleague, and life-long friend Natalia Rico.

Executive Summary

Under the supervision of Rayma Cooley, my internship partner Natalia Rico and I surveyed *n*=312 plots on the Mad River Ranger District (MRRD), located within the Six Rivers National Forest (SRNF). Our focus was to investigate vegetation change on South Fork Mountain, near the town of Ruth, CA.

We gathered data for a restoration project called the First 48 Fuel Break, which is intended to reduce the amount of lateral fuels, as well as restore California black oak (*Quercus kelloggi*) and Oregon white oak (*Quercus garryana*) woodlands, which have been encroached by dense conifer species Douglas-fir (*Pseudotsuga menziesii*) and White fir (*Abies concolor*). This proposed management approach will help reduce wildfire severity, and to promote oak woodland resilience ultimately improving the safety of adjacent communities, optimizing ground water recharge, and enhancing biodiversity.

The data gave us insight to the types of vegetation that was once present on the landscape, prior to fire-exclusion, due to Euro-American settlement and Forest Service fire suppression. The next step is to analyze the data, which will help us determine historical vegetation types, and how change in vegetation has affected various resources over time.

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Project Objectives

The U.S. Department of Agriculture career path that I have chosen for myself is a Biological Science Technician 6 & 7 through the Agricultural Research Service agency. I have obtained my

associates in Biotechnology from Southwestern Community College, and will soon be attending Humboldt State University to pursue an undergraduate degree in Microbiology and a graduate degree in Biology. I am most interested in environmental microbiology, specifically, as well as studying plant pathogens. Other areas of interest include research in extremophile microbes, brewing, and fermentation science.

Having had the opportunity to work for the U.S. Forest Service has given me various research insights. I was introduced to experts pertaining to various fields of science, who all collaborate information to achieve a common goal. Collaborations between forestry, wildlife, archaeology, fuels, and other disciplines, are necessary to carry out restoration management. My ~~teammate~~ colleague and I conducted pre-restoration research for a project called the First 48, which is dependent on inter-disciplinary collaboration. As a forestry intern, my focus was to investigate the current vegetation in the South Fork Mountain area, and look for legacies indicative of historical vegetation. Such evidence is observed as dead and dying oaks being overtopped by fir species, dead course-woody debris (CWD) of oaks, and aging Douglas-fir and oaks via counting rings of core samples. By surveying systematically stratified plots, forester and internship supervisor, Rayma Cooley, will have a more in-depth understanding of current and historic forest conditions, which will help guide restoration efforts.

Introduction

The timeline of historical events begins before 1865, when the native tribes Wailaki, and closely related Lassik lived on the land. As Keter explains in his 1995 publication, this time period is prior to European-American settlement, and conflict (1854-1865). In 1865 the surviving natives from the Wailaki and Lassik tribes were removed to the Round Valley Indian Reservation (Keter 1990).

Once the Forest Service established itself in 1905, 111 years ago, there was a major change in the way the land was managed (Keter. 1995). A century later, there are historical representations that are found presently in the SRNF. The vegetation types can be observed and interpreted as such was done by retired USDA Archaeologist ~~employee (WHAT IS KETERS TITLE?!)~~ Thomas Keter, whom researched current vegetation types of the Eel River in the North Fork Basin, in ~~(~~SRNF, MRRD~~?)~~. This is what he observed:

> "Within even aged stands of Douglas-fir that have overgrown the oaks, one can invariably find several old-growth Douglas-fir. These trees have lower radiating branches, evidence that they grew in a more open environment with little intra-species competition. After cessation of burning, these trees became the seed source for today's even-aged stands. The oaks provided shade that conserved the moisture content of the top layer of soils, allowing the Douglas-fir seedling to become established. When the Douglas-fir grew above the oaks and shaded them out, the oaks began to die. It should be noted that within many of the young Douglas-fir stands there are a few old-growth ponderosa pine. These trees are not shade-tolerant and cannot become established under a dense canopy. They provide additional evidence that a particular area was more open prior to 1865." (Keter. 1995).

Anthropogenic Fire Greatly Reduced the Congestion of Fuels

Commented [Cooley1]: retired MRRD archaeologist

Commented [Cooley2]: correct, on MRRD

Prior to Euro-American settlement, the local Native Americans, from the Wailaki, Lassiks, and Nongatl tribes, routinely burned the landscape (Personal communication, Rayma Cooley, Forester, USDA Forest Service). They did so primarily to manage hunting and gathering which improved habitat and maintained diversity (Lewis 1983). The burning removes litter, and small shrubs and trees, like a young fire intolerant Douglas-fir, from the forest floor. By preventing the establishment of the Douglas-fir forests, and maintaining grassland and oak woodland vegetation communities, aboriginal groups managed the environment to promote species habitat and diversity (Keter 1995). Additionally, other land use practices facilitated by regular burning include: travel (Essene 1942), to drive deer (Goddard 1923), collect grasshoppers (Curtis 1924), to suppress undergrowth and remove litter in order to prevent disease and facilitate the future collecting of acorns (Keter 1995: Interview 395), improve quality of basketry (Keter 1995), and to protect village sites from being burnt by uncontrolled fires (Keter 1995: Personal communication, Kathy Heffner-McClellen, Anthropologist, USDA Forest Service). Additionally, fires caused by lightning strikes further encouraged a more open, and heterogeneous landscape. Thus, the MRRD evolved with regular anthropogenic and naturally occurring fire.

Commented [Cooley3]: Look to Tom Keter's paper to discuss how Euro-American settlement and the Forest Service altered the landscape. It wasn't only fire exclusion, also due to heavy use of range animals, such as sheep. Also provide a bit of a timeline as to when these changes occurred. Whey were the natives extirpated? When did the Forest Service come in?

Wild-life Species at Risk for Habitat Destruction

Linked into the ecosystem are the wild-life inhabitants of the region such as the spotted owl, black bear, fox, and bobcats, for example, which depend on oak woodlands for food and other necessities. Vegetation change adversely effects the animals. For example, the spotted owl requires sturdy tree branches, and mostly desires old growth Douglas-fir for nesting and rooting (Personal communication, Rayma Cooley, Forester, USDA Forest Service). Amongst today's dense, young even-aged stands of Douglas-fir it is difficult for the animals to navigate through the forest (Personal communication, Krista Smith, Wild-life Biologist, USDA, Forest Service).

Additionally, bears, deer, fox, and bobcats depend on the acorns of the oak tree as a main source of food (Personal communication, Krista Smith, Wild-life Biologist, USDA, Forest Service).

Other wild-life being affected by the vegetation change are the inhabitants of the riparian environments- see below for more information on water recharge.

Current Vegetation Types Affect Water Recharge

In 1910 Willis Lynn Jepson stated that, "With an annual average rainfall of forty to fifty inches, with a rich soil and with an increasing control of annual fires, the forests and woods of this whole region are showing a decidedly aggressive character and are encroaching steadily on the barren lands. There is today more wooded area in Humboldt County than when the white man came over half a century since" (Jepson. 1910). Within 2015-2016 there has been an average to above average (50-60 inches of precipitation) amount of rain fall in the North Coast of California (WRCC. 2016), and annual precipitation influences the magnitude of water yield increase that follow timber harvest operation in forested watersheds" (Keppler 1990). Keppler [1990] also states that:

> "Vegetation affects the proportion of precipitation that is evaporated and transpired and, consequently, the amount available for soil moisture storage, groundwater recharge, and dry weather stream flow." (Keppler and Ziemer. 1990)

In forested areas of heavy timber operation water yield can be increased by vegetation removal (Ponce and Meiman. 1983), such a thinning, which increases the amount of water in the soil (Aussenac and Grainier 1987).

The Mad River watershed is partitioned into three sub-watersheds: the upper Mad River which begins in the upper headwaters and ends at Ruth Lake; the middle Mad River continues from Ruth Lake to Cowen Creek; and the lower Mad River continues from there all through the estuary in McKinleville (Mad River Alliance 2016). The portion of the Mad River watershed that pertains to our region of study is the upper Mad River.

The Mad River watershed is home to many riparian fauna such as Chinook salmon, Coho salmon, Steelhead, and several amphibians like salamanders, and turtles (Mad River Alliance 2016). Likewise, it provides drinking water for 65% of residents in Humboldt County (Mad River Alliance 2016).

Project Approach

The study site is located on Forest Service lands, southeast of Ruth Lake, and north of the town of Ruth (please refer to Appendix A.1) on the MRRD, on SRNF. Using a global positioning system (GPS) device, my internship partner and I sought out pre-destined plots in the First 48 Fuel Break Project area, that were systematically stratified in a grid formation, spaced approximately 1/3 of a mile between each plot. A map of the area was created using ArcGIS (please refer to Appendix A.2).

Our field research includes surveying for vegetation within a 60 ft^2 plot. From plot center we measured the slope using an instrument called a clinometer. We also determined the aspect and elevation from plot center. We determined if a tree was to be included in the survey by observing the trunk of the tree through a 20-factor prism. The prism helps us to determine the basal area of trees in a stand

Once we determined which trees were to be surveyed, we identified the tree's species, diameter at breast height (DBH), status (live or dead), crown class, decay class (if applicable), height, and age when applicable— we aged both the most northern and the biggest (in diameter) tree of each species. We also collected data on the following: seedlings within a 12 ft^2 at plot center, pole-sized saplings within a 36 ft^2 at plot center, and CWD and ground cover within the 60 ft^2 plot.

~~This data represents~~

Commented [Cooley4]: Sentence incomplete

The data collection was altered half way through the internship due to an injury using the increment borer- the instrument used to determine the age of trees. In an attempt to manually bore into a large diameter oak, I injured my neck. As a result we stopped boring into relatively large conifers, and relatively medium to large sized oaks. This can affect the data in relation to the age of the trees in the plot.

Commented [Cooley5]: This is too funny. ____itis!

Project Outcomes

Data analysis is pending.

Conclusion

The field data collected can be interpreted to represent the environmental distress that the Forest Service has brought upon the National Lands since their establishment in 1905. This problem was influenced through the exploitation of logging practices, extirpation of anthropogenic land

management practices such as regular burning and suppression of wild-fires, and grassland/savanna overgrazing of domestic farm animals. (Keter 1995).

This collaboration between the Water Resources Initiatives and the USDA has benefitted my professional career significantly. I have experienced a site infected with sudden oak death (SOD) and it has reinforced the roll of microbiology in the environment, and likewise had fueled my passion to study plant pathogens. This experiential learning internship has broadened my career's horizons.

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Appendices

A.1 Map of Plot sites in the First 48 Project Area

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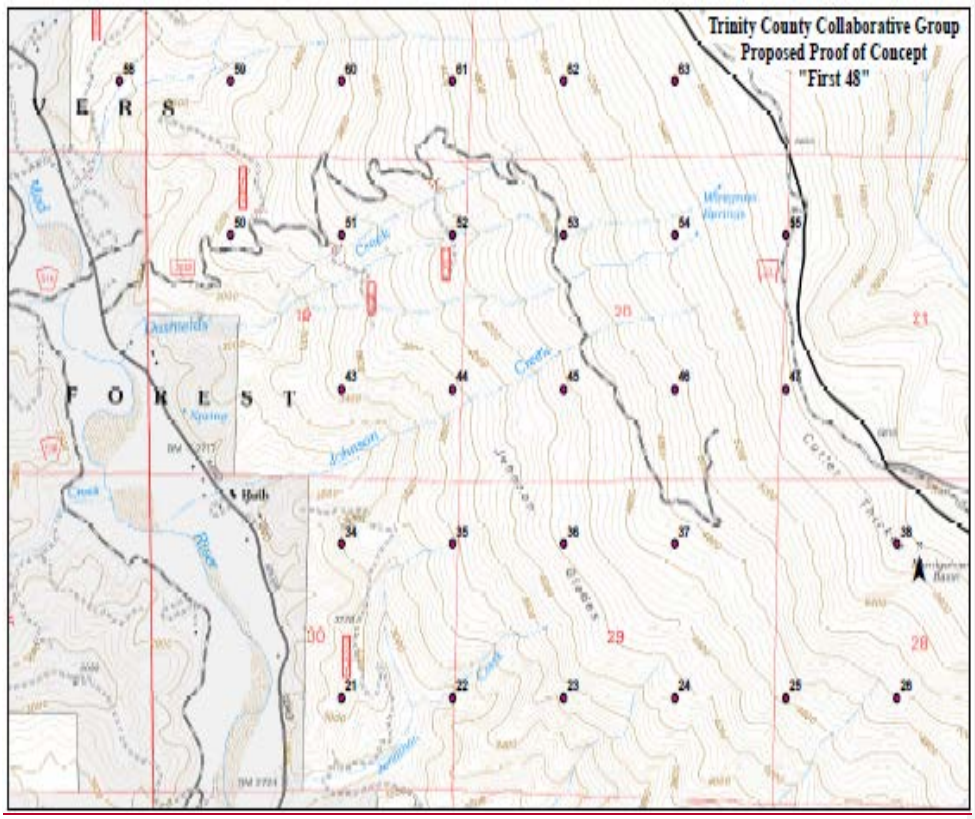

A.2 Map of the Types of Historical Vegetation, and the Project Sites.

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