Effects on Watershed Function with Changes in Plant Functional Groups across Impaired Watersheds on the Angeles National Forest

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Acknowledgements

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Executive Summary

This administrative study examines vegetation changes from altered fire regimes, which subsequently impact hydrological functions of impaired watersheds, in the Angeles National Forest. While fire adaptations of Southern California vegetation have been well documented (Franklin et al., 2001; Zedler et al. 1983; Moreno et al., 2013), long-term effects of modified fire regimes on vegetation within HUC 6 watersheds needs a more in-depth assessment in order to apply our understanding of the changes to restoration goals and objectives. The semi-arid vegetation communities provide watersheds with stability through protection from soil erosion and runoff (Heede, 1990; USFS, 2011), while providing ecosystem health by perpetuating wildlife species dependent upon that habitat (Preston et al., 2008). However, the cumulative effect of altered fire regimes impairs the recovery of these vegetation communities due to interplant competition and predominance of non-native invasive species through time which reduces the density of native deep-rooting vegetation species needed to maintain proper watershed function (Lovich and Bainbridge, 1999; Tyrrel, 1982). Vegetation inventories, fused with remotely sensed imagery and other ancillary, data enable a baseline for monitoring and inventory of facets of eco-hydrological function prior to restoration of native vegetation communities within these dynamic watersheds driven by fire and water.
Project Objectives

The Angeles National Forest (ANF) covers 700,000 acres of land and is the largest urban forest in the United States. The ANF, known as the backyard of the Los Angeles metropolitan area, has an enormous amount of visitor traffic—approximately 3.1 million visitors annually (Barry, 2012). Additionally, many homes and private lands lie within national forest boundaries. Thus, the forest’s proximity to such a large urban population makes it even more susceptible to fire (Syphard, 2011). Consequently, natural fire regimes in the ANF have been considerably altered (Sugihara, 2006; Syphard, 2011; Zedler et al., 1983).

On June 5, 2002, a fire started by a spark at a construction site, burning approximately 18,000 acres (or 28 square miles) (US v. CB & I CONSTRUCTORS, INC.). The Copper Fire was primarily concentrated in the San Francisquito Canyon area (Appendix A, Figure 1). The fire consumed chaparral and coastal sage scrub vegetation, which impaired the function of the watershed for a period of time. It was estimated that sedimentation increased three-fold in the Canyon’s watershed as a result of the Copper Fire (US v. CB & I CONSTRUCTORS, INC).

The focus of the project is to better understand the cumulative effect of altered fire regimes on vegetation communities, and the subsequent impacts on related watershed. Furthermore, based on these cumulative effects through time, our intention is to gather insight into mechanisms of the cause in an effort toward reversing these effects through restoration application, given likely future climate. In order to better understand this relationship, our investigation focused on an area burned by the Copper Fire and a portion of the Powerhouse Fire. Our project area, known as the Copper Fire Restoration Area, has been burned several times and has undergone substantial changes in vegetation groups over time. Figure 2 (Appendix A) illustrates observed changes in vegetation groups over the past 90 years; most notably we can see coastal sage scrub and invasive non-native grasses increasing in distribution over
time (Hooper, 2014). The area’s last vegetation inventory was recorded in 1930’s with the Wieslander (1939) VTM effort with previous plot data collection performed within the area during FIA plot inventory unknown due to the lack of sharing and transparency with FIA data. Baseline pre-restoration inventory within the Copper Fire area is needed to provide additional insight to these changes due to the long period since the last site-specific inventory.

In addition to collecting vegetation composition inventory, we are also taking geometric measurements to address the need for non-destructive canopy volume estimates. Vegetation volume measurements will provide insight into percent cover for wildlife as well as potential above ground biomass available for another wild land fire. In order to better understand the relationship between vegetation cover and watershed conditions, soil stability tests are also conducted at three locations within each plot using a qualitative soil erosion testing kit developed by Herrick and colleagues, which are explained in their peer-reviewed literature explaining the tool and technique (Herrick et al., 2001).

My role in this project was to conduct field surveys, enter, analyze, and map data collected in the field, as well as lead our field team. An integral part of my internship was guiding our field team to study sites and ensuring their safety. Job Hazard Analysis (JHA) and radio communications were also an important part of our everyday fieldwork. Field conditions were very hot, dry and extreme terrain requiring a thoughtful approach to each field data collection effort.

I began this internship with the personal goal of learning to accurately identify unique/region-specific vegetation that is found in the Angeles National Forest. I was also highly interested in understanding of the dynamic interactions that are found in these vegetation communities, and how are they best managed. My role in collecting vegetation inventories, coupled with the opportunity to contribute to this project, has allowed me to begin to achieve these goals; although understanding these long-term
effects of altered fire regimes on watersheds is a work in progress—due to the volume of information and the variability in responses one watershed may have when compared with another. This experience has encouraged me to pursue a career with the USFS, especially as it relates to using GIS with natural resource applications. It has provided insight into the extensive and interesting amount of work that needs to be conducted to more thoroughly understand these relationships.

**Project Approach**

The Copper Fire Restoration Project Area perimeter is illustrated in Appendix B, Figure 1. Collecting vegetation information on the entire area would be impossible, thus, to get representative information of the area 70 (20 m x 20 m) plots were randomly selected with an area-weighted approach based on vegetation group extent and size. There were three types of sampling conducted at each of these plots: vegetation composition, vegetation volume measurements, and soil stability analysis.

Vegetation composition is an estimate of percent cover by plant species distributed within a modified Daubenmire quadrat (1x2 m) across a grid of quadrats within a 20 m x 20 m area plot. The quadrat grid is placed equidistant 5 times across 4 separate rows (Appendix B, Figure 2). Each quadrat will have a unique identifier using the row (A-D) and column (1-5). At each quadrat aspect, earth shape (i.e. convex/concave), percent plant species, percent rock, percent litter, and percent sand are recorded. Percent cover estimations were based by the USGS percent cover estimation guide (Appendix B, Figure 3).

Vegetation volume measurements were performed on all plant species that intersected one of three transects radiating equiangular from the center of the plot. Transects extended 10 m from the center point to the north, southwest, and southeast (Appendix B, Figure 3). The height and two widths were recorded for a representative individual of each species on the transect. After geometry and form data are collected, an estimate of the vegetation volume will be determined using the form type method
described by Mawson and colleagues (1976) (Appendix B, Figure 4). Additional volume-based information will be generated with measurements using the LAI-2200. This instrument can enable the generation of crown bulk density estimates based on field measurements.

Lastly, soils stability was estimated using the Herrick, et al (2001) soil stability quality assessment method. Soil samples were collected at ends of the three transects leveraged for sampling vegetation geometry measurements (Appendix B, Figure 4). Each sample is dissolved for 30 seconds in deionized water. Soil stability will be determined based on one of the classes found on table 7 (Appendix B, Figure 5)

**Project Outcomes**

Data collection of over 70 plots is currently in progress. Present data is insufficient to address hypothesis. Results of baseline inventory are expected at the end of 2014.

**Conclusions**

The Copper Fire Administrative study is an assessment of the impact of altered fire regimes on vegetation communities over time. Frequency and intensity of fires have substantial impacts on shrubland communities, especially when non-native invasive species increase in abundance and distribution with each subsequent disturbance. Identifying these impacts will help inform better restoration strategies in an effort to improve watershed condition and stability.

The Copper Fire Administrative study provided me with an excellent opportunity to apply the knowledge that I have gained through my education and experience in an applied manner. Moreover, I was able to gain a greater appreciation for the abundance of resources found in the Angeles National Forest. Growing up in East Los Angeles, I was surrounded by buildings and roads and I never realized such a diverse natural environment existed within minutes of my home. The city lights and sounds all
too often drown out the flora and fauna for many of us in urban areas. However, my experience with this internship has inspired me to pursue a career with Forest Service where I can continue to be an advocate for our natural resources and encourage the preservation of our natural environment in my community.
Appendix A
Figure 1.
Figure 2.
Appendix B

Figure 1.

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Table 7. Stability class ratings.

<table>
<thead>
<tr>
<th>Stability class</th>
<th>Criteria for assignment to stability class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50% of structural integrity lost (melts) within 5 seconds of immersion in water, OR soil too unstable to sample (falls through sieve).</td>
</tr>
<tr>
<td>2</td>
<td>50% of structural integrity lost (melts) 5-30 seconds after immersion.</td>
</tr>
<tr>
<td>3</td>
<td>50% of structural integrity lost (melts) 30-300 seconds after immersion, OR &lt; 10% of soil remains on the sieve after five dipping cycles.</td>
</tr>
<tr>
<td>4</td>
<td>10–25% of soil remains on the sieve after five dipping cycles.</td>
</tr>
<tr>
<td>5</td>
<td>25–75% of soil remains on the sieve after five dipping cycles.</td>
</tr>
<tr>
<td>6</td>
<td>75–100% of soil remains on the sieve after five dipping cycles.</td>
</tr>
</tbody>
</table>
Works Cited


US v. CB & I CONSTRUCTORS, INC., No. 10-55371 (9th Cir. June 29, 2012).
