Greenhorn Forest Survey Final Report

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Introduction

The Greenhorn mountain range is the southernmost extension of the Sierra Nevada's, located West of Lake Isabella. The region is part of the Great Sequoia National Forest, which is under the jurisdiction of the United States Forest Service. Forest Service regulation allows for a mixed use policy of the land, which beyond public use also includes activities such as logging, mining, and grazing. The ecosystem is a mixed conifer forest which contains Cedar, Fir, Pine, and Oak tree species. Multiple logging projects have occurred in this area throughout the past. The repeated removal of large, healthy trees has altered the composition of the forest structure. There has also been a strict policy of fire suppression, which has significantly increased the risk of severe wildfire due to excessive fuel buildup. This region is home to a wide variety of plant and animal species, including the threatened Pacific Fisher. The health of this ecosystem and its continued protection depends on the management policies that are undertaken now and in the future. Research needs to be done to determine the affects of activities such as thinning for fire suppression, hazard tree removal, cattle grazing and targeted timber sales. The purpose of this investigation was to acquire information to give a general idea of the condition of the forest in an area that has been proposed for several timber sales. We completed 60 forest survey plots within several square kilometer areas along a region of the forest where these projects could be located. The exact locations of a proposed plan have not been specified. The surveys looked at different attributes pertaining to the quality of the habitat. By taking this assessment we hope to highlight specific impacts of logging activities and to determine some of these characteristics.

Methods

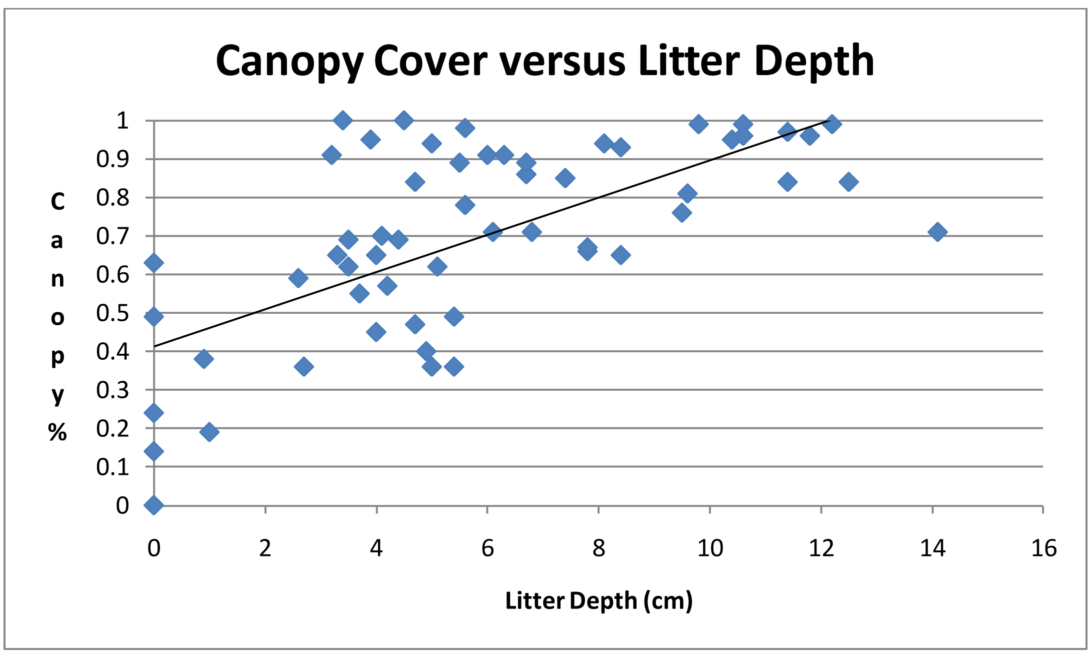
Ten survey plots were chosen within each square kilometer area, moving along 100 meter transects oriented North-South and then choosing random locations East-West along those transects. We would enter the plots in UTM format in the handheld GPS unit (GARMIN GPSmap 60CSx). When we found a survey plot we would measure and mark a ten meter radius circle from the center, with red colored flags denoting the cardinal (compass) directions. We determined canopy cover using a spherical densiometer, measuring a percentage of cover for each cardinal direction. Ground cover was estimated visually by percent coverage and divided into six categories; bare soil, litter, forbs, grass, brush, and rock. The angle and aspect of the slope at the plot center was determined using either a plumb bob or a clinometer. Litter depth was measured in centimeters at 10 locations throughout the plot, using random distances in 10 compass directions at 36° intervals. The values for canopy cover and litter depth were averaged for each plot. A rough sketch was used to record the trees in the plots. They were drawn into a diagram on our data sheet as circles, showing their relative location, species type and diameter at breast height. Saplings were counted, which we established as trees that are breast height but are less than 1 inch in diameter. We took a tally of any seedlings we found within the plot. We also recorded any downed logs, snags, or stumps, taking their measurements when possible. Stumps are measured by their diameters in feet and tenths and denoted as a circle with an x through the center. Any notes or observations we made of the plot were recorded, such as whether logging had occurred there, if we observed any wildlife, or whether it is located on a road, stream or particularly steep slope. Data was placed into an excel table for data analysis. Survey plots were also uploaded into Arcmap as a point shapefile, and the data from the excel table was joined with the Arcmap layer for further spatial analysis.

Results

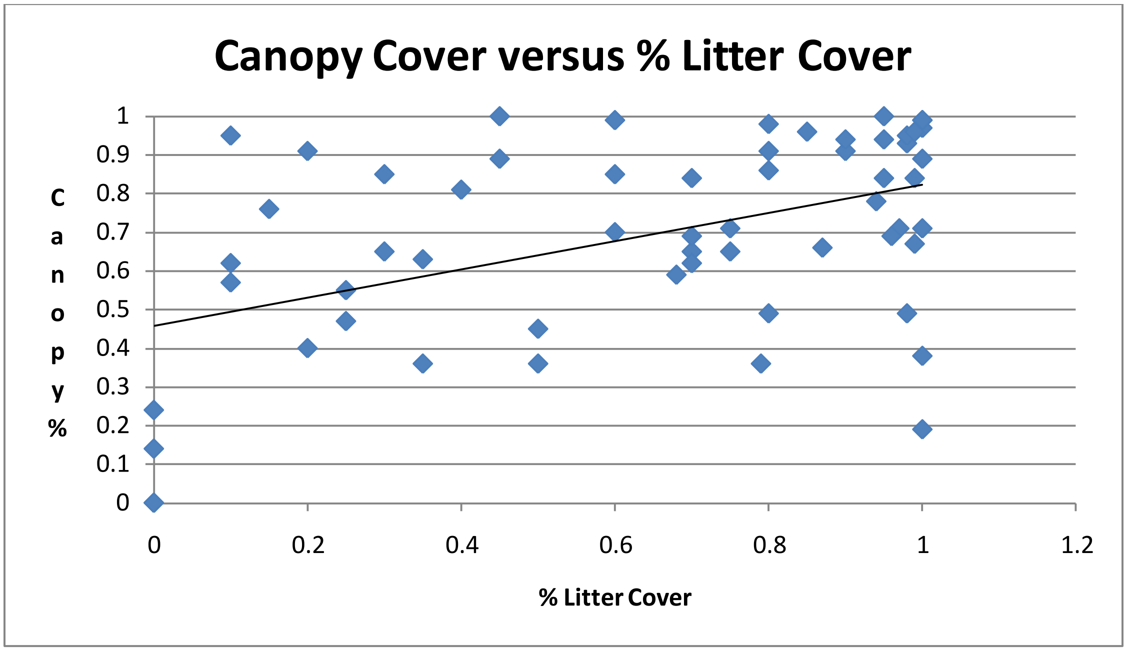
The surveys made compiled a large amount of information from different attributes associated with forest health. For the trees that we found, most of the plots were dominated mostly by Cedar and White Fir. We also saw Black Oak and varying Pine species, including Jeffery, ponderosa, and sugar. Most of the areas had a presence of understory vegetation usually consisting of forbs, grasses or brush. Forb species we encountered included Ranunculus, Miners Lettuce, Wild Eye Torreys, Indian Paintbrush, Lupine, Lotus, Wild Cherry, Chinquapin, Sticky Currant, white thorn, Stinging Nettle, Ferns, Violets, and Wild Strawberry. The table below shows the maximum, minimum, and average values for several of the characteristics we looked at.

	Maximum	Minimum	Average
Average Canopy	99%	0%	68%
Average Litter depth	14.1cm	0cm	5.8cm
Total Seedlings	254	0	36
Total Trees	44	0	17
Slope	39	9	18

We suspected that the amount of canopy cover had a connection with either the ground cover or with the number of seedlings present. We compared the readings for canopy cover with the amount of litter depth in centimeters. With denser canopy cover, it can be argued that there is more organic material from the trees dropping onto the ground. More trees causing a denser canopy could very well account for a thicker bed of litter on the forest floor.



Another factor that we noticed was a possible connection between canopy cover and the percentage of ground cover that is litter. Our suspicion was that with high canopy cover, there will be less sunlight infiltrating to the ground. With less light hitting the ground, there would be less opportunity for plant species to grow there. The percentage of ground cover being litter would then be expected to be higher when there is a thicker canopy cover.



Discussion

A forest ecosystem is an erratic and unpredictable environment, its conditions changing constantly as you move through it. Therefore it is very difficult to get a quantifiable or accurate depiction of the overall subject area. The 60 plots that were taken were able to give some general observations of the forest characteristics, but they are unable to give us a conclusive view of the area as a whole. The amount of data and analysis needed to confirm many of our suspicions was not met, and are therefore still technically speculation. Perhaps if the data from this investigation is combined with future research, a more definitive conclusion may be met. The observations we made as we surveyed the different plots gave us a lot of insight into the forest ecosystem and some of the interconnections between its characteristics. From the above graphs and through spatial analysis, it could be seen that canopy cover has a correlation with the distribution and quantity of litter on the forest floor. We also suspect that the canopy cover also influences how many seedlings are able to establish on the forest floor. With less light infiltration we can expect that fewer seedlings are able to grow successfully on the forest floor. The results from this survey however did not show any significant connection. The majority of our plots had some form of logging evidence, from either recent thinning activities, or more historic logging events. The process of logging also results in extensive roadways being cut through the area.

Roads

By looking at several plots on or near the logging road, we were able to make some observations on the roads' affect on the local vegetation. First of all, the roads are cut into the hill slope, creating a steeper gradient on the uphill side of the road, and debris piles on the down slope side. The road and the edges are prone to erosion from precipitation and surface flow due to the substrate being disturbed and roots and vegetation being removed, which would otherwise help resist erosion. The regeneration on the roadsides consists of thick brush and understory growth, mostly patches of Gooseberry, Chinquapin, and Wild Cherry. We also noticed that the first line of trees along the roadside usually have a thick growth on their lower branches, almost all the way to the ground. This could be a result of having no canopy cover along that corridor of road, and sunlight being able to penetrate to the ground over large distances on either side of the road. This edge effect can change the dynamics of the forest for large areas along both sides of the road. Light infiltration can result in higher growth rates within the understory. This reduces closed canopy habitat and creates a barrier that many species are unwilling to enter. This process ultimately fragments the forest which otherwise would have been a continuous habitat of old growth forest. The fragmentation of habitat can be directly correlated with reduction in the diversity of species in an ecosystem and the ability for wide ranging species to comfortably migrate.

Forest Thinning

Through our surveying we were also able to see many areas of the forest that have been logged in the past. We could confirm the presence of logging by the unsightly stumps and debris piles that are left behind and the disturbance made by logging trails which run through the forests. What has been said of the logging roads affect on forests can also be applied in degrees to the affects of logging within the interior. The removal of trees, large or small, reduces the canopy cover artificially and allows light infiltration to the lower parts of the forest. Scattered light infiltration is required for forest regeneration, and is usually provided by either fire events or sporadic tree fall of naturally aged or frail trees. By arbitrarily removing trees within the forest, we greatly increase the amount of light infiltrating into the forest, which can cause increased biomass in the lower parts of the forest. Having thicker understory growth in the forest can lead to a ladder effect during a fire event, where fires can become more intense and burn higher, possibly leading to crown fires, which can be detrimental to the forest. The logging of the forest interior can also cause higher accumulations of litter due to debris falling from cut trees. Sun infiltration and freer air movement can cause increased drying of the litter and forest biomass, increasing the risk of fire. It has also been shown that larger trees are more fire resistant than smaller trees, where larger trees are consistently selected for removal during fuel reduction projects. The removal of trees from the forest for timber sale will also be removing the nutrients and biological material which would otherwise be naturally recycled into the soil and back into the ecosystem. With more and more logging within these forests, there is less undisturbed ecosystem and reduced areas of old growth; closed canopy forests, which many species require.