4.14) Fuels Inventory and Monitoring

Corky Conover, Fire Management, SEKI

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Forest Stand Data				Height to Live Crown Base		
BA (m^2/ha.)	Canopy Code (0-4)	Overstory DBH (cm)	Overstory Height (m)	Dominant (m)	Intermediate (m)	Understory (m)
42	4	80	38.1	17.2	5	0.5

Fuel Load Data (kg/m^2)							
Litter	Duff	1 Hr.	10 Hr.	100 hr.	1000 Hr. Solid	1000 Hr. Rotten	Total Fuel Load
1.88	6.03	0.18	0.49	1.92	6.54	1.53	18.57

INTRODUCTION: Recent advances in computerized technologies have given resource managers more tools to help make critical resource management decisions. The development of a Geographic Information System (GIS) based fire spread model called *FARSITE*, is an example of one of these new tools. The *FARSITE* model, like most models, requires quality-input data in order to produce reliable output. The fuels model and canopy characteristic data are the most important inputs to any fire growth model. Currently, the fuel model map for Sequoia and Kings Canyon National Parks is based on 1970's vegetation maps.

PROJECT OBJECTIVE: The purpose of this study is to improve the parks GIS fuels theme and collect data on forest canopy characteristics. The canopy characteristics data will be used to develop tree height and height to live crown base GIS themes that are used within *FARSITE* to model crown fire activity (torching, spotting, and crowning).

DESCRIPTION OF THE STUDY AREA: The study is being conducted in the East Fork of the Kaweah watershed. Terrain in the watershed is rugged, elevations range from 874 m (2884 ft.) to 3767 m (12,432 ft.). The watershed, 21202 ha (52369 ac) in size, is bounded by Paradise Ridge to the north, the Great Western Divide to the east, and Salt Creek Ridge to the south. The Parks administrative boundary to the west defines the study area's western extent. The vegetation of the area is diverse, varying from foothills chaparral and hardwood forest at lower elevations to alpine vegetation at elevations between 3049-3354 m (10-11,000 feet). The study is being conducted in the mixed conifer belt and Red Fir Forest. Ponderosa Pine mixed conifer communities occur at lower elevations < 1982m (6500 ft). The middle elevations 1982-2439m (6500-8000 ft) are dominated by the White Fir mixed conifer community including the sequoia groves. The Red Fir Forest community dominates the higher elevations 2440-3049m (8001-10000 ft).

METHODS: Permanent fuel plots were established in order to track fuel accumulation over time. The permanent fuel plots were established using the planar intercept method (Brown, 1974). The plots consisted of four fifty foot transects running north, south, east and west from the center point. Ten litter and duff measurements were taken along each of the 50 foot transects. These plots will be re-read about every 5 years to track fuel accumulation. Based on previous years data the permanent plots were located in the short needle (includes sequoias) and long needle conifer forest types in the following elevation classes; low ≤ 1982m (6500 feet), mid 1982-2439m (6500-8000 feet) and high > 2440m (8001+ feet).

Tree basal area was measured at each permanent plot using Basal Area Factor (BAF) prisms. The prism was selected so that a minimum of five trees would be included. The prism was swung 360° around the sampling point and the number of trees that were "**in**"(edges still touching, not totally offset) was recorded along with the factor number of the prism used. Every other borderline tree was counted. Three trees were selected as being representative of the average diameter "in tree" in the overstory and their diameter at breast height (DBH) was measured and recorded. An average value was being calculated from the three trees measured and used to represent the overstory trees at that sampling point.

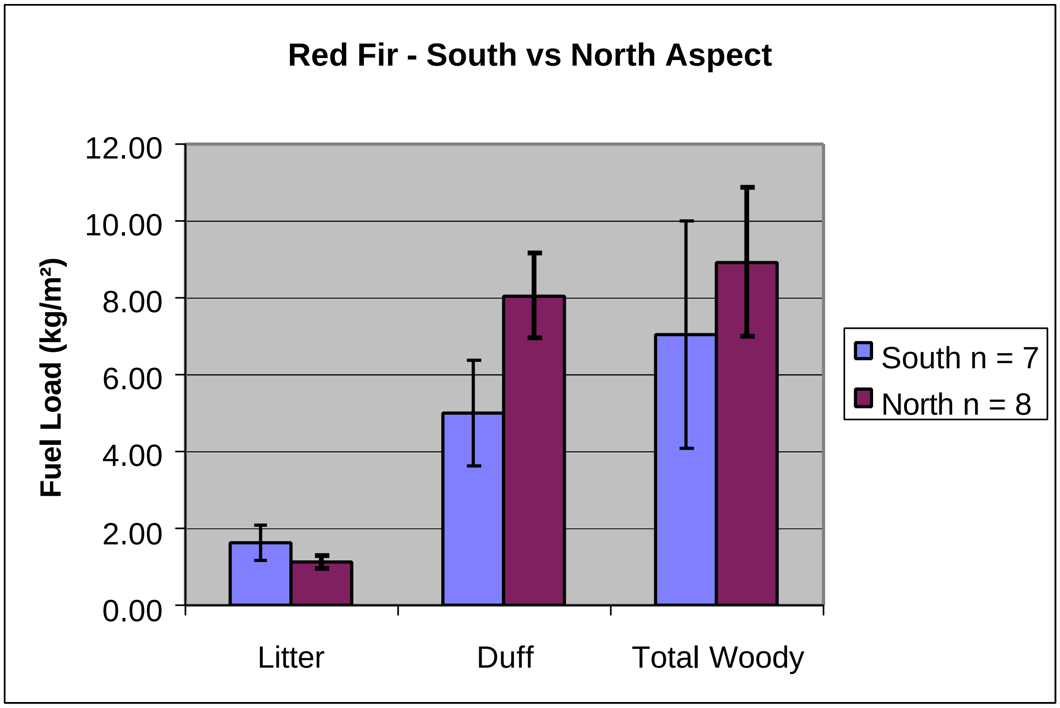
The following measurements were also taken at each permanent plot with a clinometer and recorded: overstory tree height, height to live crown base for each distinct canopy layer (dominate, intermediate, understory). Canopy cover was measured with a densiometer and recorded using the following codes: 0=0%, 1= 1-20%, 2= 21-50%, 3= 51-80%, and 4= 81-100%.

WORK ACCOMPLISHED IN 2000: The crew established three (1 Ponderosa Pine South Aspect and 2 Red Fir South Aspect) new permanent fuel plots in 2000. The emphasis for the new plots was to establish them in areas of known fire history and to increase the sample size for those types that had percent errors over twenty percent for the total fuel load estimate.

Results and Discussion: Results are presented in the graphs as mean values ± one standard error.

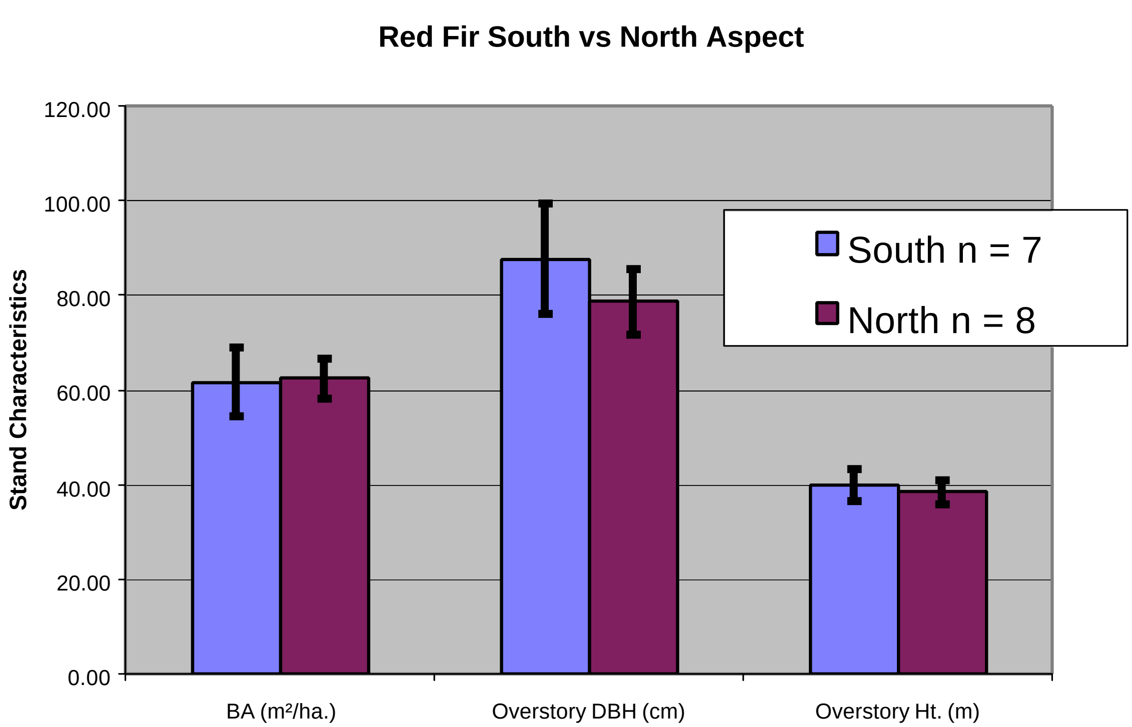
We decreased the percent error of the total fuel-loading estimate from 40.9% to 26.2% for the south aspect Red Fir Forest type, but we are still above our goal of twenty- percent. The Red Fir Forest had fuel loads of 1.6 kg/m² (litter), 5.0 kg/m² (duff), and 7.0 kg/m² (woody) for the south aspects (105-285°) and 1.1 kg/m² (litter), 8.1 kg/m² (duff), and 8.9kg/m² (woody) on the north aspects (286-104°).

Figure 4.14-1.



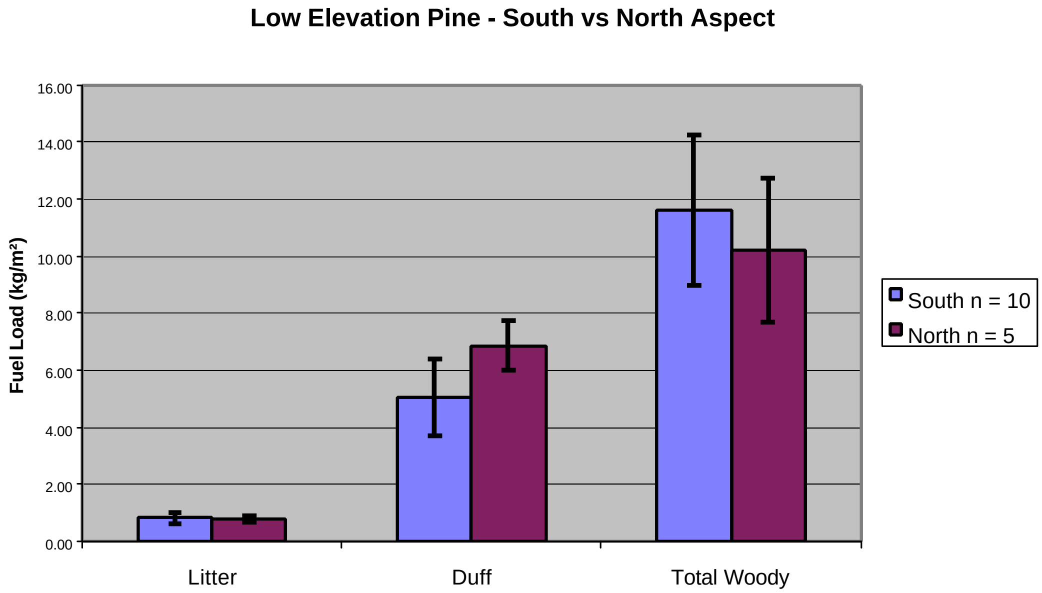
The basal area for the south aspects was 61.6 m²/hectare compared to 62.4 m²/hectare on the north aspects. The overstory tree heights were higher for the south (39.9 m) than for the north (38.5 m) aspects. The diameter at breast height (dbh) was larger for the south (87.6 cm) than for the north (78.7 cm) aspects.

Figure 4.14-2.



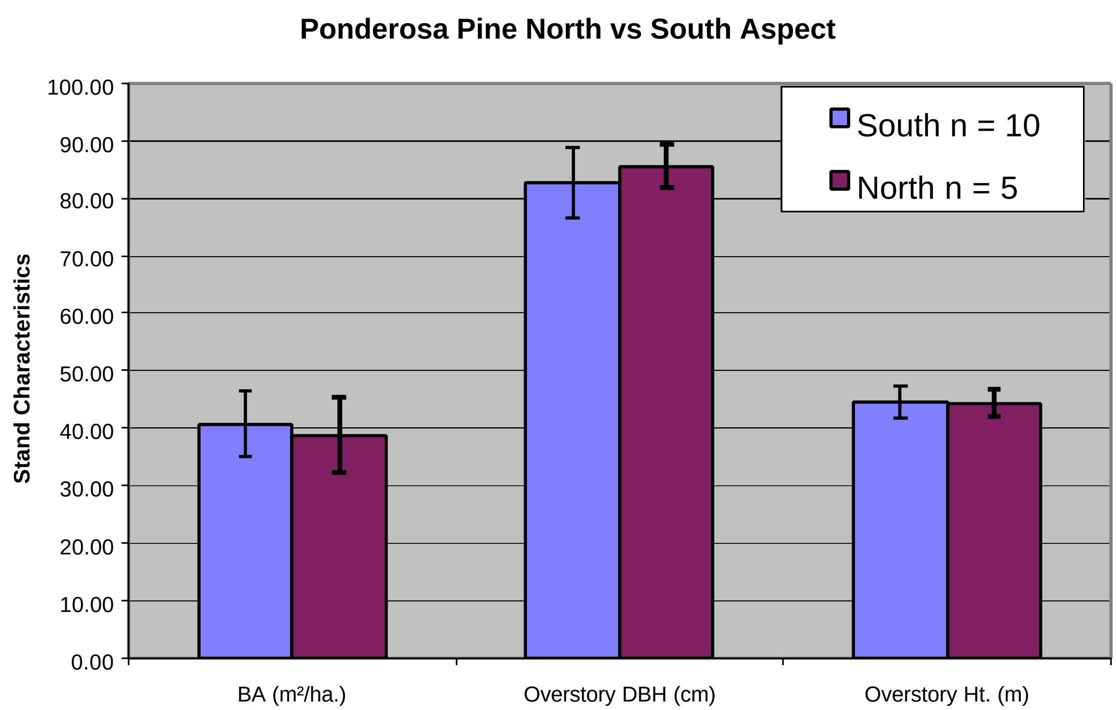
We decreased the percent error of the total fuel-loading estimate from 23.2% to 20.5% for the south aspect Ponderosa Pine Forest type, but we are still above our goal of twenty- percent. The Ponderosa Pine Forest had fuel loads of 0.8 kg/m² (litter), 5.0 kg/m² (duff), and 11.6 kg/m² (woody) for the south aspects (105-285°) and 0.8 kg/m² (litter), 6.9 kg/m² (duff), and 10.2kg/m² (woody) on the north aspects (286-104°).

Figure 4.14-3



The basal area for the south aspects was 40.7 m²/hectare compared to 38.8 m²/hectare on the north aspects. The overstory tree heights were slightly higher for the south (44.6 m) than for the north (44.3 m)

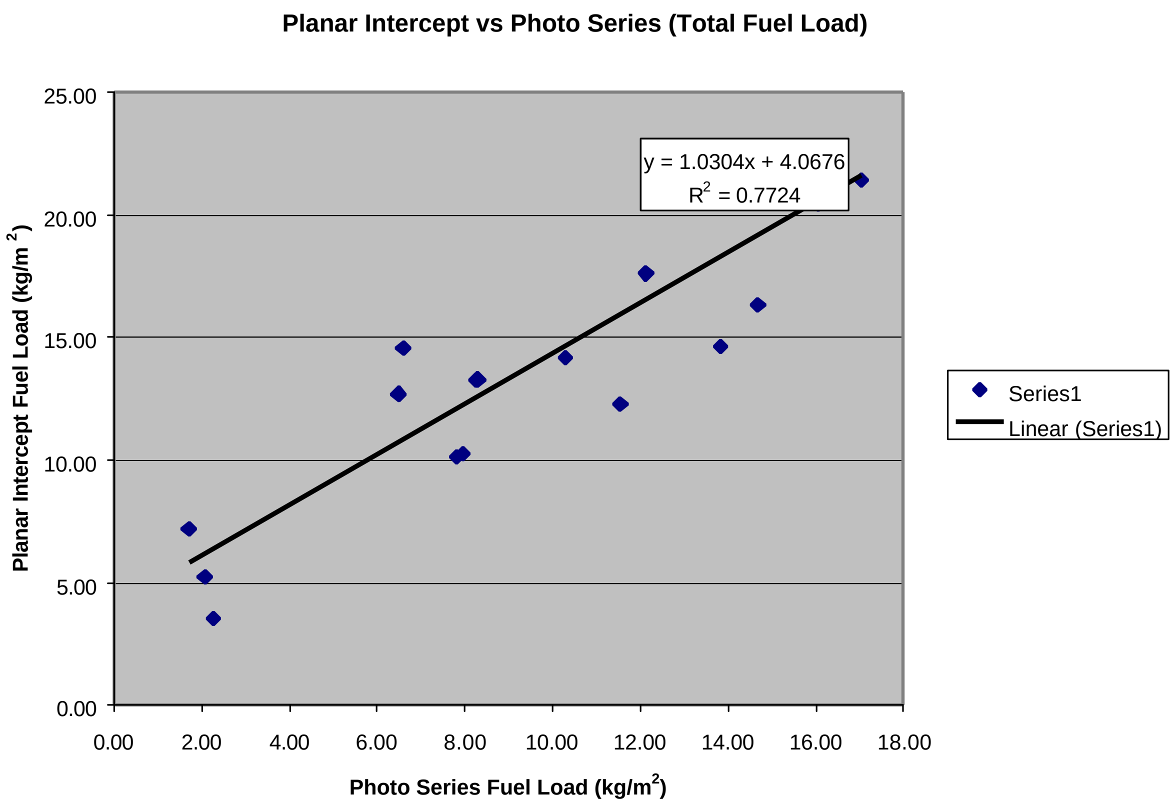
Figure 4.14-4.



aspects. The diameter at breast height (dbh) was smaller for the south (82.6 cm) than for the north (85.5 cm) aspects.

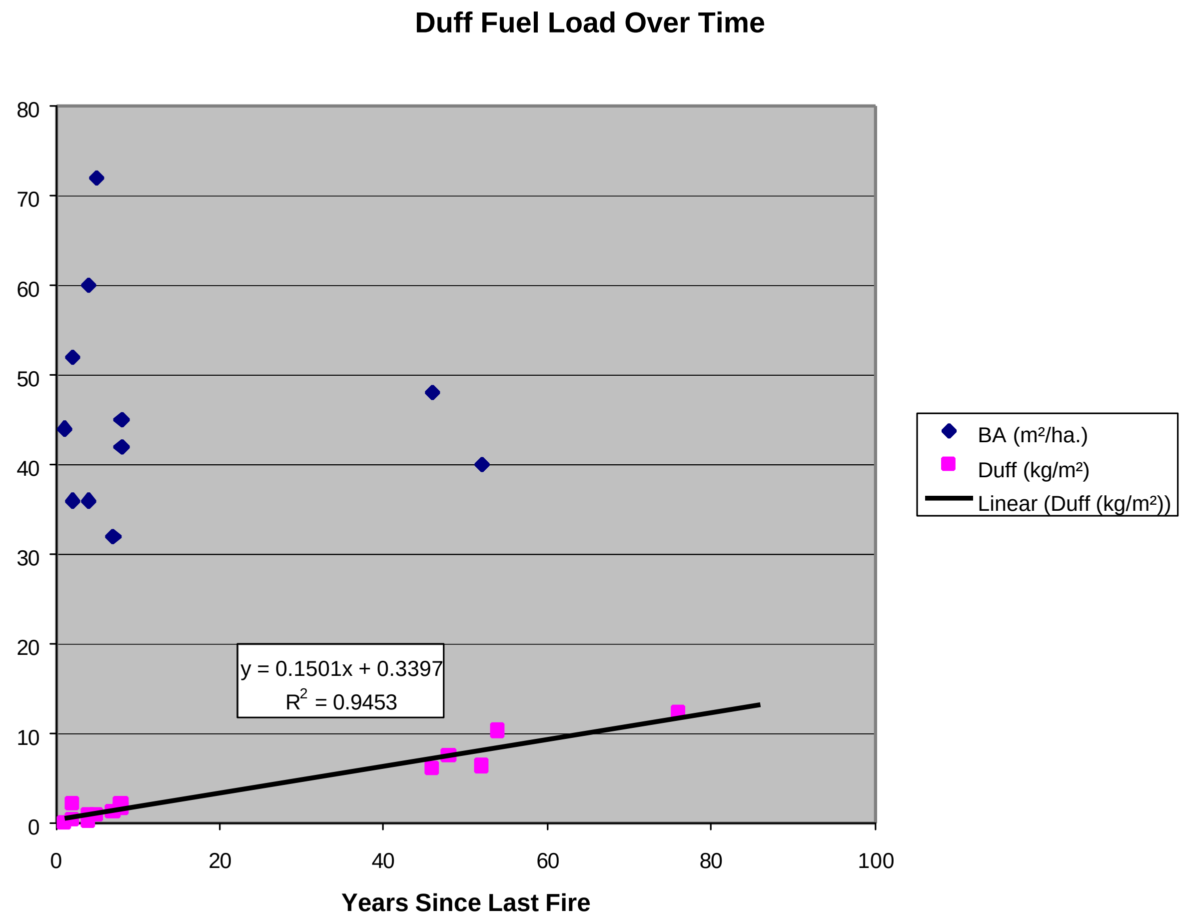
Previous years (98-99) reports indicated that we would take photo series estimates at the same location where we installed the permanent plots to see if a correlation exits between the two methodologies. If a correlation can be established, we will use this correlation to survey future areas because you can collect about five times as many sample points with the photo series when compared to the planar intercept method. The results are steadily improving and there appears to be a relationship between the two methods.

Figure 4.14-5.



When we compared the known fire history with our plot locations, we came up with fourteen plots that occurred in areas that we knew the date of the last fire. As stated in previous years (98-99) reports we were going to see if a relationship exists between the number of years since the last fire and the fuel loading. Last years report indicated a good relationship for duff fuel load over time. We increased our sample size from eleven to fourteen plots this season and we continue to show a good relationship ($R^2 = .945$) with duff load overtime (**figure 4.14-4**). With the additional data we have improved our linear relationship for litter fuel load over time ($R^2 = .547$ up from $R^2 = .294$). Last year we collected our new data in areas of older fires (>20 years), much of the earlier data is from areas of recent (last 2-5 years) fire events and this is probably not enough time to smooth out site-specific differences in fire intensity and mortality for the other fuel categories.

Figure 4.14-6.



Future Plans: Our goal was to have enough permanent plots by elevation and forest type so that the percent error of our total fuel loading estimates was less than twenty percent. We will need to install some more plots in the Red Fir South aspect and Low Elevation Pine South aspect forest types to lower the percent error of the total fuel-loading estimate. It will probably take 1 new plot in the Low Elevation Pine South aspect forest type and between 2-3 new plots in Red Fir South aspect forest types to achieve our goal of less than twenty- percent error. When installing future permanent fuel plots, we will continue to take photo series estimates at the same location and record the data. We will try to install these new plots in areas of know previous fires in order to increase our sample size and improve on our correlation between time since last fire and fuel load. We will try to locate these new plots in areas of older fire events (>10 years). We will also work with the fire history ecologist to obtain last know fire dates for previously installed plots.

References

Brown, J.K. 1974. Handbook for Inventorying Downed Woody Material. USDA Forest Service General Technical Report INT-16.