Greater Alpine FSC Chipping Projects: Methodology and Analysis

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Executive Summary

The Greater Alpine Fire Safe Council has developed methods for (1) calculating the volume of brush cut by homeowners; (2) estimating the area cleared around their homes; (3) estimating the time homeowners spent cutting and stacking the brush; and (4) estimating the productivity of the homeowners and crews. We find that (1) well-organized piles of brush can be chipped at 700-1000 cu ft / hr but this rate falls to about 300 cu ft / hr for randomly stacked piles; (2) homeowners cut and stack brush at 44 +/- 8 cu ft per hr, providing an accurate and cost-effective way to estimate their contribution to matching funds in large chipping projects.

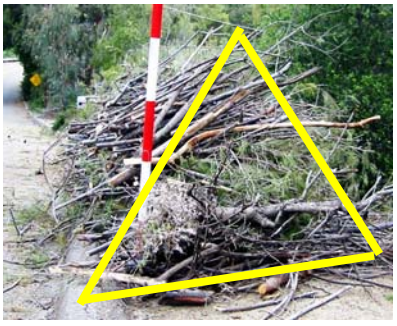
We would like to acknowledge Jorge Juarez for his contribution measuring the dimensions of the piles.

Introduction

The Greater Alpine Fire Safe Council, a 501 (c) 3 corporation, was founded in 2006 to implement the Alpine Community Wildfire Protection Plan. A key part of this plan is to help homeowners in especially fire-prone areas to create defensible space around their homes by providing them with a free chipping service. Homeowners must clear all flammable brush, especially chamise and buckwheat, within 100ft of their homes and stack it in orderly piles. The Greater Alpine FSC chips these piles using grants from the federal government and insurance companies and each quarter reports on the volume of brush chipped and acreage cleared.

In carrying out this work, the Greater Alpine Fire Safe Council has developed methods for (1) calculating the volume of brush cut by homeowners; (2) estimating the area cleared around their homes; (3) estimating the time homeowners spent cutting the brush; and (4) estimating the productivity of the crews. We present this work using data collected from chipping programs carried out in five different locations in Alpine, California. We hope that our methods and analyses will prove useful to other Fire Safe Councils.

Methodology



Volume of Brush

In two areas, homeowners were asked to stack their piles of brush adjacent to the street as shown in the end and front view pictures, with each item laid down perpendicular to the curb to speed the

chipping work. In the other areas no such directions were given, and homeowners built a mixture of well-organized and randomly stacked (RS) piles.

We calculated the volume of each pile by modeling it as a triangular ("roof-like") prism with base B, altitude A, and length L. We show how well this approximation works in the end view picture. Then using a graduated six-foot pole as a reference in each end and side view picture, we obtained the volume V of the pile:

$$V = \tfrac{1}{2}\, LAB \text{ cu ft}$$

Note a Gerber Variable Scale is very useful when doing these calculations.

Definitions

L Length of pile
A Altitude (height) of pile
B Base (width) of pile
V Volume of brush in pile
H Average height of brush before cutting
S_b Average spacing of brush before cutting
S_p Average spacing of brush in the pile
R Rate of cutting and stacking brush by homeowners

Area Cleared

We developed the following formula to estimate the area cleared C around the home:

$$C = (V/H)\,(S_b/S_p)^2 \text{ sq ft}$$

where V again is the volume of the pile, H is the average height of the brush before clearing and S_b and S_p are the average spacing of the brush before cutting and then afterwards in the pile. Typically H and S_P can be estimated with good accuracy but S_b is more difficult to estimate and is therefore mainly responsible for the error in C.

Homeowner Time

When carrying out a large chipping project involving hundreds of homeowners, it is impractical to get all of them to report the time they spent cutting and stacking the brush around their homes, either at all or certainly with any accuracy. We therefore took a different approach using a sampling technique that we believe produces more accurate results and leads to a better use of project funds. We selected 20 homeowners at random from the three groups that represent small (up to 300 cubic feet), medium (300 to 600 cubic feet), and large (above 600 cubic feet) piles of brush and interviewed them about the time they spent. We then calculated the rate R and standard deviation at which homeowners cut and stacked brush per hour.

Within the accuracy of our technique, we found that R did not depend on the volume of the brush cut and stacked and was:

$$R = 44 \pm 8 \text{ cu ft / hr}$$

Crew Productivity

We also calculated the productivity of each crew by keeping track of the piles of brush that each crew chipped. As an accidental outcome of this analysis, we discovered that every crew was significantly slowed when faced with a randomly rather than the linearly stacked pile, shown in the photographs. While the crews chipped between 700 and 1000 cubic feet per hour when chipping the well organized piles, their productivity fell to about 300 cubic feet per hour when faced with randomly stacked piles. While some of this difference is probably attributable to differing driving times between piles, the result nevertheless highlights that well-organized, linearly stacked piles ensure the efficient use of project moneys.

The productivity variation between piles masked any productivity variation that may have existed between the individual crews.

Summary of Data

Location		A	B	C	D	E	TOTAL	MEAN
Pile Type (WO or RS*)		WO, RS	RS	WO, RS	WO	WO		
Volume Chipped	(cu ft)	12098	2995	6995	21856	4388	48332	
Area Cleared*	(acres)	10.00	2.48	5.78	18.07	3.63	39.96	
Homeowner Time	(hrs)	278	69	161	502	101	1111	
Crew Productivity	(cu ft / hr)	504	279	583	986	731		
Homeowner Productivity	(cu ft / hr)							44 +/- 8

*WO - well organized, linearly stacked, RS - randomly stacked

In total, 103 homes were protected in this chipping project so that an average of 0.4 acres of defensible space was created around each of them.