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How Much Fertilizer in Slash?

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There has been much discussion among foresters and fi re managers over the last ten years regarding the nutrient value of slash. Understanding this is critically important in making decisions about treating slash to reduce fire hazard or harvesting small trees and slash for methanol, co-generation, or other bio-fuels.

Moisture is the most influential factor limiting tree growth in most Idaho forests. But inadequate nutrients limit growth as well. Adding nutrients increases tree growth on most Inland Northwest forests, particularly fertilizers containing nitrogen, potassium, sulfur, and boron, though the size of the response from different fertilizer mixes varies considerably by site. Idaho's forest soils are not usually deficient in phosphorus (one of the "big three" plant nutrients whose weight is listed on the label at the bottom of fertilizer bags).

Slash piles can hold significant amounts of nutrients.
Photo by Robert Barkley, Idaho Department of Lands.

Presumably, repeatedly removing nutrients from these forests in the form of trees and slash will produce an opposite effect (reductions in tree growth). How much of a reduction has not been studied thoroughly, but one way of looking at it is to study the nutrient content of slash. How much nutrient capital is removed when green slash is burned or hauled away for biofuel? The standard response to this has been to note that roughly half of a tree's above-ground nutrients are tied up in the tree's crown. The Intermountain Forest Nutrition Cooperative has been studying this question to develop more precise estimates of the nutrient content of trees on different types of sites.

For example, one case study projected the nutrient content of trees in an 80 year old stand in northeastern Oregon, on grand-fir habitat type, with basalt parent material (see Figure 1). The stand in the example has 102 ft^2 of basal area/acre, and a species composition by volume of: 82% grand fir, 6% Douglas-fir, 2% ponderosa pine, and 11% other species. This type of stand would be fairly common on the lower to mid-elevation sites in northern Idaho. In the crowns of this stand, there would be 122 lbs of nitrogen/ acre and 101 lbs of potassium/acre. An equivalent amount of fertilizer would cost roughly $100-120 an acre to apply – more if you added micronutrients such as sulfur or boron. Note that an additional 79 lbs of nitrogen/acre and 136 lbs of potassium/acre would be removed from the site if you took all the merchantable logs.

Nitrogen naturally re-accumulates in forests from atmospheric precipitation and from nitrogen-fixing plants and microbes. But this occurs slowly. A University of Idaho study on a north Idaho cedar

site found that nitrogen reaccumulated at a rate of roughly four lbs per acre per year annually. Potassium and other nutrients also re-accumulate, but even more slowly, mostly from parent material weathering and a miniscule amount from atmospheric precipitation. The same study found potassium re-accumulating at roughly two and one half pounds per acre per year annually. The amounts are variable by site, but the loss of potassium and micro-nutrients would be even more critical on rock types that were lower in these nutrients, and slower to decompose.

Letting slash over-winter on site will capture many of the nutrients as they leach from the slash, though how much has not been studied precisely. In operations with very light slash accumulations, you might not even need to treat the slash very aggressively.

Nutrients are a critical dimension of your forest's health and growth. As you work to reconcile nutrient issues with fire hazard, contact your local IDL fire warden for assistance.

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Photo by Chris Schnepf, University of Idaho Extension

Figure 1. Overstory Nutrient Components (lbs/acre)
ROCK TYPE: Basalt; VEGETATION SERIES: Grand fir (amount standing before any cut)

Nutrient	Foliage	Small branches	Coarse branches	Total crown	Unmerch bark	Merch bark	Unmerch wood	Merch wood
Biomass	5798.0	2331.8	14076.0	22205.8	983.3	20062.7	11446.8	57462.6
N	58.891	14.001	48.629	121.521	2.677	54.593	4.917	24.448
K	38.283	12.543	50.357	101.183	2.743	56.766	16.086	79.378
P	7.129	3.238	13.263	23.630	0.782	16.109	4.560	22.783
Ca	75.908	21.956	89.570	187.435	8.302	172.207	21.406	106.043
Mg	6.426	3.110	12.423	21.959	0.618	12.604	4.108	20.332
S	3.687	1.163	4.514	9.365	0.241	4.964	1.230	6.169
Mn	0.733	0.523	2.366	3.621	0.282	5.928	0.557	2.744
Fe	0.385	0.613	1.136	2.133	0.086	1.728	0.656	3.238
Zn	0.112	0.085	0.422	0.618	0.027	0.549	0.169	0.824
B	0.224	0.036	0.123	0.383	0.009	0.179	0.053	0.263
Cu	0.009	0.039	0.270	0.317	0.013	0.254	0.104	0.517

Source: Intermountain Forest Nutrition Cooperative