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Best Management Practices (BMP's) for Forest Roads in Idaho

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Best Management Practices (BMP's) were developed as guidelines for Idaho's forest owners and managers to follow to comply with the Idaho Forest Practices Act and enable better land management and stewardship.

- Part I of this series, *Best Management Practices for Idaho Riparian Areas* appeared in the Fall/Winter, 2005-2006 (Vol. 17, No.1) edition of Woodland NOTES (available on-line at: <http://www.cnr.uidaho.edu/extforest/WN Archives.htm>).
- Part II of the series, *Best Management Practices (BMP's) for Timber Harvesting in Idaho* appeared in the Spring/Summer, 2006 (Vol. 17, No. 2) edition of Woodland NOTES (available on-line at: <http://www.cnr.uidaho.edu/extforest/WN Archives.htm>).
- This third article of the series will cover BMP's for Idaho forest roads.

Best management practices for roads provide standards for road construction, reconstruction, and maintenance that maintain forest productivity, water quality, and fish and wildlife habitats. Most private forest landowners will not have the expertise or the equipment needed to build a forest road themselves, but many will have need of a road on their forestland at sometime, whether it be an temporary, unimproved road to haul logs from a single harvest, or a permanent road used for access and multiple harvests.

Forest roads are regarded as the largest sediment producers on forested lands, producing up to 90% of all sediment from forest activities. Properly planning, designing, constructing, and maintaining forest roads can significantly

decrease or eliminate erosion and sedimentation into streams, thereby protecting and even improving water quality.

The Idaho Forest Practices Act provides standards and guidelines for road construction, reconstruction, and maintenance that will maintain forest productivity, water quality, and fish and wildlife habitat.

When planning a forest road:

- ensure road specifications and plans are consistent with good safety practices and are designed to be no wider than necessary for safety and anticipated use.
- plan roads to the minimum standards for the intended use.
- adapt the plan to the site's soils and terrain.
- do not locate the road in stream protection zones (SPZs), except for approaches to stream crossings.
- plan for areas of vegetation between roads and streams.
- design minimal and balanced cuts and fills, especially near streams, and fit the the road to the natural terrain as closely

as possible. Compact fill material or plan to dispose of evacuated waste material on geologically stable sites.

- design roads to drain naturally, outsloping or in-sloping with cross-drainage and by grade changes when possible. Plan for effective, well-placed dips, water bars, cross-drainage, or substrate surface drainage.
- place relief culverts or roadside ditches where natural drainage will protect the road surface, excavation, or embankment. Plan culvert locations to prevent fill erosion or direct discharge of sediment into streams.
 - designate a minimum number of stream crossings. Stream crossings must be planned and installed as stated in the Stream Channel Alteration Law, Title 42; Chapter 38, Idaho Code.
 - be sure all Class I stream culvert installations allow fish passage.
 - ensure that culverts are designed to carry 50-year peak flows.

Culvert sizing tables are provided in the Idaho Forest Practices Act for North Idaho and the Salmon River Drainage and for South Idaho. "The minimum culvert size required for stream crossings shall not be less than 18 inches in diameter, with the exception of that area of the Snake River Drainage upstream from the mouth of the Malad River, including the Bear River basin, where the minimum size shall be 15 inches".

- be aware that culverts used for temporary crossings are exempt from the 50-year design requirement, but must be removed immediately after they

CONTINUED ON PAGE 4



Thresholds and Environmental Change

Ron Mahoney

A *threshold* is usually defined by dictionaries as a beginning, or the plate of a door opening. An environmental threshold is often described as a *tipping point*. One of the most enduring metaphors describing a tipping point is “the straw that broke the camel’s back”: the camel was fine until one more, small unit of burden was added, and then the situation changed dramatically.

Think of bringing water to a boil. If we observe water in a vessel over heat, it just sits there still and calm until it suddenly changes to a boil - the threshold or “tipping point” where the water temperature exceeds the barometric pressure of the atmosphere that holds molecular activity of the water in check and the water begins to change from a liquid to steam, or its gaseous state. Most of us know the temperature threshold of water boiling is 212 degrees Fahrenheit. Many people also know this temperature threshold changes with altitude. At higher elevations, the atmospheric (barometric) pressure is less, and water boils at a slightly lower temperature. Thus, environmental thresholds vary with the setting, and even small variations such as the boiling point of water can have big effects. (e.g., the “high elevation” directions we see on many packaged food products and baking recipes). Ignorance or failure to respond to thresholds may just result in pancakes better suited to throwing as frisbies, but it could also lead to fatal botulism if home-canned food is not boiled longer during processing at high elevations. Understanding natural thresholds and environmental consequences can be incidental or profound.

In the forest and other natural environments, countless thresholds are involved in simple to complex relationships. Some of these have been studied and documented - the temperature thresholds of ignition for various fuel types on the forest floor, or the angle of repose and moisture content thresholds for landslides and avalanches. More complex thresholds are described with less precision for predator/prey complexes such as wolves and elk, or bark beetles and conifers. Some benign thresholds are called the “point of marginal returns” by economists, in that inputs have an effect up to a point, then adding more has no additional effect. This might be illustrated by some fertilizers, although an additional threshold of toxicity might operate at very high levels.

Discussions and dialogue about thresholds for carbon monoxide, ozone, temperature, and other climatic factors related to climate change or “global warming” can be contentious. Often, people are confused when measurements of real change are very small, yet both scientists and non-scientists cite them as evidence of environmental change we are experiencing now or will be soon. Many people understandably scoff at the notion that a one or two degree change in average annual global temperature could melt polar icecaps, raise oceans, and flood coastal cities. A lot of the confusion may result from poor communication about how thresholds operate and which limits are being reached or exceeded and how they relate to



both natural processes and human impacts. There is also confusion and continuing research about the reliability of these estimated and predicted changes.

Carbon dioxide, for instance, provides many threshold complexities. Just about everyone knows that we breathe in air, including oxygen, and breath out air containing an increased amount of carbon dioxide. Many people think plants actually breathe in carbon dioxide and breathe out oxygen. This is simply not true; plants respire just as we do. They do use carbon dioxide in photosynthesis, releasing oxygen from the water they use in the process. By removing more carbon dioxide from the atmosphere than they release through respiration, plants can be a net carbon “sink” or storage mechanism. Thus, oxygen is limiting and has a threshold for respiration, and carbon dioxide is limiting and has a threshold for plant growth. There are many similar processes for respiration, also called oxidation, and these are the major factors in human-caused increases in the total carbon dioxide on our planet. Burning (fire), rusting, and decomposition are all oxidation processes that humans have a great impact on. The biggest culprit in increasing carbon dioxide concentrations (and contributing to global warming) is burning oil, gasoline, coal, and other fossil fuels. The biggest counter to increased carbon dioxide is “sinking” carbon through plant growth which captures and stores carbon in plant material, releasing oxygen from the molecule as described earlier.

The threshold of concern is the point where carbon (dioxide) increases faster than it is captured in plant growth. Rusting is the same process as burning, but contributes little to the global equation, but decomposition has the potential to contribute enormously if the highly-organic permafrost zones continue to warm, melt, and decompose.

Most people know and accept that increased global carbon dioxide holds more of the earth’s heat in and increases temperature. The argument seems to be whether carbon dioxide is really increasing, how much human activity contributes, and whether reducing carbon emissions can have a significant impact. Understanding the concept of thresholds can

help us understand and accept substantial predicted changes based on small environmental changes.

Multiple thresholds of concern are being approached by real and potential/predicted climate change. Some of these have already been documented, such as melting glaciers and icecaps, thawing permafrost, ocean plankton die-off, etc. One current, dramatic event clearly associated with a climatic threshold is the vast outbreak of mountain pine beetle killing lodgepole pine in British Columbia, covering millions of acres with nearly all of these pines dead or expected to die within the next few years. Historically, average winter low temperatures were below the threshold for beetle survival, otherwise many of these otherwise susceptible monoculture, old and over-dense forests would have succumbed to beetles long ago. The entire forest management regime in these areas must change in response to this new threat, including dramatic changes in deciding which tree species to favor and in the wildlife habitat and economic systems that depended on the traditional forest. This is just one example of how many things we know about forest management (and food and other agricultural crops) can be dramatically challenged by climate change, whether it be increasing global warming as forecast, or just in dealing with changes in climate thresholds that are already soundly documented.

Other climatic threshold effects may be predicted by using our knowledge of habitat or other environmental thresholds for various species. For example, should current climatic trends continue, polar bears will approach extinction, and western larch and Engelmann spruce may disappear from our western landscape. Some of the many predictions being made will unfold as projected and some will not. Two problems hinder our ability to make a sensible scientific approach predicting climate change and its effects and providing an informative, effective public education effort, especially through the media. We either lack scientific information on the thresholds for many relationships (and I have seen many cause-effect relationships that operate on a threshold versus a gradual basis) or we know the thresholds (e.g.: minimum annual precipitation on south slopes for ponderosa pine), but don’t know how much change there will be.

In the case of public information, the impacts and challenges of dealing with the social, political, and economic impacts of climate change are enormous and challenging. The subjects of the oceans rising and agricultural zones shifting into desert, for example, are so interesting and subject to sensationalism that it will take a long time, and the reality of a few disasters, I fear, for any large-scale policy to take effect. But as forest scientists, educators, managers, and owners we are particularly challenged NOW to make as much sense as we can of the data available, seeking to understand and plan for change, because the decisions we make today will be with us for decades, or perhaps centuries.

How Much Fertilizer in Slash?

Chris Schnepf

There has been much discussion among foresters and fire 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).

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 bio-fuel? 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 ft² 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 re-accumulated 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. For more information check a Woodland Notes article entitled "Tons of Slash" archived on the UI Extension forestry web site (Vol. 14, No. 1 - Fall/Winter, 2002-2003).

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.

Thanks to the staff from the Intermountain Forest Tree Nutrition Cooperative for information and comments on this article

Figure 1. OVERSTORY NUTRIENT COMPONENTS (lbs/acre)
 ROCK TYPE: Basalt, VEGETATION SERIES: Grand Fir
 Amount in standing crop before any cut

Nutrient	Foliage	Small Branches	Coarse Branches	Total Crown	Unm arch bark	Merchant Bark	Unmerchant wood	Merchant Wood
Biom ass	3798.0	233.18	14076.0	22205.8	983.3	20062.7	11446.8	37462.6
N	38.891	14.001	48.629	121.521	2.677	54.393	4.917	24.448
K	38.283	12.543	90.337	101.183	2.743	36.766	16.086	79.378
P	7.129	3.238	13.263	23.630	0.782	16.109	4.360	22.783
Ca	75908	21936	89370	187435	8302	172207	21406	106043
Mg	6426	3.110	12423	21939	0.618	12.604	4.108	20.332
S	3.687	1.163	4.314	9.363	0.341	4.964	1.290	6.169
Mn	0.733	0.323	2.366	3.621	0.282	3.928	0.337	2.744
Fe	0.385	0.613	1.136	2.133	0.086	1.728	0.636	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	0.234	0.104	0.317

Source: Intermountain Forest Nutrition Cooperative

Strengthening Forest Stewardship Skills Summer Events

Don't miss our summer *Strengthening Forest Stewardship Skills* programs!

Adaptive Silviculture on the McGovern Forest, Coeur d'Alene, ID. Friday, May 25, 2007. 8:00 am to 4:00 pm. To register, call (208) 446-1680.

Forestry Shortcourse, Sandpoint, ID. Wednesday, June 13 to July 18, 2007. 9:00 am to 12:00 pm. To register, call (208) 263-8511.

Thinning and Pruning Field Day. Two locations.

- Bonners Ferry, Saturday, June 16, 2007. To register, call (208) 263-3235.
- Orofino, Thursday, June 28, 2007. To register, call (208) 476-4434.

Pruning for White Pine Blister Rust, Sandpoint, ID. Friday, June 22, 2007. To register, call (208) 263-8511.

Managing Forest Organic Debris, Priest River, ID Friday, July 13, 2007. To register, call (208) 446-1680.

Forest Insect and Disease Field Day. Two locations.

- Moscow, Thursday, July 19, 2007. To register, call (208) 476-4434
- St. Maries, Friday, July 20, 2007. To register, call (208) 446-1680.

For additional information on these programs go to our web site at www.cnr.uidaho.edu/extforest/Calendar.htm and download a flyer.

are no longer needed and before the spring runoff period.

Construction.

The most important thing a private forest landowner can do when constructing a forest road is to hire an experienced and skilled contractor. Call several and ask for references.

And although you may not be constructing the road yourself, a little knowledge and a few tips on the good, the bad, and the ugly of road construction can go a long way towards ensuring that your road will withstand the test of time.

Most forest roads are constructed by excavating a road surface. The bulldozer starts at the top of the cut slope, excavating and sidecasting material until the desired road grade and its width is obtained. While cut-and-fill road construction is common for gentle terrain, full-bench roads are usually built on slopes over 65%. In full-bench construction, the entire road surface is excavated into the hill. The excavated material is pushed or hauled to an area needing fill or to a disposal area.

During construction:

- debris, excess soil and rock, and other material from cut-and-fill operations must not enter streams. Excess material should be placed on geologically stable sites outside the stream protection zone to prevent erosion and material from entering streams.
- erodible exposed surfaces such as road surfaces, cut- and/or fill-slopes, borrow pits, and waste piles must be stabilized prior to fall or spring runoff by seeding, compacting, rocking, mulching, or other suitable means.
- compact road fill material to settle it, and reduce erosion and water entry into the fill. Minimize snow, ice, frozen soil, and woody debris buried in embankments.
- no significant amount of woody material should be incorporated into fills. Limited slash and debris may be windrowed along the toe of the fill to provide a filter near stream crossings.
- postpone earthwork or material hauling when roads are saturated and likely to erode.

Maintenance.

A well-maintained road provides safe access to your forested land for management activities, recreation, and fire control. Regular maintenance activities ensure minimal disturbance to forest productivity, water quality, and fish

and wildlife habitats. Maintenance of active and inactive roads will differ. All forest roads should have debris associated with road maintenance placed where it will not enter streams, and repair slumps, slides, and other erosion sources that could cause sediment from entering streams. Ensure that all forest roads used during the winter maintain their drainage capabilities, keeping culverts, ditches, and other structures free of snow and ice. Consider limiting access during wet periods.

Active forest roads are those that are being used for hauling forest products, rock, and other road building materials. Maintain active roads by:

- keeping culverts and ditches functional.
- maintaining proper drainage.
- postponing hauling and other heavy use during wet seasons.

Inactive forest roads are those that are no longer used for commercial hauling but are maintained for access for fire control, management activities, recreational use, and occasional use for minor forest harvesting.

Maintain inactive forest roads by:

- clearing culverts and ditches after active use and ensuring the road surface is left in a condition to minimize erosion. Culverts and ditches will need to be maintained thereafter as needed.
- blocking roads, seasonally or permanently, to vehicular traffic to prevent undue degradation.

Long-term inactive forest roads are those not intended to be used in the near future, but will likely be used again in the distant future. Long-term inactive roads should be left in a condition to control erosion, and blocked to vehicular traffic. The Idaho Department of Lands may require you to remove bridges, culverts, ditches, and unstable fills. Any bridges left in place must be maintained by the landowner.

Permanently abandoned roads are those that are not intended to be used again. The Idaho Forest Practices Act has requirements for permanently abandoned roads:

- All drainage structures must be removed and roadway sections treated to minimize erosion and landslides.
- All stream gradients must be restored to their natural slope and the road surface treated to break-up compacted areas.
- Fill slopes of roads within stream protection zones must be pulled back to provide for long-term stability.
- All bare earth areas created while

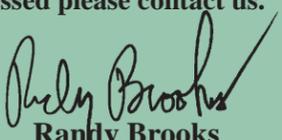
constructing, using, and maintaining the road must be stabilized by seeding, armoring, mulching, or other suitable means.

For more information on the Idaho Forest Practices Act and Forestry BMP's, contact your local Idaho Department of Lands Forest Practices Advisor (*see box below*) and request a copy of *Rules Pertaining to the Idaho Forest Practices Act, Title 38, Chapter 13, Idaho Code*. You may also contact the UI Extension Forestry office at (208) 885-7718 and request a copy of the publication titled *Forestry BMP's for Idaho*.



Idaho Department of Lands Contacts for Private Forestland Owners	
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We hope that you have find Woodland NOTES useful. If you have any comments or topics you wish to see addressed please contact us. We would appreciate your participation.

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