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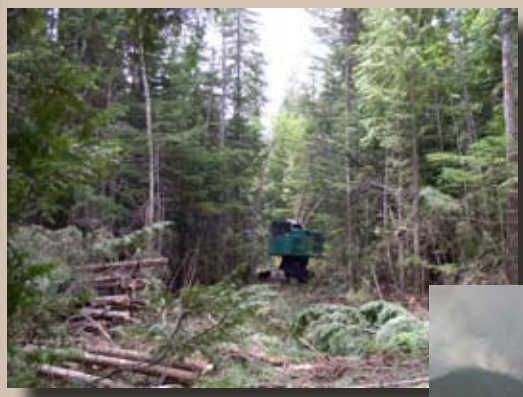
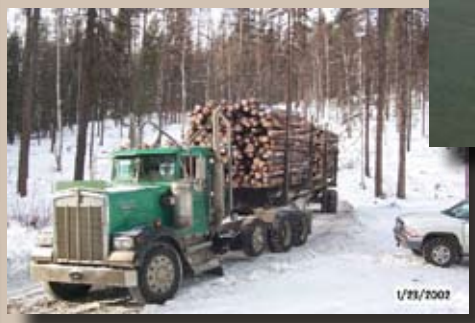
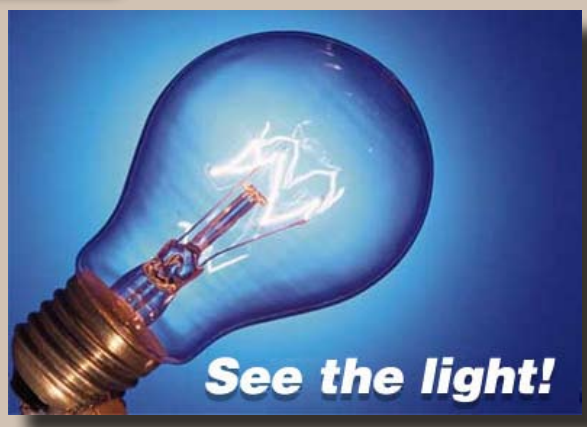
WOODY BIOMASS UTILIZATION DESK GUIDE







WOODY BIOMASS UTILIZATION DESK GUIDE

Forest Management

Forest and Rangelands

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"Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. The best way to break this addiction is through technology. By applying the talent and technology of America, this country can dramatically improve our environment, move beyond a petroleum-based economy, and make our dependence on Middle Eastern oil a thing of the past."

President George W. Bush

January 31, 2006

INTRODUCTION

Woody Biomass is defined as the by-product of management, restoration, and hazardous fuel reduction treatments, including trees and woody plants (i.e., limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment). This document may use the word "biomass" and phrase "woody biomass" interchangeably. The reader should realize woody biomass is being discussed specifically in both instances.

Woody Biomass Utilization (WBU) is defined as the harvest, sale, offer, trade, and/or use of woody biomass. This utilization results in the production of a full range of wood products, including timber, engineered lumber, paper and pulp, furniture, and value-added commodities, as well as bioenergy and/or biobased products such as plastics, ethanol, and diesel.

Small-Diameter Utilization (SDU) refers to a more specific size class of woody biomass that includes small-diameter trees that do not meet minimum specifications for sawlogs, but are large enough to be used as posts, poles, tree stakes, small pulplogs, or other similar forest products.

1.1 Woody Biomass Utilization (WBU) Projects and Implementation—Why Is Biomass Utilization Important?

Background: In June of 2003, a Memorandum of Understanding (MOU) on Policy Principles for Woody Biomass Utilization for Restoration and Fuel Treatments on Forests, Woodlands, and Rangelands was signed by the Secretaries of Agriculture, Energy, and Interior. This MOU established eight policy principles:

1. Include local communities, interested parties, and the general public in the formulation and consideration of WBU-utilization strategies.
2. Promote public understanding of the quantity and quality of woody biomass that may be made available from Federal lands and neighboring Tribal, State and private forests, woodlands, and rangelands nationwide.
3. Promote public understanding that WBU may be an effective tool for restoration- and fuels-treatment projects.
4. Develop and apply the best scientific knowledge pertaining to WBU and forest management practices for reducing hazardous fuels and improving forest health.
5. Encourage the sustainable development and stabilization of WBU markets.

6. Support Indian Tribes, as appropriate, in the development and establishment of WBU within Tribal communities as a means of creating jobs, establishing infrastructure, and supporting new economic opportunities.

7. Explore opportunities to provide a reliable, sustainable supply of woody biomass.

8. Develop and apply meaningful measures of successful outcomes in WBU.

The MOU drove the need for an interagency group that is focused on the implementation of the MOU. The Federal Woody Biomass Utilization Group (WBUG) was developed for this purpose.

The WBUG has developed this desk guide as part of the group's implementation plan to help Federal land managers either start or build upon existing regional, forest, district, and other field offices and community-level small-diameter tree and biomass-utilization programs.

National Policies: In addition to the MOU, numerous laws and policies have been established that relate to WBU, which has established the need for and means of addressing issues, challenges, or opportunities, such as:

- The Biomass Research and Development Act of 2000.
- The 2000 National Fire Plan.
- The 2001 National Energy Policy.
- The 2002 Healthy Forests Initiative.
- The 2003 Healthy Forests Restoration Act.
- Sections 9006 and 9008 of the 2002 Farm Bill.
- National Energy Policy Act of 2005.

1.2 Vision, Goals, and Purpose of the Desk Guide

The WBUG is implementing a strategy for increasing the harvest and utilization of woody biomass and woody-biomass products and residues from forest and woodland health, management and restoration treatments whenever environmentally, economically, and legally appropriate.

Vision: An ecologically and economically sustainable woody biomass harvest and utilization will result in more diverse forest, woodland, and rangeland ecosystems—characterized by native flora and fauna, healthy watersheds, better

air quality, improved scenic qualities, resilience to natural disturbances, and reduced wildfire threats to communities—and provide an alternative residue management strategy contributing to rural economic vitality and national energy security.

Goals: The goals of WBUG are:

1. Reduce the cost and improve the quality of forest, woodland, and rangeland restoration or hazardous fuel reduction treatments. Reduce forest restoration cost and increase the use of woody biomass as a renewable energy resource through environmentally sound actions which also provide economic opportunity in rural communities.
2. Reduce the risk of catastrophic fires through adoption of widespread WBU practices.
3. Provide a sustainable and reliable supply of woody biomass from forests, woodlands, and rangelands across a range of ownerships and regions of the nation.
4. Develop and implement consistent and complementary policies and procedures that will maximize Federal efficiency and effectiveness of WBU.
5. Restore at-risk forest, woodland, and rangeland ecosystems to healthy and resilient conditions.
6. Develop sustainable, living wage jobs and appropriately-scaled industries in communities.
7. Enhance national security through clean, renewable, diversified energy production.
8. Contribute to the stabilization of greenhouse gas concentrations.
9. Develop and apply appropriate technologies and provide technology transfer to stakeholders.
10. Substantially divert biomass currently directed to landfills to higher value use.

Purpose: Given the stated vision and goals for biomass utilization, the purpose of the desk guide is to:

- Provide a quick reference guide and suggestions to local land managers on how to locate and collaborate with biomass stakeholders.
- Assess the viability of offsetting the costs of accomplishing hazardous fuels and ecosystem restoration treatments by utilizing marketable small-diameter trees and other biomass.

- Provide suggestions on how to use current National Environmental Policy Act (NEPA) planning tools to start up quickly and then maintain a biomass-utilization program.
- Provide suggestions on how to use cost-effective sale preparation techniques and cost-effective timber sale/stewardship/service contract preparation techniques to provide increased supplies of biomass.

This guide does not provide a magical recipe for successful implementation of small-diameter tree utilization and biomass projects. Rather, this guide provides encouragement and useful tips to help land managers implement projects and build small-diameter tree utilization/biomass infrastructures in their communities.

The tips are derived from the lessons learned by those forests and districts that currently have successful programs. The lessons learned have come from both successes and failed attempts to build SDU programs and infrastructures in communities.

In spite of all the barriers and challenges that come with attempting to implement or build on existing SDU and biomass programs, the WBUG strongly believes it is worth the struggles we all face in accomplishing these objectives.

The following chapters divide the challenges into four important areas that the WBUG feels need to be considered individually but tackled simultaneously in order to have a chance for success:

Chapter 2—Project and Program Design

This chapter contains subsections on project integration, forest product markets, project-value mix, extraction technologies, and transportation technologies.

Chapter 3—NEPA, Choose the Right Tool

This chapter contains subsections that include planning questions to contemplate and types of projects that could be implemented under FSH 1909.15, Section 31.12 and 31.2 (including HFI projects), under 36 CFR Part 215 and under 36 CFR Part 218 (HFRA).

Chapter 4—Contract and Permit Strategies

This chapter contains subsections that discuss the merits and limitations of using free-use permits, personal-use permits, service contracts, various forms of timber-sale contracts, including discussions on special contract provisions, stewardship contracts, rules of thumb for selecting the best contracting instrument and considerations for transitioning values of forest products.

Chapter 5—Project (Sale) Preparation Strategies

This chapter focuses mainly on suggestions on cost-saving measures that could be considered when implementing timber sale or stewardship-type projects.

Chapter 6—Conversion Factors and Glossary

Chapter 7—Useful Web Sites and Publications

PROJECT AND PROGRAM DESIGN

2.1 Project Integration

2.11 Scale

So, how is a SDU-biomass project or program integrated into the local land management program? These questions may be helpful:

- How will the harvest of biomass help achieve the desired future condition (DFC) and where are the highest priority areas (risk to human health and safety) for treatment?
- How large a project is being considered: 1 acre; 100 acres; 1,000 acres; 100,000 acres, or more?
- What are the existing markets? Are there local crews to perform the work?
- Is biomass currently being harvested and utilized in the area, and if so, has a rapport been established with the purchasers and mill owners?
- Is there support from the local community and environmental groups?
- What are the short-term (1 to 10 years) or long-term (10 to 20 years or more) or sustainable needs for integrating SDU-biomass treatments into the program?
- How many acres per year would be treated?
- What size is the budget and workforce?

Once the scale of the project is known, it's easier to determine the size of the community workforce, what the appropriate NEPA tool(s) are for implementing the project or program, and what contracting instrument(s) to use.

For example, as a land manager working in a small community with the small-scale and possibly short-term need to thin small-diameter trees located within a number of administrative or recreational sites, it might be best to implement the thinning under the NEPA authority of FSH 1909.15, Chapter 31.12, paragraph 3 - "Repair and Maintenance of Administrative Sites." Once the trees to cut are marked, if the trees are too small to meet minimum specifications for sawlogs, open the area up to personal-use firewood cutters or possibly conduct a sealed-bid auction for commercial sale of post, pole, tree stake, rustic furniture wood, chips to be used in a school biomass facility or firewood material, depending on what kind of forest-product industry is in the area.

Here is another example on the opposite end of the scale. Let's say as a land manager working in a community that is somewhat dependant on forest products industries, there is a need to conduct fuels reduction and restoration work on 100,000 acres of overstocked small-diameter timber stands. This presents a different type of challenge.

In this case, given the local workforce and budgetary limitations, it is possible to work up to and then maintain a 2,000-acre annual fuels reduction program for the next 50 years, maybe sustainably with appropriate silvicultural prescriptions put in motion.

Perhaps there are smallwood-market entrepreneurs (small-scale loggers) in the community who sell post-and-pole material to a fence post and rustic furniture manufacturer. These specialized loggers could help with the fuels-reduction program, but only with a capability of thinning about 100 acres per year with their current equipment and markets. Also assume that the workforce would be unable raise the $20,000 cash or credit (minimum) to purchase a forest-products sale.

Under this scenario, try to arrange a small-scale fuels-reduction program that targets relatively small parcels of timber stands—between 70 and 1,000-acres—utilizing an assortment of NEPA decision documents available under FSH 1909.15, Chapter 31.2 that include limited timber harvest, timber stand and wildlife habitat improvement, and hazardous-fuels reduction projects that can be categorically excluded from documentation in an environmental assessment or environmental impact statement. Use contracting instruments that fit the financial limitations of the potential timber-sale purchasers, (i.e., the workforce).

These examples show how scale affects the overall design of a project or program. Throughout the guide more scenarios are used to show how all these factors are intertwined in the development or expansion of local SDU-biomass projects and programs.

2.12 Stand Composition

Market inventory is another term for stand composition. During the project-design phase, there needs to be a general idea about the composition of the stands undergoing treatment. Some of the questions to be answered include:

- Are the stands composed of mixed species, and if so, what species?
- What is the percentage of species, by size class, stocking levels, basal area, etc.?

This information helps determine whether there is a gold-mine of forest products or an unsavory pile of low-grade biomass. At either end of this product-value scale, remember that "one persons' garbage is another's gold mine" and quite possibly vice versa!

For example, a land manager may be looking at treating a diseased stand of large-diameter white pine, which normally would be considered veneer-grade sawlogs. However, let's say this land manager is working in an area that does not have a sawmill within 300 miles that can handle large sawlogs. In other words, his potential gold mine is actually garbage.

On the other hand, another land manager may be looking at treating a dense stand of mostly pure lodgepole pine ranging in size between 2 and 6 inches diameter breast height (dbh). This may at first appear to be a bunch of garbage trees. However, in this case, what if 50 miles down the road from this land managers' timber stand is a small-scale manufacturer who markets doweled fence posts and poles and rustic furniture, and he is willing to pay $40 per green ton for live and dead lodgepole pine in the 2- to 6-inch diameter range. By the tree-length log-truck load, this equates to about $1,120 per load or $140 per hundred cubic feet. Gold mine!

2.13 Treatment Objectives: What Do You Want Left (i.e., the DFC)?

Whether the project area has been identified through collaborative efforts for fuels reduction concerns or just through the regular vegetation-management program process, the next step will be to determine the end results of the treatments. The main questions to answer are:

- Is one trying to achieve a DFC for forest health and ecology, or is one trying to achieve an altered DFC from the natural condition to provide a higher level of protection to adjacent communities?
- What species, size classes, and stocking levels need to be left to accomplish the desired fuels-reduction level, fire resiliency, and silvicultural objectives?
- What needs to be left to achieve coarse-down-woody and nutrient-cycling objectives?
- What needs to be left for cavity nesting and other wildlife species?
- What needs to be left for special riparian-habitat management objectives?
- What needs to be left for visual-resource objectives?

- What needs to be left for adequate fuels to accomplish a prescribed fire following removal of excess fuels?
- What needs to be left for any other resource objectives?

Once these questions are answered, it becomes apparent what market values to remove from the available supply inventory. This information will also help determine what operational equipment may be appropriate.

For example, if the desired end result for a project area is to leave ponderosa pine trees with a dbh ranging from 6 to 10 inches on a spacing ranging between 15 to 20 feet, then there is only small-diameter biomass to offer as a marketable product, and requires a small-size harvester to cut and process the material to minimize mechanical damage to the residual stand.

2.14 Utilization Objectives: What Is To Be Removed?

Utilization—the fun and challenging part of project design—is the main purpose of the guide.

The answer to the question of what to remove is simple. Remove—and utilize to the fullest extent that which is economically feasible—everything that is not needed in the project area following treatment.

One of the biggest challenges is to identify the highest commercial value for all the excess biomass available for disposal in the project area and, most importantly, to find a way to get all the various products transported out of the project area and into the appropriate markets.

If suitable markets cannot be found, then try to make the markets happen. The first step could be reading this guide. Hopefully, it's not a waste of valuable time. More suggestions on markets and market development are discussed in later subsections.

2.15 Integration with Fuels, Timber Stand Improvement, Recreation, Wildlife, Watershed, and Other Programs.

Integrating small-diameter tree and biomass-utilization projects with fuels-reduction programs is an obvious way to integrate. Fuels programs should be leading the way for utilizing this material. It costs money to slash, buck, pile, and burn excess fuels, whether they are connected to timber sales or are a direct result of fuel-reduction projects. If the local district working group currently does not coordinate activities between fuels and vegetation management programs, the time to do so is now.

Similarly, timber stand improvement programs should be coordinating their program activities with vegetation management and fuels programs. Because fuels reduction objectives normally include the need to cut and remove or burn the smaller diameter trees and brush, the same stands that need the fuels-reduction treatments also will usually benefit from thinning treatments that have in the past been considered to be precommercial treatments. Also, conducting prescribed fires in small-diameter timber stands that have been thinned usually is not feasible because the residual trees are too small in diameter and the crowns are too close to the ground to be fire resistant. Exceptions exist, such as long-leaf pine plantations in the Southern States.

Also in the Southeast, biomass harvest from fire-suppressed areas may be needed to improve habitat for threatened and endangered species or to improve smoke-management situations, thereby facilitating prescribed burning.

Not quite as obvious as the integration between vegetation, fuels, and timber-stand improvement programs, other programs such as wildlife, recreation, and watershed programs can and should be integrated as much as possible to not only utilize SDU and biomass material but also to help fund beneficial treatments for those resources.

An example of how wildlife habitat could benefit from an integrated SDU-biomass project could involve aspen stands that are being encroached by conifer species or that have become decadent due to past fire suppression. By integrating with vegetation and fuels programs, wildlife biologists could restore healthy aspen clones through the mechanism of a small-diameter biomass timber sale, or through a specially designated personal-use firewood cutting area that would cut and remove the conifers and perhaps most of the decadent-aspen trees, followed by a prescribed fire to help rejuvenate the aspen. This integration could make the project cost effective.

This example focuses on watershed restoration. It involves a specially designed treatment to remove a dense understory of small-diameter mixed conifers within a riparian-habitat conservation area. The objective is to favor the growth of large-diameter cedar trees that in the long term will help shade streams, cool water to benefit trout, and eventually die and fall into the stream zones to improve stream stability and fish habitat.

What about integration with road maintenance? Often, we read about how many miles of forest roads need to be maintained, yet consistently are underfunded to accomplish desired routine work. Finding markets for small-diameter trees and brush can help here too. SDU-biomass sales could provide an economical means to clear roadsides and perform other minor maintenance (i.e., blading roads and reestablishing ditch lines) for public safety and improved ingress and egress in case of emergency wildfire-evacuation needs.

2.2 Forest Product Markets

2.21 High-value Products

What is considered a high-value market? Keeping in mind the maxim of "One persons' garbage is another's gold mine," high-value markets can vary from location to location around the country. Normally speaking though, high-value includes forest products that allow the raw-material handlers and manufacturers to make a reasonable profit after factoring in their operating costs.

2.211 Uses

Uses of high-value forest products include dimensional lumber (sawlogs), veneer wood, houselogs, and utility poles.

2.212 Product Specifications

Sawlogs—Technology exists today–and is being used in certain parts of the country–that can make dimensional lumber from logs as small as 9 feet long with small-end diameters of 3.5 inches. For most of the country however, the standard minimum-piece size is about 8.5 feet long with small-end diameters of 5.6 inches inside the bark.

Veneer logs—Veneer logs–softwood and hardwood species–are some of the higher valued material processed into wood products. An ideal veneer log is cylindrical with the pith in the geometric center of the log-end sections. The bark surface and the log's end sections are entirely free of blemish and defect. The log's grain is straight. Veneer logs produce veneer as wood cut 0.01- to 0.25-inch thick using a rotary- or slicing-knife method. Larger logs produce higher yields of veneer. Veneer logs, or bolts, are typically peeled in lengths of 8 feet plus trim, and can be peeled down to a 3.5-inch-core diameter. Uniform thickness, minimum surface roughness, and minimum buckle are three desirable characteristics of veneer. Four end-use categories for veneer are construction and industrial plywood, face veneer for hardwood plywood and decorative panels, core and cross-band veneer for decorative plywood, and container veneer for boxes and baskets (USDA Tech Bulletin 1577, 1978).

Houselogs—This is a potentially very high-value product if the market area supports houselogs. Normally what log-home manufacturers are looking for are dead (but not always), fairly straight logs that are free of sap rot, large beetle boring holes, and spiral checks. Fire-charred trees may or may not be considered a defect. Houselog species preferences vary depending on the market area, but many manufacturers utilize cedar, lodgepole pine, spruce, white pine, western

larch, and alpine fir in the Western States. In the South, bald cypress, southern-yellow pine, and eastern hemlock are utilized. In the Midwest, eastern-white cedar, oak, and other species are used. Do not automatically discount certain species. Preferred diameters can vary from 6 inches to over 18 inches and lengths of 25 feet or longer (shorter pieces can be used for archways, gables, etc). If log-home manufacturers are within several hundred miles of the project area, they may be interested in coming to get the houselog trees. Contact local log-home builders to find out exactly what their preferences are.

Utility poles—This is another potentially very high-value product if the market area is right. Utility poles for power-transmission use normally are southern pines, Douglas fir, and western-red cedar in 20- to 125-foot lengths. Other species are often used for distribution poles. Forest Products Lab General Technical Report 128 provides useful information about species and strength characteristics of various species of trees used for utility poles. The report can be accessed at http://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr128.pdf

2.213 Current Purchasing Locations or Regions and Value Ranges

To view current purchasing locations or regions and value ranges visit: http://fsweb.fpl.fs.fed.us

2.22 Value-added Products

Value-added forest products refer to those products that normally are a byproduct of high-value products. They also can have a fairly high value to niche marketers. Value-added products may or may not be marketed by the initial forest products sale purchaser. Usually value-added products are sold to secondary purchasers, often times salvagers of nonsawlog decks and slash piles following a traditional timber sale. In some areas of the country however, value-added products could be derived from small-diameter forest-product sales that accomplish thinning or fuels-reduction treatments and may or may not include traditional sawlog products.

2.221 Uses

Common uses include a wide range of forest products depending on the locality or region of the country. Examples include—but are not limited to—post and poles, tree stakes, trellis poles, rustic furniture (bed frames, cabinets, lamp posts, coat racks, etc), spindles for log-home railings and stairways, stairway steps, arches, character wood (i.e., burls or cat-faced wood), landscape chips and bark, garden mulch, animal bedding, composite wood, and many other uses.

2.222 Product Specifications

Product specifications for the various value-added product markets are so variable that it would take too much space here to list them. Basically, value-added products can be made from virtually any species and size-class tree growing anywhere in the country.

However, of all the products currently being marketed nationally, when it comes to land managers being able to tap into value-added markets to accomplish fuels reduction, restoration, or normal vegetation-management treatments, the markets with the most potential include the post, pole, tree-stake, and spindle-wood products. Mainly, these markets use lodgepole pine in the Western States, eastern-white cedar, red pine, and jack pine in the Midwest, and yellow pines in the Southern States, although more localized species preferences may exist around the country.

The best way for land managers to find out what possible value-added markets may exist in their working area would be to check Web sites and yellow pages and then follow through by making contact with those manufacturers to find out what their specific needs are (including annual supply needs so the potential size of the program can be determined). Refer to section 7 for a listing of some value-added markets or links to Web sites for those markets.

2.223 Current Purchasing Locations or Regions and Value Ranges

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To give meaning to the term value-added, consider that in some parts of the country where spindle-wood markets exist, manufacturers are willing to pay around $2,000 per log-truck load for dead lodgepole pine in tree-length form (log-truck lengths) and as small as 2 inches in diameter. Some post-and-pole companies have also been paying around $40 per ton (roughly $1,100 per truck load) for small-diameter live- and dead-lodgepole pine.

Has anyone noticed those little bundles of split campfire wood that are selling for around $5 per bundle at stores located near campgrounds? How much is that per cord?

Land managers should not overlook the potential to utilize value-added markets to drive a major fuels-reduction, restoration-, or timber-stand improvement project or program. Value-added markets can suddenly fall into the high-value category with the right forest products infrastructure in place.

2.23 Low-Value Products

Low-value markets barely provide a profit margin to those people involved in the harvesting and transporting the material to the market. Normally the low-value products find their way out the woods because of higher-value products being removed at the same time.

2.231 Uses

Uses include paper pulp and chips for oriented strand board (OSB) and other composite lumber.

2.232 Product Specifications

The most important specification for paper pulp is that pulp logs cannot be fire-charred into the cambium (charred bark sometimes is accepted). Pulp logs generally should not contain more than 50-percent soft rot. Many tree species can be utilized for paper pulp. Acceptable species mixes and size specifications also will vary based on the kind of paper product a mill is making (i.e., newsprint, kraft paper, cardboard, magazine-quality paper, etc.). The same variables exist for OSB, particle board, composite wood, and other home-siding and flooring-lumber products.

To determine local forest-product specifications, seek out those industries that are local to the region.

2.233 Current Purchasing Locations or Regions and Value Ranges

To see current purchasing locations or regions and value ranges visit: http://fsweb.fpl.fs.fed.us

2.24 No- or Negative-Value Products

The no-value or negative-value forest-product markets are the markets that need to be developed and nurtured the most to accomplish economically the objectives of the National Fire Plan, Healthy Forests Initiative, Healthy Forest Restoration Act, National Energy Policy Act (2005), the 10-Year Comprehensive Plan, the objectives of the Woody Biomass Utilization MOU, and many other interrelated initiatives and laws.

2.241 Uses

Uses include hog-fuel chips to fuel old technology wood-to-steam turbine-to-electricity power facilities (many sawmills use this system to generate their own power) or for high-tech cogeneration electric generation facilities. The term "cogen," means that not only is electricity being utilized, but at least one other byproduct of the electricity generating process, such as steam, is being used also, such as for heating a building with the steam that was used to turn the turbines. Another term used to describe cogen is combined heat and power.

Other promising uses—in the early stages of development—include converting wood chips into ethanol and biodiesel with the purpose of reducing the United States dependency on foreign oil, while at the same time helping to reduce excessive forest fire fuel loadings and restore forest health.

The combined uses of these forest residues (biomass) bring with it a demand for mass quantities of small trees, branches, needles, and brush. The problem of course is that currently—if there is any local market for the material at all—the value of the raw material is too low for anybody to make a profit out of harvesting and transporting the material to a facility that can use the product. In addition, the cost to pay somebody to harvest and remove all the excess biomass is currently so high that Congressionally-appropriated funding for this removal work is not likely to be provided.

Is it worth the challenge to find ways to utilize biomass? Yes, there are millions of acres of federally managed forests (including shrublands) containing millions of tons of excess forest fuels that need to be disposed of in order to achieve our DFC or improve forest health. The easy way out of this problem is to slash and burn the biomass, wasting perfectly good energy and adding to smoke emissions to the atmosphere or, the biomass can be turned into electricity or transportation fuels that will help the country become less dependent of fossil fuels and foreign oil. It may be worth the effort to meet the challenge.

2.242 Product Specifications

The specifications for no-value or negative-value biomass are whatever is left over after the high-value, value-added, and low-value products are used up. The source of this low-grade biomass could be from small-diameter (i.e., nonsawlog) timber stands, scattered logging slash, slash piles, precommercially-thinned trees, noncommercial-juniper trees, or brush species. Other sources that could come from State and private community partners in biomass-utilization projects include sawmill residues and landfill-wood waste.

2.243 Current Purchasing Locations or Regions and Value Ranges

To see current purchasing locations or regions and value ranges visit: http://fsweb.fpl.fs.fed.us

2.25 Market Development Collaboration with Entrepreneurs

Webster's New World Dictionary defines collaboration as "to work together." Webster's also defines an entrepreneur as "one who organizes a business undertaking, assuming the risk for the sake of profit."

When talking about collaborating with entrepreneurs for the purpose of market development, keep in mind that our business partner (the workforce) needs to minimize his or her risk of going bankrupt. Similarly, for Federal land managers to be successful in accomplishing fuels reduction and restoration work economically—in other words, at low cost to the American taxpayers—they need to be sensitive to the economic effects on our workforce (i.e., the business) when environmental protection measures are required before making biomass available for use. In other words, we need to work closely with our partners to develop cost-effective methods of utilization while at the same time protecting the natural resources.

Federal land managers do not have much control over most of the market forces that will drive SDU and biomass-utilization businesses. However, one market factor that Federal land managers do have some control over is supply.

As a land manager working near a large urban area or near a rural community of less than 1,000 people, the SDU-biomass project or program should be tailored to fit the needs of the community. Committing to a long-term program, means committing to a steady supply of forest products so the business partner can bank on that supply. It does not matter if the commitment is 10 acres-worth of products per year or 1,000 acres. The key to everybody's success in maintaining a healthy business and land management program is in the steadiness of the supply.

Another factor that land managers have some control over in minimizing business risk is in how much money our business partner is asked to spend in the process of taking possession of the material we want to dispose of.

For instance:

- How much stumpage will our partner pay?
- How much money will our partner pay for brush-disposal deposits and other post-harvest treatment expenses?

- How much money will we cause our partner to spend to use certain types of equipment?
- How much money will our partner have to spend on an annual basis to maintain cash credits?
- How much money will our partner have to spend on a monthly basis (i.e., is the partner paying a lump-sum, or pay as they go)?
- How much money will our partner have to spend in harvest production time due to project layout (i.e., terrain), silvicultural prescriptions, timber-cutting contract designations, and other contractual stipulations?
- How much time will we allow our partner to "play the markets" to optimize their profit margin?

While not getting into intimate discussions with the business partner about their financial health and capability, land managers should have some level of discussion with potential entrepreneurial partners to customize the project or program and do the best job of minimizing the risk of failure of both the program and the partner's business.

Begin the discussion with questions such as:

- What products and specifications do you want to market?
- What is the quantity of products you want to start with?
- How large of a market do you want to eventually achieve and maintain?
- What do you currently have for harvesting and transportation equipment?
- If you aren't interested in the harvesting and transporting of products to your manufacturing facility, what price would you be willing to pay somebody else to bring you the product?
- If you are willing to pay somebody to bring you the product, what form do you want the material delivered (i.e., tree length, chunks, chips, bundles, etc.)?

2.26 Nature of Markets

Land managers must be aware of the particular nature of the market(s) that will be utilized to accomplish their SDU-biomass project or program. For example, some markets are fairly steady throughout the year while others have seasonal fluctuations. Other markets may have an inverse relation to other markets. The nature of markets will have a direct effect on how land managers design their local project or program.

2.261 Seasonal Markets

Seasonal markets may only have a demand during certain times of the year. The fence post and pole market is one example. Nobody likes to build fences in the winter time in those locations around the country that get cold and snowy. So to design a SDU-biomass program tailored to this market, schedule supply availability in the spring (as soon as ground conditions permit), summer, and fall months. Timing harvest operations would be important when putting together contract packages. Unless there is a business that can build inventory in the winter months, it might not be a good idea to offer short-term post-and-pole sales late in the fall or winter.

2.262 Year-Round Markets

The entrepreneurial partners need reassurance that there will be a steady supply of forest products for their markets; land managers need some reassurance for a steady demand of those same forest products. It takes time (years) for land managers to plan and implement a SDU-biomass program. Year-round markets may have fluctuating levels of demand and values throughout any given year, but normally the demand does not go away completely.

2.263 Multiple Markets

Some communities either have existing—or the potential for—multiple markets. The more markets there are to exploit, the better. Similar to investment strategies, a diverse portfolio of markets provides for stability for both supply and demand concerns. If one market is down, chances are another market is up.

An example of opposing market swings is the relationship between sawlog and pulp markets. Normally—but not always—when sawlog prices are high, sawlog supply to mills increases, and the result is a glut of pulp logs available as the sawmill's byproduct. When this happens, the prices paid for pulp logs declines—because the supply exceeds current demand. So, with a fuels-reduction project that involves the sale of mostly small-diameter pulp log material and the pulp prices drop below around $24 per green ton for delivered pulp logs, the project contractor may decide to hold off harvesting them until the market rises above what they consider to be their economic break-even point.

Another example concerns the relationship between pulp mills and biomass facilities that exist within the same market area. If there is a biomass facility that needs large volumes of hog fuel, their access to supply of that material could be drastically affected by the rise in pulp prices.

Biomass facilities also are affected by market-value swings in natural gas prices. When utility companies operating multiple-source energy facilities have to pay more for natural gas, their demand for biomass usually increases.

2.264 Current and Future Market Strength

Land managers need to know the market strength and likelihood of maintaining a suitable workforce for accomplishing fuels reduction, restoration, and other vegetation management objectives utilizing small-diameter tree and biomass sales. Much of this will hinge on the combination of forest-product values, quantity-demand levels, and the likelihood of long-term needs for the product.

For example, when researching the possibility of building a SDU program based on the post-and-pole industry, try to answer the following questions:

- Within the working area (looking out at least as far as about 100 miles), how many post-and-pole companies exist?
- What is the average range of prices the post mills are paying for raw material?
- What is the average annual volume demand for raw material for all the companies?
- What is the turnover rate of post companies in the area, have they all been in existence for a long time, or do they open and close on a regular basis and if so, why (supply problems or market related)?
- Are the post companies trying to expand their business or just maintain their current level of demand for raw material?
- On a broader scale (i.e., regionally, nationally, or internationally), does this particular market seem to be growing or have the potential to grow?

Once these questions are answered, establishing and maintaining the workforce size and type needed becomes clearer.

What if someone in the community (or a neighboring community 100 miles away) is considering installing a biomass energy facility? If that's the case, then it's important to find out the answers to these questions:

- What size facility is being considered (1, 5, 10, or 100 megawatts for instance)?
- What will the annual needs be (tons, either green or bone dry) to keep the facility running?

- What percentage or tonnage of annual feedstock would need to be provided from Federal land?
- What's the life expectancy of the facility (i.e., will it be a portable facility or fixed with a financial payoff period of 40 years)?
- What value range might the facility be willing to pay for delivered chips, bundles, whole trees, or logs?

Finding answers to these questions helps decide how large of a commitment to make for supplying the biomass and the size and type workforce needed to provide the supply. Also, if the facility is any larger than 1 megawatt, the commitment for supply will more than likely have to involve multiple districts and forests as well as State, county, city, tribal, and private landowner commitments.

2.3 Project Value Mix

This section concentrates on project-level rather than general program considerations. Understanding the actual potential mix of forest product values in any given project will be a very important element of the project design.

2.31 Determining if a Project Can Pay for Itself

The first objective for a fiscally responsible Federal land manager is to make the American taxpayers' SDU-biomass project pay for itself. If appropriated funding is required to supplement the treatment costs, the chances of getting funded to the level necessary to accomplish the fuels reduction, restoration, or other vegetation management treatments may be reduced greatly.

The following sections discuss how to determine if a project can be implemented without supplemental funding.

2.311 Gate Price

The first step is to determine the delivered biomass price for the area. This is the price paid for the material delivered to a buying or utilization site. Call several sites to determine a likely gate price for biomass appraisals.

2.312 Logging Costs

Using regional cost-calculation methods, determine the cost for processing the biomass from the stump onto the landing. This is the timber property value for biomass sales when the material is sold from the landing.

2.313 Transportation Costs

Using regional cost-calculation methods, calculate the cost of transporting the biomass from its current location to the buying or utilization site. Forests establish a profitable haul (PH) distance for each outlet or facility accepting biomass in their respective areas.

2.314 Volume and Value in Project

The definition of biomass assumes products such as sawlogs, posts and poles, firewood, and other local products, have been separated from the material that is truly biomass. Depending on the location, biomass material can have little or no commercial value as stumpage at its current location. The biomass material will cost money to move it from where it is—either from within the stand, standing, or on the ground; on a landing; or decked in a storage area either on or off national forest lands—to a location where it can be used. How much biomass removed depends on how the transportation costs are paid and the distance from the buying location or utilization center.

If the investment has been made to get it to a landing or storage area, biomass typically has sufficient value to cover transportation costs over a defined distance. For example, some forests in the Southern Region (R-8) use 30 miles as the haul distance to where no subsidy for biomass is needed to reach a utilization location. In other words, based upon the cost of operating a truck with driver, the value of the biomass is sufficient to pay a trucker to haul biomass up to 30 miles. This is the PH distance. The distance depends on market conditions for biomass, fuel price, availability of trucks, etc., and these variables can change on a daily, weekly, or monthly basis. Forests need to establish a PH distance for each outlet or facility accepting biomass in their respective areas. This should be based upon average conditions.

If the material is still standing in the woods, an Integrated Resource Service Contract (IRSC) with added appropriated funds and/or stewardship receipts, in addition to the value of the commercial products, can pay to have the biomass material cut and either left in the woods, lopped and scattered, machine- or hand-piled, or yarded to the landing and piled. Typically (under an integrated resource timber contract (IRTC), the value of the commercial products can cover the costs of these biomass treatments), if the investment has been made

to get the material to a landing, and the piles are within the PH distance, the contractor will haul it to a buying or utilization site. The IRSC and IRTC can also include as a requirement the hauling of the material to a specific location for use. This will be an added cost in the contract against the value of the commercial products and may require additional appropriated funds and/or stewardship receipts.

Biomass—either existing or generated from a vegetative treatment—can be treated in a stewardship contract. Funds can be added to the contract to complete the needed work, or value from the products removed can be used to offset the cost of the work. IRSCs can accommodate many different restoration treatments related to biomass; cut-and-leave in the stand; cut, yard, and deck; cut, yard, and haul, etc. While the PH distance is important, forest managers need to recognize the trade-offs of requiring biomass to be hauled beyond the PH distance and its effect on reducing the number of acres treated or number of projects completed because of the cost incurred.

In an IRSC in which the contractor does not want the biomass material, and the contract required yarding and decking of the material, or in a timber sale which has decks of material from accepted and deleted units that are planned for burning, and the purchaser does not want the material, the decked biomass can be sold in a separate contract using the FS-2400-2 contract (see FSH 2409.18, 53). Complete an appraisal to determine the advertised rate for the biomass. In using a FS-2400-2 contract, at least the minimum rate, plus deposits, is charged for the material to be removed.

Preexisting biomass on the ground or standing in the woods cannot be treated with a conventional timber contract. The Brush Disposal Act of 1916 authorizes the Forest Service to collect deposits to treat activity-created fuels, or require the purchaser to treat activity-generated fuels. Preexisting fuels cannot be treated by collected brush-disposal deposits or by the purchaser in a timber sale. However, biomass is created from purchasers' operations in the woods and generated on landings from yarding operations. The purchaser is likely to remove this material, upon agreement, if the PH distance results in a profit, or break-even. This material can be given to the purchaser without charge, subject to agreement on deposits if needed for road maintenance. Mechanisms for providing biomass without charge that is outside the PH distance include B(T)3.41 in the timber sale contract, D(T).4.1 in the Integrated Resource Timber Contract, Administrative Use pursuant to CFR 223.2. (See FSH 2400-8 and FSM 2463.)

2.315 Appraising Biomass

Biomass has a value based upon where it is located in the supply chain. Removal of piles or decks of biomass located within the PH distance are to have an appraisal completed on the material. Deposits for road maintenance, as necessary, should be added to the advertised rate to arrive at the total the purchaser will be paying. Use a simplified appraisal approach, such as shown in the example. Include all applicable costs in the appraisal; clean-up of landings, erosion control, equipment cleaning for noxious weeds, etc. Use of the transaction evidence appraisal system is not required. See the following example—a sale for row thinning of pine. The purchaser did not want the biomass material. The sale administrator accepted all purchasers' work in the units and deleted them from the sale. The district opened the piles up for firewood cutting. All products of value have been removed. The piles are within the PH distance of the local cogeneration power plant. A FS-2400-2 contract will be used to facilitate payment and transfer of title of the biomass to the purchaser.

Gate Price (delivered biomass price)	$25/ton
Weight of one (1) cubic foot (cf) of pine	52 pounds
Loading cost	$18/100 cubic feet (ccf)
Profitable haul (PH) distance	30 miles
Distance to utilization facility	15 miles
Haul cost	$12.00/ccf
Timber property	$45.00/ccf
Road maintenance deposits	$1.50/ccf

Convert price per ton to a price per ccf:

($25/ton) x (1 ton/2,000 pounds) x (52 pounds/1 cf) x (100 cf/1 ccf) = $65/ccf

Delivered biomass price		$	65.00
Loading cost	-	$	18.00
Haul cost	-	$	12.00
Subtotal		$	35.00
Rollback factor - 10% [1]	-	$	3.50
Indicated advertised rate [2]		$	31.50
Minimum rate		$	0.25
Advertised rate		$	31.50/ccf
Road maintenance deposit	+	$	1.50
Total rate paid by purchaser		$	33.00/ccf
Timber property ($31.50 - $0.25)		$	31.25
To National Forest Fund (NFF)		$	0.25

[1] *The rollback factor reflects differences in sale conditions that may not have been reflected in the appraisal, and allows for the risk that markets or other economic conditions may change during the period of the contract (FSH 2409.18, 45.32). Rollback factor shall not exceed 10 percent.*

[2] *The indicated advertised rate results from the subtraction of all costs, and the rollback factor, from the delivered biomass price.*

In this example, the purchaser would pay $33.00 per 100 cubic feet for the material, which includes $31.50 per 100 cubic feet for stumpage for the biomass, and $1.50 per 100 cubic feet in road maintenance deposits. If the subtotal in the example was less than the minimum rate, the biomass would be given to the purchaser without charge for the material. The forest would collect road maintenance deposits for haul over forest roads utilizing a bill for collection as the collection instrument. Not all of the timber property could be collected on this contract.

Appraisal could have been completed in tons, or any unit of measure, as long as the appraisal data is in the same unit of measure.

If the piles were further than the PH distance, the biomass material can be given to the purchaser without charge. Road maintenance deposits would be collected, if required.

If the biomass material resulted from the precommercial thinning of trees, the pounds per cubic foot number would be different. The gate price (delivered biomass price) likely would not change.

2.316 Minimum Rate for Biomass

The national minimum rate for biomass sold within the PH distance is $0.25 per 100 cubic feet, $0.08 per ton, or $0.50 per thousand board feet. Regions and forests can establish their own minimum rate for biomass, but it cannot be less than the national minimum rate.

2.317 Timber Property and Biomass

Timber-property sales involve recovery of value in excess of stumpage value or standing-tree value. Timber-property values are the cost of manufacture from the standing tree to manufacture where the sale is made, which is usually in decks. This would include the constructed value of felling and bucking, skidding, decking, treating slash, preventing erosion, and a proportionate share of overhead and depreciation (FSH 2409.18, 47.3). Timber property should be added to biomass sales to the extent that will result in advertised rates that are reflective of fair market value for the material.

Determine the average unit rates for the species or products with property value for the entire volume in the species or product group, based on its current state of processing. Enter the total timber-property value in one of the blank lines on the bottom of the regional appraisal summary report. In completing the Form FS-2400-17 - Report of Timber Sale portion after the sale is made, subtract the timber-property rates from the rates bid by the high bidder to develop the statistical high bid.

Biomass transported beyond the PH distance is deficit sales, and should be given to the purchaser at no charge.(See FSM 2462 [2409.18 Chapter 80] and 36CFR 223.5 through 223.11) No timber property would be collected in this situation.

2.318 Material Larger Than Biomass, but Smaller Than Sawtimber

Regions have various names for this size material: nonsawtimber, chip-n-saw, pulpwood, chip material, pee-wee wood, etc. The size of this material varies by region based upon forest plan direction, manufacturing capabilities of local mills, predominate tree size being offered for sale, cruising specifications, utilization standards, etc. Many sawmills have retooled to facilitate processing logs down to a top diameter inside bark of 3.5 inches and lower. Processing of these smaller logs into lumber is dependent upon favorable market conditions, ability to develop and maintain niche markets for this lower value product, and the number of current and anticipated orders for this material.

Forests should seek to maximize the value of the products being utilized from this size material. When lumber markets are high, this material will be made into lumber. When lumber markets are low, forests should seek to sell posts, poles, and firewood. The remaining material would likely go into chips or biomass, or be burned on the landing. What this means related to timber sales is that the appraiser determines the amount of this wood to be nonsawtimber, pulp, chip-n-saw, etc., and how this material will be appraised and included in the contract, either as sawtimber or nonsawtimber, based upon current market conditions. Timber-sale purchasers determine its value through the competitive bidding process. The remainder of this wood hopefully will be removed and utilized as biomass, instead of being burned on the landing.

Some biomass sales may have piles that are located both inside and outside the PH distance. In appraising these piles, calculate the price of the biomass inside the PH distance and develop a weighted average price based upon the entire volume. See the following example.

Volume outside the PH distance (given to purchaser)	25 ccf
Volume inside the PH distance	100 ccf
Appraised value of biomass inside PH distance	$35.00/ccf

Weighted average price for the sale of this biomass;

(100 ccf x $35)/(25 ccf + 100 ccf) = $28.00/ccf

Forests receive credit for the biomass sold when the volume is entered into Timber Information Manager. Forests also can receive credit for biomass that is given to purchasers at no cost (FSM 2462 [2409.18 Chapter 80] and 36 CFR 223.5 through 223.11) by entering it into Timber Information Manager as a permit with no value. A table for converting biomass sold in a unit of measure other than 100 cubic feet is included in the chapter 6.

After following through with the previous calculations and resulting stumpage price, assemble the total estimated volume and value of the project, broken down by the marketable forest products.

Now may be a good time to do a little more collaborating with potential entrepreneurs. The ultimate way to determine if the project can pay for itself will be to put it up for bid. If it sells, the answer is "yes!" However, in order to improve the chances of getting an acceptable bid, find out if the price is right for having a sellable project.

2.319 Minimum Requirements, Rules of Thumb

Various economic computer models may be a useful tool to utilize in determining if it's a good idea to offer a SDU-biomass forest-product sale. These models would be most useful under the following circumstances:

- There is no local entrepreneur in the community yet.
- There is an entrepreneur in the community who is interested in getting into the SDU-biomass marketing business, but they do not have enough practical experience to determine for themselves if the project is economically viable.

Some models currently available include the Fuel Reduction Cost Simulator at:

http://www.fs.fed.us/pnw/data/frcs/frcs_home.htm and the Users Guide for STHARVEST program at http://www.fs.fed.us/pnw/pubs/gtr582.pdf.

The most reliable method to determine whether the project may be able to pay for itself is to discuss it with the potential SDU-biomass project purchaser(s). Do not ask them exactly what they would be willing to pay for stumpage on a SDU-biomass sale, but perhaps approach a potential purchaser and ask a question, such as "If a small-diameter timber sale was offered up for around $20 to $30 per green ton, is there any interest?" If a reply is received, and the answer is "yes," that's good. If the answer is "no," find out why and start looking at ways to reduce the project's minimum bid. Perhaps some nice-to-do contract requirements were included into the project, such as requiring new gravel surfacing along an entire haul route when maybe spot gravelling sections of road that really need it would suffice for the short term. The main focus with most densely stocked small-diameter timber stand treatments is on fuels reduction, making an initial "rough cut" to reduce fuels, put the stand in a more economically manageable condition, and start trending the stand conditions towards long-term species composition objectives.

A general rule of thumb for small-diameter timber sales successfully sold on the Idaho Panhandle National Forests is:

- For SDU sales that include a mix of roughly 60-percent sawlog- and 40-percent nonsawlog-forest products (average cut tree size for sale as a whole being 7 to 8 inches), and that require tractor logging systems, a minimum bid (including deposits for road maintenance and brush disposal) of around $15 to $30 per green ton will usually sell. Reduce this value accordingly for skyline and helicopter systems. Only one SDU sale on the forest has been sold that used helicopter yarding in combination with feller-bunchers for a portion of the sale, and the purchaser paid about $22 per green ton (at calendar year 2000 costs) for the sale.

Rules of thumb for small-diameter biomass contracts that have been sold successfully in the Pacific Northwest Region (R-6) include:

- A buying site or utilization facility is within the PH distance.
- Handling of the material is minimized (decreases cost).
- Piles are preferred or very short skidding distance.
- No skyline or helicopter yarding of the material.
- Sell the material or include in an existing contract when personnel and equipment are onsite or in the area (no extra move-in/move-out cost).
- Other required work (repiling of slash, erosion control, etc.) is minimized.
- There is no—or very low—road maintenance or other deposits.

Remember, these are just rules of thumb being used in specific areas of the country, and the values fluctuate on these forests based on the individual sale composition, logging systems, and a multitude of other variables. Every community will have somewhat different rules of thumb because of differences in transportation costs and other factors.

Strive to set the minimum bid (including deposits) under what the market will bear, and then let the competition determine what the actual market will bear. Rejoice if there is even one bidder.

2.32 Supplemental Funding Mechanisms To Offset Deficit Operations

If the project cannot be accomplished solely through the sale of forest products, creative financing could be an option. The good news is that there are more options available now for supplemental funding than there used to be. The

bad news is that a lot of other people are after the same money and there is not enough for everybody. The following subsections discuss two funding categories, non-Federal and Federal.

2.321 Non-Federal Funding Mechanisms

2.3211 Partnerships

There may be several options to obtain supplemental funding through non-Federal mechanisms. These mechanisms may include sources like partnerships with State or private entities, used in combination with stewardship contracts or possibly other contracting instruments. Community-based groups, wildlife-conservation organizations, and maybe even State or county governments may be interested in contributing funds or other cost-reducing resources (labor or equipment for instance) to help accomplish the project(s).

Partnerships with universities to conduct biomass-utilization research may provide another funding mechanism.

Collaborative partnerships with groups, such as The Rocky Mountain Elk Foundation, The Nature Conservancy, and similar organizations, could help accomplish a combination of biomass-utilization, fuels-reduction, and habitat-improvement objectives by pooling resources. If these funding mechanisms sound like an opportunity, contact a local forest grants and agreements specialist to see if there is a possible agreement instrument that will work.

Visit the Partnership Resource Center Web site http://www.partnershipresourcecenter.org/index.shtml for more ideas about how to make partnerships help accomplish projects that cannot pay for themselves through commercial sales of forest products.

2.322 Federal-Funding Mechanisms

There are many possible Federal-funding mechanisms available to help finance deficit project(s). These mechanisms fall into two general categories: appropriated funding and funding through Federal grants in combination with partnerships.

2.3221 Appropriated Funding

If the project cannot be accomplished through a forest product sale contract, consider utilizing an integrated funding strategy among the district or forest timber stand improvement, fuels, or even wildlife departments to accomplish multiple resource-management objectives.

For example, combine district program funding from timber, timber-stand improvement, and fuels appropriations to accomplish thinning a dense timber stand normally considered to be a "precommercial thinning" operation, followed by a service contract to collect bucked-up small trees using a miniature grapple machine and transport and deck the small-diameter material at a nearby roadside or landing, which could then be sold to post-and-pole marketers. This kind of integrated funding mechanism would accomplish timber-stand improvement, fuels reduction, and increased biomass utilization objectives with a single project.

2.3222 Federal Grants or Appropriations Through Partnerships or Other Entities

Federal funding mechanisms may be available through special biomass grant programs awarded to local community collaborative groups or private businesses.

Also, resource advisory committees that are responsible for expenditure of Craig-Wyden appropriations to counties possibly may help fund select biomass-utilization projects (pending an extension of this authorization).

Some federally funded grant programs focusing on small-diameter and biomass-utilization projects include those administered by the Forest Products Lab and the National Fire Plan.

To learn more about how these funding mechanisms may help the deficit project happen, visit the following Web sites: Forest Products Lab Biomass Grant program at: http://www.fpl.fs.fed.us.html and National Fire Plan at: http://www.healthyforestsandrangelands.gov/

Also, the Forest Service Rural Community Assistance program may provide both technical assistance as well as funding for developing new forest product businesses at http://www.fs.fed.us/spf/coop/programs/eap/index.shtml

2.4 Harvesting and Yarding Technologies (Low-tech to High-tech)

The objective in removing small-diameter trees and other low-or-no value biomass is to use technologies that are the most economical and also meet resource protection needs. New technology is wonderful to use when and where the economics can work, but land managers must be keenly aware that some of the currently available biomass harvesting and transporting equipment could

cost well over $500,000. Finding the most economical means to remove and utilize biomass will continue to be one of our biggest challenges.

This section discusses some of the current and prototype equipment that may be available, and how these technologies can be applied practically. The discussion does not include an exhaustive listing of technology, but rather a sampling of what is available or in prototype stage. The technology is discussed based on three forms of harvesting and yarding small trees and biomass from treatment areas: whole-tree and log-length, chipped and bundled, or as loose material. Some rules of thumb for determining the best combination of equipment to use are provided also.

2.41 Whole-tree and Log-length Equipment

A variety of equipment is available to handle whole-tree and log-length material. Let's start with small-scale equipment and work our way to large-scale.

2.411 Horses

For really small jobs, don't rule out the biological option! Actually, horse logging presents an option for treating small parcels of small-diameter and biomass-timber stands.

Figure 1—Horses.

Highly sensitive areas, such as around public recreation, may be logged effectively with minimal disruption using horses. Small parcels of federally managed lands within urban-interface areas may also provide opportunities to utilize horse-logging for accomplishing fuels-reduction work, perhaps in areas that have adjacent homeowners who are sensitive to noise.

The following equipment information in subsections 2.412 through 2.414 is excerpted from a report posted on the University of Idaho Forest Products Department Web site (Small-scale Fuels Reduction Equipment by Jeff Halbrook and Dr. Harry Lee: http://www.cnrhome.uidaho.edu/default.aspx?pid=73790

2.412 Iron Horse Pro Mini-Skidder

The tracked design allows this machine to work over a variety of conditions including snow and slash. Logs are winched onto the rear bunk by an onboard winch. A load is secured, and the operator controls and walks with the machine to a landing where the logs are decked. Slash on this site was piled and burned.

Figure 2—Iron Horse Pro mini-skidder.

Engine: 9 horsepower Honda

Winch: 2,500-pound capacity (50 feet of cable)

Advantages:

- Easily fits into the back of a conventional light-duty truck.
- Can work on snow and slash.
- Does not need a trail system to operate.
- Small and highly maneuverable.
- Easy to operate.

2.413 All-Season Vehicle RC-30 with Radio Controlled Winch

This machine has been modified and guarded by University of Idaho Departments of Forest Products and Mechanical Engineering. Modifications include a quick detachable log winch utilizing the all season vehicle's

hydraulics and a remote control for the winch. Logs were winched to roadside decks both up and downhill over slopes varying from 10 to 36 percent. Slash on this site was piled and burned.

Basically a skid steer (Bobcat, Uniloader, etc.) with tracks instead of wheels.

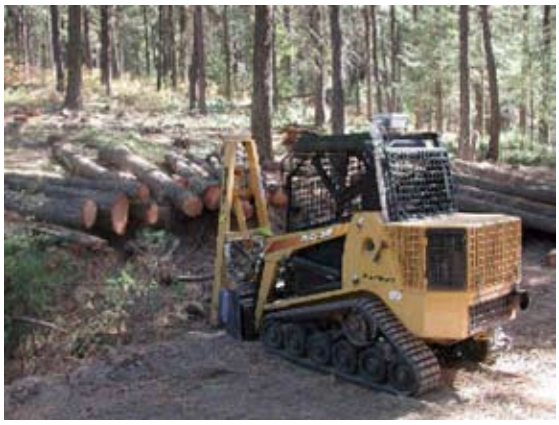

Figure 3—All-season vehicle.

The winch has pulling capacity of 4,600 pounds.

130 feet of cable.

30 horsepower machine.

3.1 pounds per square inch ground pressure.

Advantages:

- Highly maneuverable.
- 0-degree turning radius.
- Easily transported by conventional light-duty truck.
- Winches logs to roadside for loading onto log truck.

2.414 Modified Farm Tractor with Log Loader and Remote-Controlled Winch

This system consists of a Lamborghini 105 horsepower 4-wheel-drive tractor with 2 drum Igland remotely controlled winch and a frame-mounted Patu log loader. The trees and brush are felled manually and whole trees and bunches of smaller trees are winched to the roadside or to trails. Merchantable logs are removed and the unmerchantable limbs, tops brush, and small trees are piled with the grapple loader for later burning. Large slash piles can result at the road or trailside for burning or transport from the site.

An experienced timber faller and tractor/winch/loader operator are required for this system. The system works well from the roadside or on terrain less than 20 percent.

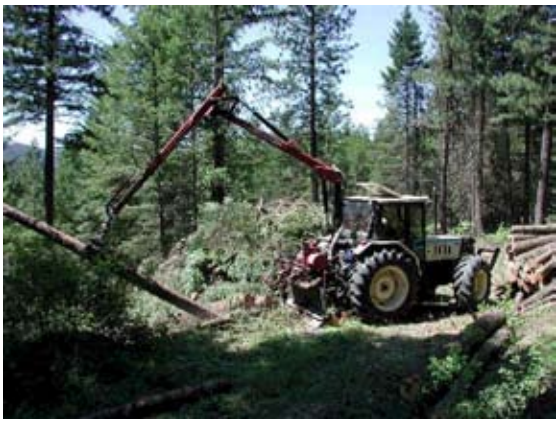

Figure 4—Modified farm tractor with log loader and remote-controlled winch.

Advantages:

- Minimal soil disturbance in the forest.
- Capable of handling sawtimber up to 20 inches.

2.415 Skid Steer (Bobcat, etc)

Similar to the all-season vehicle, the machine shown in the photo was used to load post-and-pole material onto a flatbed truck. These kinds of machines also can include cutting attachments.

Figure 5—Skid steer.

Advantages:

Small and multifunctional.

- Best applied in situations where small and flat woodlots need treatment, for example in FireSafe-type fuels-treatment projects in urban-interface areas.

2.416 Unique One-of-a-Kind Equipment

Here are some examples of how local entrepreneurs developed their own equipment to accomplish fuels reduction treatments in an economical manner.

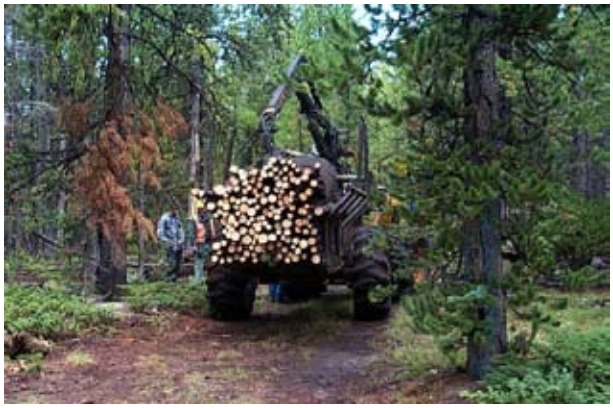

Figure 6—Home-built forwarder.

Advantages:

- It's inexpensive.
- Effective method to move larger than light-duty truck loads of material to collection point.

Here's an example of a small home-built skyline system that also loads the yarded material (posts and poles in this case) onto the flatbed truck. This set-up is capable of yarding material as far as 400 feet.

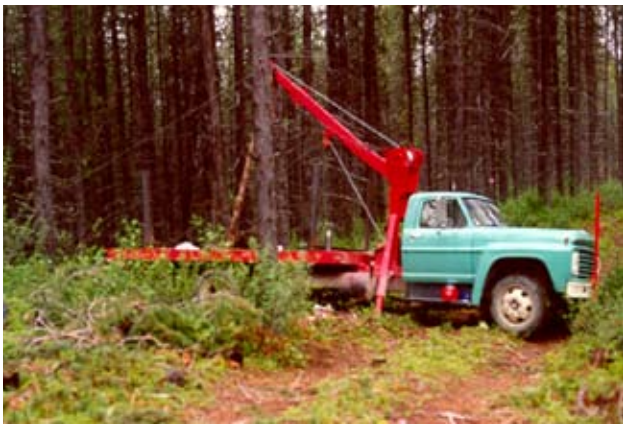

Figure 7—Home-built skyline-swing loader - hauler.

Advantages:

- Another relatively cheap system.
- Not only yards material, but also loads and hauls it.

2.417 Forwarders

Moving into larger-scale treatment areas requires larger and more expensive equipment. For those projects it may be necessary to use some form of cut-to-length harvesting system (either mechanical or with hand-operated chainsaws). Forwarders offer a way to yard material to a landing without dragging the logs on the ground.

Figure 8—Forwarder.

Advantages:

- Can carry approximately 14 tons of logs at a time, without dragging on ground.
- Low ground disturbance, especially when operating on slash mats.
- Can operate on slopes up to about 40 percent if kept from side-hilling. Side-hill travel must not exceed 8- to 10-percent slopes due to tip-over risk. Excavated skid trails should be used when slopes exceed this level.
- Can also load log trucks, eliminating the need for another piece of equipment.

2.418 Grapple skidder

Another way to efficiently yard material is by using grapple skidders. The photo shows small-diameter sawlogs processed in the woods being yarded through a treatment area that has been thinned to a spacing of approximately 20 feet.

Advantages:

- Are particularly effective when small diameter material has been gathered into bunches.
- Can be used to move slash or loose material short distances.

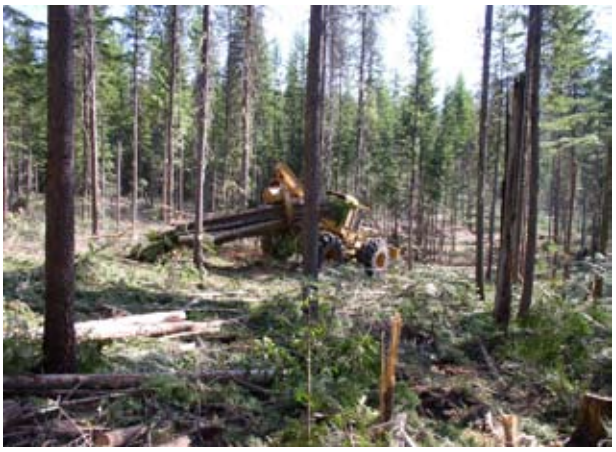

Figure 9—Grapple skidder.

2.419 Small-scale harvester

If the work is in timber stands that don't include removal of much large timber (roughly in the 4- to 18-inch dbh range), small-scale harvesters could be utilized. Several manufacturers currently offer this type of machine.

Figure 10—Small harvester.

Advantages:

- These machines normally weigh about half as much, are more nimble yet can match the production level and work on similarly steep slopes (50-percent plus) as their full-sized cousins, and are cheaper to purchase.
- Very useful for large-scale treatment areas consisting of mostly small-diameter timber stands.
- Can cut the trees to desired length, processing them in the woods rather than at a landing.

2.4110 Small-scale Feller-Bunchers

Similar to the small-scale harvesters, small-scale feller-bunchers can be highly useful for treating timber stands consisting of small-diameter trees.

Advantages:

- Speed.
- Has a little more tree-felling directional control than harvesters.
- Usually have capability to grasp multiple stems while cutting.
- Works well as giant "weed whacker," meaning they can slash unmerchantable material as they are also cutting down and setting aside the useable trees.

Figure 11—Small-scale feller-bunchers.

2.4111 Standard-sized Feller-Bunchers

These machines currently are being widely used for more traditional sawlog-harvesting treatments. They also are useful for small-diameter and biomass timber-stand treatments, but they are best used in timber stands that have at least a 30- to 50-percent "traditional" sawlog component to be removed.

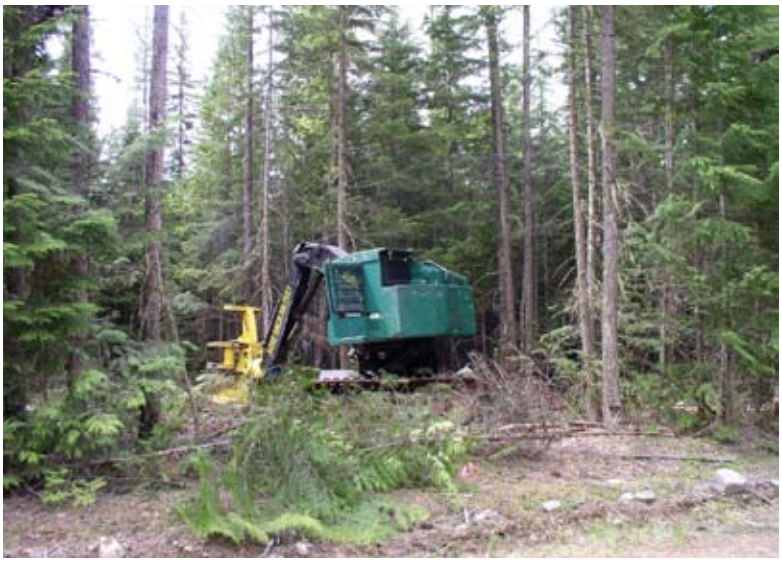

Figure 12—Standard-sized feller bunchers.

Advantages:

- Well suited for working in dense multidiameter-class timber stands.
- Very economical for treatments in "doghair thickets" where hand-operated chainsawing would be nearly impossible.

- Many machines are available for purchase on the used market—so it could be one of the most economical machines to use in low-value timber stands if it can meet your other resource needs.
- Effective at performing progressive slashing of unmerchantable material while also harvesting merchantable material.
- Can operate on fairly steep (50 to 55 percent) slopes and can be used in combination with skyline or helicopter yarding.

2.4112 Standard-sized Harvesters

These machines currently are being used widely for more traditional sawlog-harvesting treatments. They also are useful for small-diameter and biomass timber-stand treatments, but they are best used in timber stands that have at least a 30- to 50-percent "traditional" sawlog component to be removed. Because these machines process trees into desired log lengths in the woods, they are used best in combination with either grapple skidders or forwarders.

Figure 13—Standard-size harvester.

Advantages:

- Well suited for working in dense multidiameter-class timber stands.
- Many machines are available for purchase on the used market, so it could be one of the most economical machines to use in low-value timber stands if it can meet other resource needs.
- Can operate on fairly steep slopes (50 to 55 percent) and can be used in combination with skyline.

2.4113 Small-scale Skyline Yarders

Small-scale skyline yarders can come in handy on steep (40-percent or greater) terrain and include portable tow-behind models as well as tracked- or wheeled-mounted self-propelled models, some of which can even be operated off-road (i.e., as ridge-runners).

Figure 14. Towable skyline yarder. (photo courtesy of Koller)

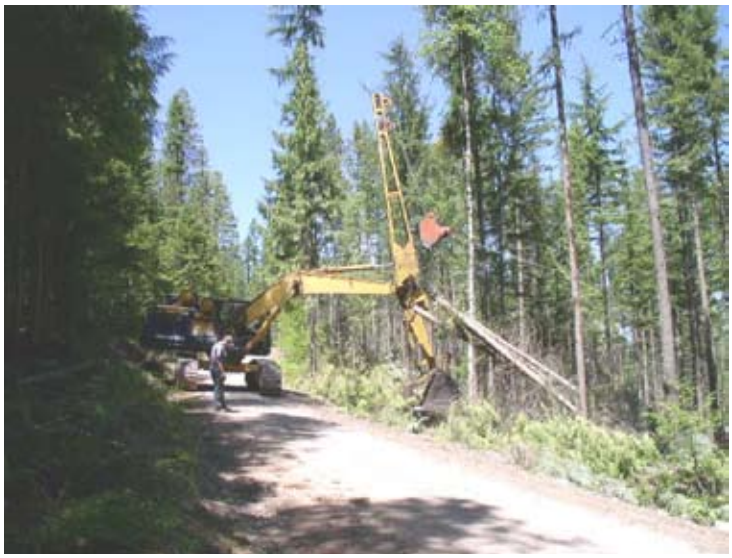

Figure 15. "Excaliner." (Excavator-mounted skyline yarder.)

Advantages:

- Can yard material from slopes that are too steep or sensitive for ground-based equipment use.
- Normally can retrieve material as far as 1,200 to 2,000 feet off roads or ridges.

- Excavator-mounted versions are multipurpose. They can be converted to backhoe, harvester, etc. relatively easily, saving on the need for additional logging equipment.
- Uses bucket for brace, which is a good thing if you're working in small-diameter timber stands that lack large trees needed for guyline anchors for other skyline systems.

2.4114 Helicopter

Although it is rarely economical to remove small-diameter and biomass material from a treatment area by helicopter, it has been used in certain parts of the country, so it should not be ruled out. When used in combination with a feller-buncher so that "bunches" of small-diameter trees can be flown in a single trip, the economics may allow for use of this system when less expensive systems just will not work, or when road building is not an option.

Figure 16—K-Max helicopter.

Advantages:

- Can retrieve material from areas that are hard to access or on steep slopes.
- An alternative to costly road and bridge building.

2.42 Chipping Equipment

Chipping small trees and slash uses a system that can bring in as much tonnage of biomass with as few transports as possible in order to maximize economic efficiency. When converting biomass to electricity or transportation fuels, at some stage of the process small trees, tree-tops, and limbs have to be converted to chips. The big question that remains unanswered is at what stage of the process is it most economically efficient?

The options for removing small-diameter trees and biomass from a treatment area in chip form are limited. It can be accomplished two ways: chipped in the woods and transported out to road systems or chipped at landings after being yarded in as whole trees. When considering in-woods chipping, we are basically entering uncharted waters as far as these technologies being used for Federal land-management practices is concerned. Ideas are being offered on how some equipment is being used currently in other countries, is being manufactured for purposes other than biomass utilization, or some prototype equipment may be used in our quest to utilize biomass.

2.421 In-woods Chipping Equipment

2.4211 Tracked Chipper

A mobile off-road chipping machine like this looks like it might have some potential, but it needs a tow-behind trailer of some kind to catch the chips.

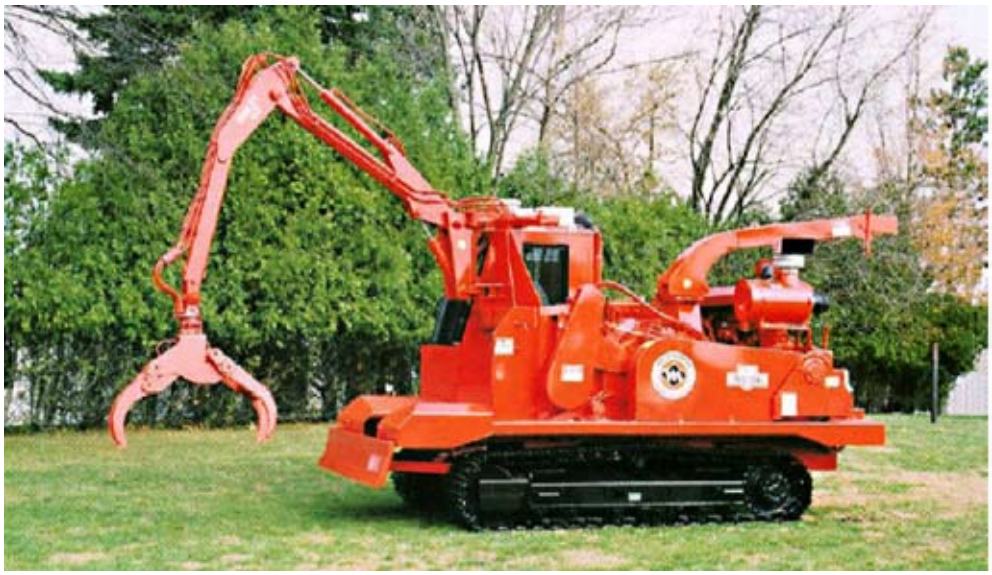

Figure 17—Morbark Model 20/36 Track Chipper. (Photo courtesy of Morbark, Inc.)

2.4212 Terrain Chipper

The photos shown here are designs of machines that are untested in the United States. These kinds of machine have the capability to fell trees and then chip them in the woods rather than cut them into logs. The chips are blown into a detachable chip container.

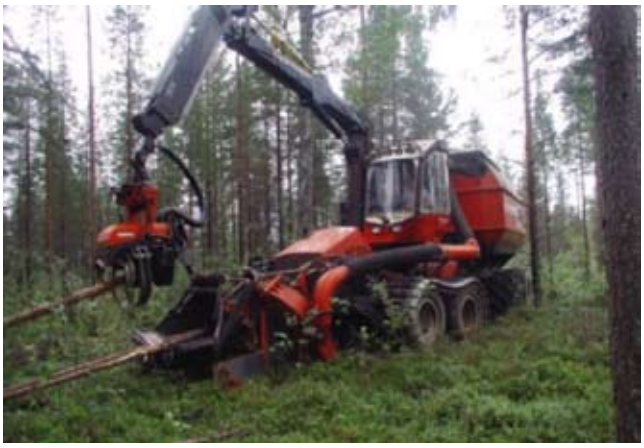

Figure 18—Valmet 801c BioEnergy Chipper. (Photo courtesy of Valmet.)

Figure 19—In-woods chipper and chip container transporter. (Photo courtesy of Karsten Frisk, Danish National Forest and Nature Agency.)

2.422 Chipping at Landings

Chipping at landings is a common practice on private lands in the United States and other countries, compared to in-woods chipping. Chipping slashed material brought into landings occurs either as a result of forestry or from residential development. Chippers come in all shapes and sizes (and price ranges). When it comes to chipping logging residues at landing sites, the challenge is not in making the current technology work to meet Federal land management needs, but rather making it work economically. Our challenge is to find the right

combination of chipping and transportation equipment used to deliver the chips to the nearest facility in the most economically feasible manner. Chip transportation equipment options are discussed in the next section.

Figure 20—Dual chipping operation, flail chipper on left making "clean" pulp chips and tub grinder on right making "dirty" fuel chips. (Photo courtesy of Morbark, Inc.)

2.43 Bundling and Loose Material Handling Equipment

Removing logging residues as bundles and as loose material has been ongoing in Scandinavian countries for some time, but not to any production level in the United States.

2.431 Bundling

Bundling involves converting loose logging slash into compressed bundles (i.e., slash logs) that can be cut to desired lengths and held together with multiple wraps of twine.

Limited testing of the bundling technology was conducted recently in the United States and Canada, with early indications that the technology may be economically and operationally feasible for Federal land management purposes. At this time, only one bundler has been sold in North America to a private logging contractor in Michigan. However, due to insufficient markets at this time (2007) the machine is not being operated. The Southern Research Station has published a report on the testing of the Timberjack 1490D slash bundler on the Web and also has a report available on CD. The report can be viewed at: www.fs.fed.us/forestmanagement/WoodyBiomassUtilization/products/bundling/documents/bundler_report_final.pdf). File does not open (swc)

Figure 21—Timberjack 1490D Slash Bundler, first test site in North America, Bonners Ferry Ranger District, Idaho Panhandle National Forest (NF), 2003.

Figure 22—Forwarding bundles to landing. (Bonners Ferry Ranger District, Idaho Panhandle NF, 2003.)

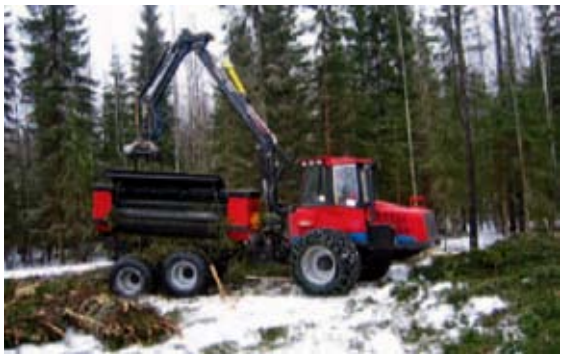

Figure 23—Another manufacturers' version of a slash bundling machine. This one quickly converts to a forwarder. (Photo courtesy of Valmet.)

Advantages:

- Provides a way to bring loose slash into landings in a compressed form, allowing for more tonnage to be brought into a central location more economically for transporting to a biomass or chipping facility.
- Provides for prolonged storage benefits at biomass facilities compared to chips that may be more susceptible to spontaneous combustion.

2.432 Loose Material Handling Equipment

Handling loose slash is probably the least economical way to gather up logging residue, except in small-scale situations. There is a variety of equipment to retrieve loose biomass. The options for removing biomass from a treatment area in loose form are limited. Similar to chip-form removals, loose-material removal can be accomplished two ways: gathered up in the woods and transported out to road systems where it can be chipped onsite or transported to a chipping facility, or if the material is already at landings in large-processor piles from whole-tree yarding, it can then be loaded into transport vehicles and taken to chipping facilities. The photos below show a few examples.

2.4321 In-woods Loose Material Equipment

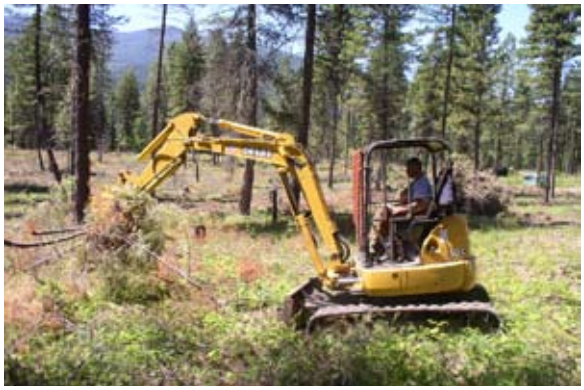

Figure 24—Mini-excavator normally used for piling slash could toss biomass in off-road-capable trailer.

Figure 25—Load-compacting HavuHukka forwarder for transporting logging residues from stump to satellite terminals. (Photo courtesy of Vapo.)

2.4322 Loose Material Handling at Roadsides and Landings

Figure 26—Crane loading loose landing slash pile material into large "dumpster-style" container. (Photo courtesy of Craig Rawlings, Montana Community Development Center.)

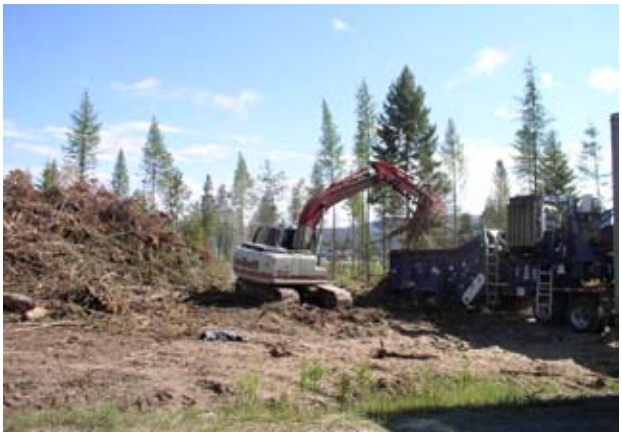

Figure 27—Small excavator used to load loose landing slash pile into a horizontal grinder. (Bonners Ferry, Idaho, 2006).

Figure 28—Loader on right of photo used to retrieve loose material from nearby slash piles and feed material to the excavator. (Bonners Ferry, Idaho, 2006).

2.5 Transportation Technologies

Similar to the previous section, some of the current and prototype transportation equipment that may be available, and how these various types of technology can be practically applied will be discussed later. The discussion does not include an exhaustive listing of technology, but rather a sampling of what is available or in prototype stage. The technology is based on three forms of transporting small-diameter trees and other woody biomass from treatment areas: whole-tree and log-length, chipped or as loose material, and bundled. Rules of thumb will be provided for determining the best combination of equipment to use.

2.51 Whole-tree and Log-length Transport

The decision to transport small trees in tree-length or log form from a treatment area is dictated by the harvest system being used as well as the form the processing facility (i.e., sawmill or chipmill for instance) purchasing the material wants it delivered. A wide variety of transport vehicles exist that are designed to meet local or regional needs for maneuverability and load capacity. The photos below show just a few versions available across the country, some of which are set up for hauling tree-length and others that carry "short-logs," and still others that carry "bolts."

Figure 29—A load of whole-tree roundwood "whips" at a post-and-pole business in Montana. (Photo courtesy of Karen Kovatch, Roundwood West Corp., Seeley Lake, MT.)

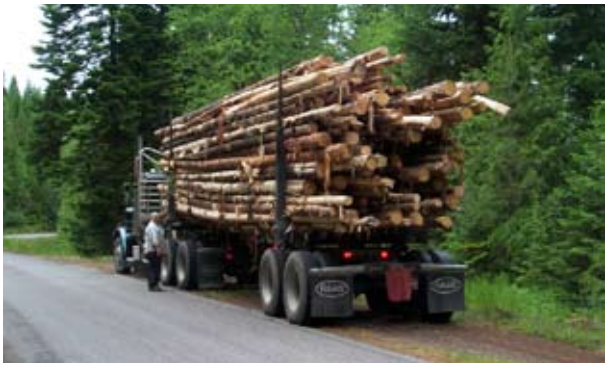

Figure 30—Long-log (approximately 25- to 35-foot logs) truckload of smallwood. (Bonners Ferry Ranger District, Idaho).

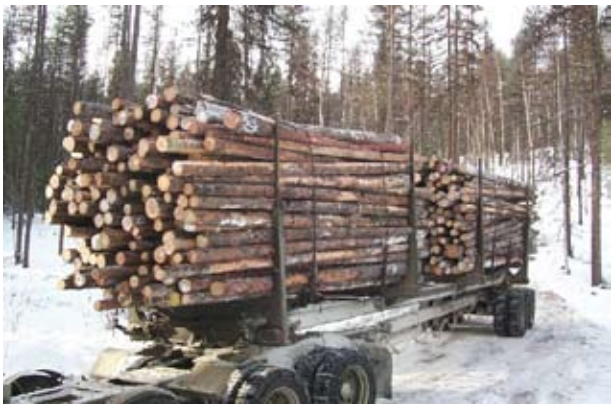

Figure 31—Short-log (18 foot) load of small-diameter sawlogs on double bunks. (Bonners Ferry Ranger District, Idaho.)

Figure 32—Lake States pulp-log load in "bolt" form. (Bob Rummer, USFS).

2.52 Chip and Loose Material Transport

While transportation of tree- and log-length material off harvest areas is relatively easy and economical to accomplish, transporting biomass off of

harvest areas in chip- or loose-form creates some special challenges for land managers. Two of the largest challenges are providing suitable access to typical chip vans, and when dealing with low-standard forest roads not suitable for normal chip vans, being able to find suitable chip or loose material-hauling vehicles that can haul an economical amount of low-value biomass.

The photos below show a typical chip van being used in easy access areas and also other designs of chip and loose material transport vehicles, most of which are not yet being used on a regular basis on Federal land-management projects.

Figure 33—Standard chip van with a load capacity of about 30 green tons of chips. The vehicle is on a flat gravel road on private property being developed for residential construction. Notice low ground clearance and long length of chip van, which restricts its use on low standard forest roads. Slash piles are being chipped in a horizontal grinder and chips are being fed directly into van (Bonners Ferry, Idaho).

Figure 34—Roll-off container vehicle. Prototype stage, but transport vehicles like this may be economically feasible to use on low-standard roads when high ground clearance and maneuverable vehicles are required to gain access to biomass. (Photo courtesy of Craig Rawlings, Montana Community Development Corp. [MCDC])

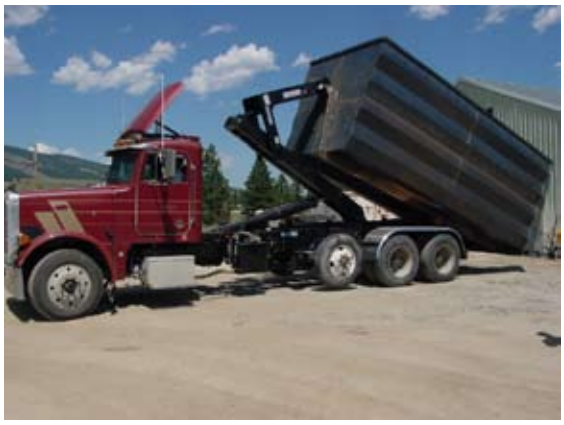

Figure 35—Another prototype version of a roll-off container vehicle. This one can transport two empty containers in a "nested" configuration. (Photo courtesy of Craig Rawlings, MCDC.)

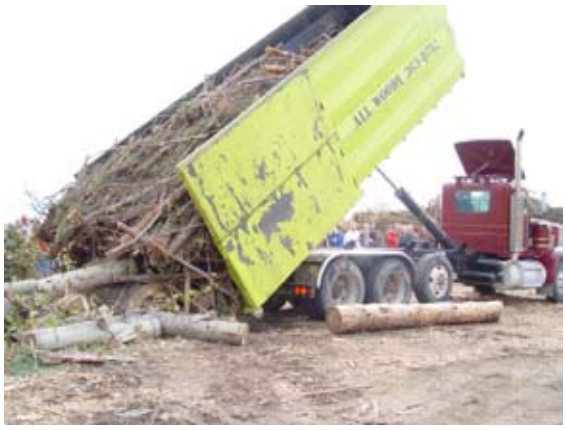

Figure 36—The roll-off container has a dumping feature and can be used to transport chips or loose slash. Economics would dictate short haul distances (Photo courtesy of Dave Atkins, USFS).

2.53 Bundle Transport

Technology for "bundling" loose slash into compressed, cut-to-length slash logs that are held together with multiple wraps of baling twine is common in Scandinavian countries, but currently only one commercially owned bundler exists in the United States. Once the bundles have been forwarded to a central roadside landing area, transport vehicles similar to those used for short-log hauling can be used to transport bundles, but the bunks need to be spaced to accommodate preferred bundled lengths of around 10 to 12 feet.

Figure 37—Loading decked bundles in Finland. (John Deere/Timberjack photo.)

2.54 Rules of Thumb To Select Best Transport Methods

Within the confines of the land managers' road access and contractual requirements, the logging contractor determines the most economical transport method to use for hauling forest products, whether it's tree-length, log-length, chipped, loose slash, or bundled. Land managers must collaborate with potential purchasers of biomass during the project planning phase in order to arrive at mutually feasible operational methods.

NEPA—CHOOSE THE RIGHT TOOL

Why weren't environmental analysis procedures under NEPA discussed earlier? The previous sections discussed the process of developing a local SDU-biomass project or program similar to the fire suppression tactic of sizing up a fire, but in this case the discussion is a fuels-reduction or restoration project rather than a wildfire.

So, by going through this size-up process for a SDU-biomass project, the reader should have an understanding on the project's size and the resources available (or what's still needed) to accomplish the project or program. Now, the question is how to integrate the NEPA tools available to accomplish the mission.

The tools currently available in our NEPA toolbox provide an opportunity to integrate short-term with long-term project planning strategies. This section discusses and gives examples of how to use the various NEPA authorities to get a SDU-biomass program started and keep it going.

3.1 Questions To Contemplate

Upon completion of the project or program size-up process, answering these questions is easy:

- Based on the vegetative composition and infrastructural resource availability or potential within the management area, will the program best be implemented as a long-term small-scale (i.e., less than 1,000 acres per year) or large-scale program, or both?
- If committing to a long-term small-scale program, does it make sense to plan for accomplishing fuels reduction and restoration treatments over large-scale treatment areas, or does the management area consist of only small-scale parcels of vegetation needing treatment?
- If committing to a long-term large-scale program, does it make sense also to conduct short-term plans for accomplishing fuels reduction and restoration treatments on small-scale treatment areas while also planning for large-scale projects?
- Is there an existing forest products infrastructure in communities within the zone of influence that needs to be sustained in the short-term?
- What is the budget and personnel requirement to implement either small-scale or large-scale projects?

With the answers to these questions, the next step is to select the right NEPA project-planning tools to accomplish the project(s). Sections 3.2 through 3.5 discuss the available NEPA authorities and give examples of their potential application.

Refer to the NEPA Handbook link for details on each category being discussed http://fsweb.wo.fs.fed.us/directives/fsh/1909.15/

3.2 Potential Projects Under Authority of FSH 1909.15, Section 31.12

Under this authority, fuels reduction, hazard-tree removal, visual enhancement, public safety, and recreational-site maintenance goals can be accomplished on a short-term and small-scale basis.

For example, if a district office or outlying work stations are sited where there is a concern about overstocked or unhealthy trees near structures, utilize Section 31.12 (3) to conduct either a commercial thinning or salvage sale, service-contract thinning with product removal through salvage rights, or force-account thinning and use the available material for other administrative purposes, such as fence building, providing firewood to nearby campgrounds, etc.

If there are similar tree conditions but located at campgrounds, day use areas, or even hiking trails (trailheads), utilize the authority under Section 31.12 (4 and 5) instead.

Another potential use of this authority could be to conduct roadside clearing of brush and trees along cut-and-fill slopes and remove hazardous trees that could fall on the roads. Doing this work would improve public safety, including improved evacuation-route conditions during wildfires. It also would facilitate snow plowing by providing room to plow snow off the roadsides, perhaps on roads used in winter months to access recreational ski or snowmobile trails. In this case, Section 31.12 (4) would be used.

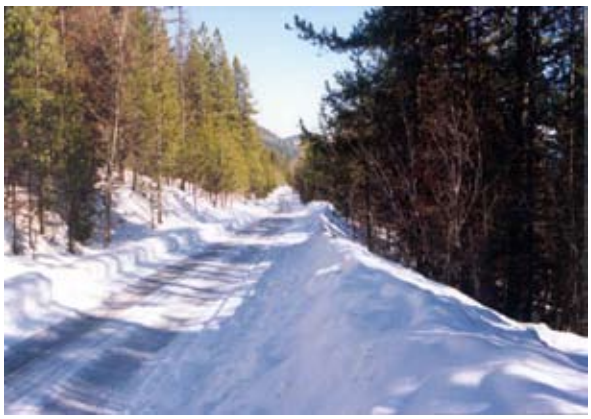

Figure 38—Problem, a Forest Service road used in the winter season to access a Park and Ski cross-country ski trail and parking area, with no room to "wing" snow off road and provide safe turnouts for vehicles. (Bonners Ferry RD, Idaho).

Figure 39—Solution, remove brush and trees using Section 31.12 (4) and a commercial timber sale contract to make room for snow removal. Treatment is taking place on the RIGHT side of the photo!

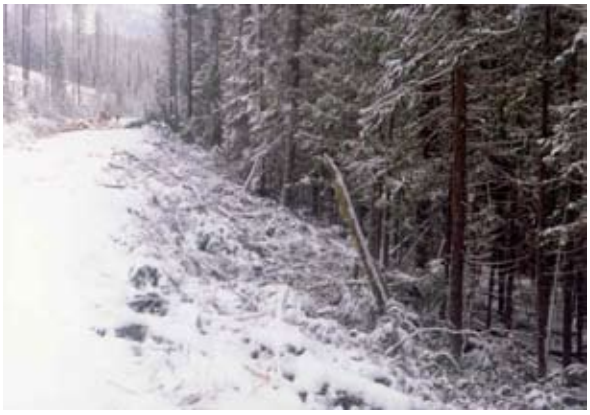

Figure 40—Products removed, slashing not completed. Snow plowing and public safety vastly improved following this treatment. (Bonners Ferry RD, Idaho).

3.3 Potential Projects Under Authority of FSH 1909.15, Section 31.2

Section 31.2 of the NEPA Handbook provides for a variety of small-scale project planning tools.

There are many possible ways to integrate all the various activities that fall under these categories of actions into a small-scale SDU-biomass program. Whether the categorical exclusions are used as a sole means to drive the program, or as a gap-filler while planning large-scale projects or, more likely, as a component of a fully integrated NEPA strategy, launching projects under these categories is a good way to get the supply chain moving, because the analysis process is much more streamlined and less time-consuming than conducting large-scale environmental assessments and environmental impact statements.

Also, when working on fuels-reduction projects within many wildland urban interface areas, land managers are likely to be dealing with small parcels of Federal land as opposed to vast continuous forest and brush lands. Under these conditions it makes perfect sense to utilize these categories of actions to accomplish the treatments.

Figure 41—Here's an example of a small hazardous fuels-reduction project (about 90 acres) alongside a county road and adjacent to private residences. The project was authorized using the Healthy Forest Initiative categorical exclusion under FSH 1909.15 Section 31.2 (10). This photo shows part of the project before treatment.

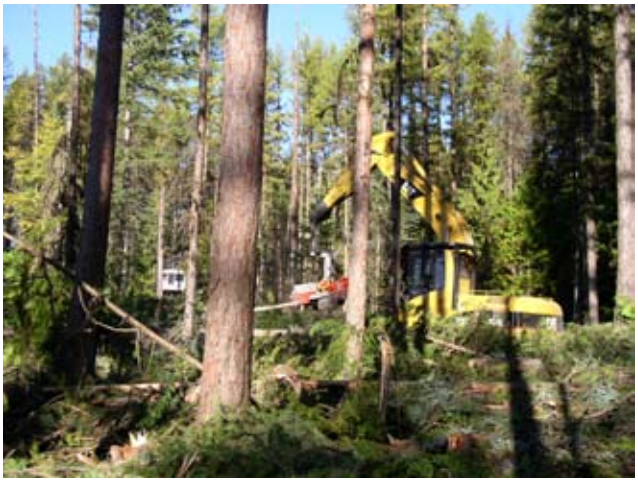

Figure 42—Same project area during fuels-reduction treatment. Pictured here is a feller-buncher in the background cutting trees and an in-the-woods processor in the foreground that is processing short logs down to a 4-inch top diameter. The logs are then skidded out using a grapple skidder.

Figure 43—Same photo point after fuels-reduction treatment. Public scoping commenced in September 2003, Decision Memo was signed April 2004, the sale was sold July 2004, and completed in May 2005. This project was initiated at the request of an adjacent landowner due to fire concerns and the NEPA and sale prep work was partially funded using Craig/Wyden money appropriated through a local Resource Advisory Committee. (Bonners Ferry RD, Idaho)

3.4 Potential Projects Under Authority of 36 CFR Part 215

There is good existing guidance on how to prepare environmental assessments and environmental impact statements, but relatively little guidance about how to use them strategically as a tool to accomplish land management objectives, especially when it concerns SDU-biomass focused projects.

When planning projects that fall under the authorities of 36 CFR Part 215, but that exceed the limitations for categorically excluded activities, strive to maximize the usefulness of environmental assessments or impact statements by including as many acres of small-diameter timber stands that need fuels reduction, restoration, or other vegetative treatments in the project area as possible.

Section 2.15 of this guide addressed project integration with the needs of timber stand improvement, fuels, wildlife, watershed, fisheries, and other resource shops in the working area. Oftentimes, special vegetation treatments proposed separately from a large project may not be viable economically or may not be considered a priority project given limited budgets.

Including special treatment areas within a large-scale project will provide an opportunity to make those projects viable, either by being washed in with other higher-value treatment areas, by generating trust funds that can then be used to fund the treatment, or by using an IRTC or IRSC in trading goods for the services of treating those areas.

Even if there are no current markets for a particular forest product, getting NEPA coverage for a treatment area in advance of it becoming economically viable allows a quick response to an emerging markets. Lacking preapproved new market development project areas, it's impossible to exploit a new market if it takes a year or more to provide a project area.

Also, even if it is determined that the local SDU-biomass program will entail long-term but small-scale operations, roping in large-scale treatment areas under one analysis document will not only accomplish landscape-scale treatments, it also will help demonstrate efficient planning and demonstrate a long-term commitment to keep entrepreneurial partners and their financial backers supplied with the desired forest product(s).

Using a nice mix of multiple NEPA documents, the Apache-Sitgreaves' White Mountain Stewardship Project is a good example of large-scale planning to accomplish long-term but small-scale SDU-biomass projects. For more details on their planning strategy, visit their Web site at:
http://www.fs.fed.us/forestmanagement/projects/stewardship/results/documents/WhiteMountainStewardshipSW2004_web.pdf

3.5 Potential Projects Under Authority of 36 CFR Part 218 (HFRA)

The Healthy Forests Restoration Act (HFRA) of 2003 (P.L. 108-148) contains many provisions to expedite hazardous-fuel reduction and forest-restoration projects on specific types of Federal land that are at risk of wildland fire or insect and disease epidemics. The HFRA helps rural communities, States, Tribes, and landowners restore healthy forest and rangeland conditions on their lands.

Except for some unique limitations and requirements, using the HFRA authorities in your NEPA planning strategy to implement SDU-biomass projects would be similar to that used under Part 215 procedures. Refer to the HFI-HFRA Web site and field guide for more details at:
http://fsweb.wo.fs.fed.us/hfra/

And finally, here's a word about NEPA project planning strategies that take into consideration project location selection as it relates to controversy. If there is a choice between starting up a project in an area that includes lots of hot button issues versus a location with low complexity and low potential for controversy, choose the less controversial area(s) first.

CONTRACT AND PERMIT STRATEGIES

Congratulations! It is assumed that the NEPA strategy is implemented and there is a project area to begin operations in. What contract or permit strategy is there to use.

Once again, using fire suppression terminology, the initial project size-up should be completed at this point and therefore the answers to the questions are already known:

- Can the project be accomplished entirely through the sale of forest products?
- If the project doesn't have enough forest product value to be accomplished through a commercial forest product sale, is there enough value to perhaps use an IRTC or IRSC in trading goods (i.e., forest products) for the services of a contractor to complete the treatment, perhaps while also supplementing the traded goods with additional money?
- If the project is not economical even with trading the available goods for services and supplement with additional funding, is there an opportunity to let the public make use of the available products for their personal use (i.e., firewood, posts and poles, Christmas trees, etc.)?
- Is the only way to accomplish the project is by paying a contractor to do it?

This section discusses the contracting and permitting instruments currently available to land managers and how to use them in the overall strategy to accomplish SDU-biomass projects. This section includes Free-Use permits, including Administrative Free Use; Personal-Use Permits; Service Contracts; Commercial Timber Sale Contracts; and Stewardship Contracts. The section also will discuss "rules of thumb" for selecting the best instrument and considerations for transitioning values of products.

For full details on the various contracting tools, visit the appropriate links to the Forest Service Handbooks and Manuals:
http://fsweb.wo.fs.fed.us/directives/fsm/2400/

Figures 44 and 45—Typical timber sale landing and grapple piles, ready to be burned, or perhaps in situations like this we would be justified to use the administrative free use authorities to dispose of this material for biomass energy (donate to a local Fuels for Schools project for example)?

4.1 Free-Use Permits (Permit Form 2400-8)

Please refer to FSM 2462 (2409.18—Timber Sale Preparation Handbook, Chapter 80—Uses of Timber other than Commerical Timber Sales) and 36 CFR 223.5 through 223.11 for specific situations where free use may be granted. See FSM 2404.28 for delegation of authority.

4.2 Personal-Use Permits (Permit Form 2400-1)

Here are a few suggestions on what kinds of SDU-biomass work can be accomplish utilizing the personal-use permit authority:

It is possible to direct personal-use charge-permit activities into recently completed timber-sale areas in order try to utilize posts, poles, firewood, and other forest products prior to burning up the logging residue. This is a time when coordination between small-sales special-forest products program managers, sale administrators, and fuels-treatment personnel comes in handy.

Another example would be if commercial markets for posts-and-poles are low or nonexistent in the area but demand is high for personal uses of posts-and-poles (i.e., in ranching communities perhaps), setting up a special personal use post-and-pole harvesting area might be a good idea.

4.3 Service Contracts

Using service contracts and appropriated funding to accomplish fuels-reduction and restoration treatments may still provide an opportunity for SDU-biomass utilization.

If existing markets cannot pay for the cost of removal of SDU-biomass material during vegetation treatment projects such as traditional precommercial-thinning treatments or during post-harvest brush-disposal treatments, there may be opportunities to increase utilization when implementing these types of service contracts.

For example, precommercial-thinning contracts could require transport and piling or decking of the cut trees at a location that could be accessible to secondary salvagers such as biomass facility operators who may wish to bring in equipment to chip the piled biomass and transport it to their facility. Given appropriate market availability, it's possible to consider contractually requiring that the biomass be transported off the national forest.

4.4 Timber Sale Contracts (FS-2400-3(S,T,P), FS-2400-4, 2400-6(T), FS-2400-2)

Chapter 53 of Forest Service Handbook 2409.18 provides the best reference source to determine which of these contract instruments would be authorized for use to accomplish a particular SDU-biomass project.

The link to this handbook direction is
http://fsweb.wo.fs.fed.us/directives/fsh/2409.18/

Excerpted below is Exhibit 01 from the Forest Service Handbook, the Contract/Permit Use Matrix.

53 - Exhibit 01

Contract/Permit Use Matrix

Type of Use	CONTRACTS			PERMITS	
	Complex, Large Sales	Simple, Small Sales	Simple, Low-Value	Charge	Free Use
SalesContract Form FS-	2400-6 2400-6T	2400-3S 2400-3T 2400-3P	2400-4	2400-1	2400-8
Use for Complex Sales [1/]	Yes	No	No	No	No
Use for Premeasured Sales	Yes	2400-3T	Yes	Yes	Yes
Use for Scaled Sales	Yes	2400-3S	No	No	No
Use Primarily for Timber Sales for Standing Trees or Log Products	Yes	2400-3S(T)	Yes	No [3/]	No [3/]
Use Primarily for Charge for Special Forest Products	No	2400-3P	No	Yes [17/]	No
Use Primarily for Free Use	No	No	No	No	Yes [18/]
Use for Timber Settlement	Yes	Yes	Yes	No	No
Use for Administrative Free Use	Yes	Yes	Yes	No	Yes
Use for Convertible or Non-Convertible Forest Products	No [19/]	Yes	Yes	Yes	Yes
Maximum Period of Contract or Permit	10 Years	1 Year [23/]	1 Year	1 Year	1 Year
Maximum Advertised Product Value	No Limit	No Limit [22/]	$10,000	$ 0	$ 0
Maximum Direct Sale Product Value	$10,000	$10,000	$10,000	$300	$20 [9/]
Maximum Contract Volume	No Limit	2000 CCF	NA [14/]	NA [14/]	NA [10/]
No. of Payment Units or Subdivisions	No Limit	No Limit	1	1	NA
Sales Advertised	Yes [12/]	Yes [12/]	Yes [12/]	No	No
Direct Sales Permitted [2/]	Yes [12/]	Yes [12/]	Yes [12/]	Yes	No
Special Requirements Allowed	Yes	Yes	Yes [4/]	Yes [4/]	Yes [4/]
Non-Recurring Special Provisions or Requirements Allowed	Yes	Yes	Yes [4/]	Yes [4/]	Yes [4/]

Contract/Permit Use Matrix—*continued*

Type of Use	CONTRACTS			PERMITS	
	Complex, Large Sales	Simple, Small Sales	Simple, Low-Value	Charge	Free Use
SalesContract Form FS-	2400-6 2400-6T	2400-3S 2400-3T 2400-3P	2400-4	2400-1	2400-8
Payment at Flat Rates	Yes	Yes	Yes	Yes	No
Payment at Escalated Rates [21/]	Yes	No	No	No	No
Associated Charges (Road Maintenance, Scaling, and Slash Deposits)	Yes	Yes	Yes	Yes	No
KV/SSF/BD Fund Plans Allowed	Yes	Yes	Yes [5/]	Yes [5/]	No
Payment is Refundable	Yes	Yes	Yes	No	No
Export Requirements West of 100th Meridian	Yes	Yes	Yes	No [3/]	No
Painting and Branding West of 100th Meridian	Yes	Yes	Yes	No [3/]	No
Contract Modification Allowed	Yes	Yes	Yes	NA [16/]	NA [16/]
Contract Term Extension	Yes	No	Yes [13/]	No	No
Additional Timber Allowed	Yes	Yes	Yes [7/]	No	No
Performance Bond Required	Yes	Yes	Yes [8/]	No	No
Type of Performance Bond	Any	Any	Cash [15/]	No	No
Use of Payment Guarantees	Yes	Yes	No	No	No
Periodic Payments Required	Yes	Yes	No	No	No
Downpayment Required	Yes	Yes	No	No	No
Cooperative Agreements Allowed	Yes	Yes	No	No	No
SBA Set-aside Sales	Yes	Yes	No	No	No
SSTS Set-aside Sales	Yes	Yes	No	No	No
Use of Normal Operating Seasons	Yes	Yes	No	No	No
Market-related Contract Term Addition	Yes	No	No	No	No

Contract/Permit Use Matrix—*continued*

Type of Use	CONTRACTS			PERMITS	
	Complex, Large Sales	Simple, Small Sales	Simple, Low-Value	Charge	Free Use
SalesContract Form FS-	2400-6 2400-6T	2400-3S 2400-3T 2400-3P	2400-4	2400-1	2400-8
Contract Term Adjustment	Yes	Yes	No	No	No
Timber Subject to Agreement	Yes	Yes	No	No	No
Default Damage Provisions	Yes	Yes	No	No	No
3rd Party Agreements Allowed	Yes	No	No	No	No
Use When Special Provisions Must be Added to Protect Known Heritage Resources	Yes	Yes	No	No	No
Use When Special Provisions Must be Added to Protect Habitat of Threatened, Endangered, and Sensitive Species	Yes	Yes	No	No	No
Use When Special Provisions Must be Added to Protect Cave Resource	Yes	Yes	No	No	No
Report of Timber Sale (FS-2400-17) Required	Yes	Yes	Yes [11/]	No	No
TEA Appraisal (FS-2400-17)	Yes	Yes	Yes [11/]	No	No
Timber Sale Statement of Account	Yes	Yes	No	No	No
Use of Transferred-in Purchaser Credit for Advance Deposits	Yes	No	No	No	No
Scheduled Rate Redetermination [20/]	Yes	No	No	No	No
Use of Performance Bond for Felled Timber	Yes	No	No	No	No
Tripartite or Bipartite Land Exchange Provisions	Yes	No	No	No	No
Catastrophic Damage Provisions	Yes	No	No [6/]	No	No
Specified Road Work	Yes	No	No	No	No
Temporary Road Construction	Yes	Yes	No	No	No
Incompletely Marked Timber	Yes	No	No	No	No

[1/] Indicators of complex sales include, but are not limited to:

a. Sales requiring specialized logging equipment such as a cable or helicopter,

b. Elaborate requirements for protection of threatened and endangered species or cultural resources, or

c. Elaborate or intricate resource protection requirements.

[2/] There is a $10,000 limit to an individual per fiscal year, except for timber settlement sales.

[3/] Permits shall not be used for log products west of the 100th meridian. Use of permits for log products is optional east of the 100th meridian.

[4/] Special requirements can be listed only in the space provided for "Other Conditions." Contract Form FS-2400-4 is limited to 4 pages. Permit Forms FS-2400-1 and FS-2400-8 are limited to a total of 10 "Other Conditions."

[5/] Plans are allowed on a Contract Form FS-2400-4 or Permit Form FS-2400-1 that meet the requirements of Forest Service directives (FSM and FSH). District-wide K-V Plans for projects are not allowed. Salvage Sale Plans may be District-wide.

[6/] The mutual cancellation authority at 36 CFR 223.116 shall be used to cancel sales with catastrophic damage; or they may be mutually modified or allowed to proceed without modification.

[7/] Additional timber is allowed but should not exceed 50 percent of the original total contract product volume. The $10,000 limit to an individual per year of direct sales applies.

[8/] Performance bonds are required for Contract Form FS-2400-4 when product values are greater than or equal to $2,000 and optional for product values less than $2,000.

[9/] A maximum value of $20 in free use can be granted to individuals by district rangers ($100 for forest supervisors). See the regulations at 36 CFR 223.5 through 223.11 for other provisions.

[10/] Free use to individuals is restricted by value, except in Alaska where it is restricted by volume (36 CFR 223.5 through 223.10).

[11/] These forms are required for sales with advertised product values greater than or equal to $2,000. They are optional for sales with advertised product values less than $2,000.

[12/] All sales are advertised when competition exists or the sale value is equal to or greater than $10,000.

[13/] This contract can be extended, not to exceed a total contract term of 1 year.

[14/] The limit is based on value.

[15/] This type of preference bond can be cash or equivalent, such as bank or postal money order, personal check, credit card (where applicable), official bank check, or certified check.

[16/] The forest officer may make pen and ink changes for such items as a new permit area or vehicle information. Changes to name, address, ID, or product designation are not allowed.

[17/] Products on charge permits may be resold.

[18/] Products on free use permits may not be resold (36 CFR 261.6(f)).

[19/] This contract does not have standard or special provisions developed to sell non-convertible forest products and is not recommended.

[20/] Rate redetermination may be scheduled for sales equal to or greater than 7 years in contract length, but do not schedule rate redetermination before the end of year 5.

[21/] Except for situations that are disadvantageous to the Government, Forest Service timber sale contracts that exceed 1 year in contract length in the Western United States should provide for stumpage rate adjustment (FSM 2431.34).

[22/] For Contract Form FS-2400-3P, the maximum advertised dollar value is $100,000.

[23/] One year, except for sales of non-convertible products where 3 years is allowed.

4.41 Standard "B(T)" and Special "C(T)" Contract Provisions to Improve SDU-biomass Utilization

Some of the available timber sale contracts can include the use of Standard "B(T)", such as B(T) 3.41 and other "Special C(T)" provisions that can help improve utilization of SDU-biomass products. Directions for using these provisions can be found in FSH 2409.15, Chapter 42.14(a) and FSH 2409.18, Chapter 53.43. Refer to the following link:
http://fsweb.wo.fs.fed.us/directives/fsh/2409.18/

4.5 Stewardship Contracts and Agreements

The Forest Service and the Bureau of Land Management (BLM) received a new authority to implement stewardship contracting and agreements in the 2003 Appropriations Act (Public Law 108-7).

Direction for use of stewardship contracting is provided in Chapter 60 of FSH 2409. 19 at the following link: http://www.fs.fed.us/forestmanagement/projects/stewardship/direction/index.shtml

To differentiate what the terms "timber sale," "service contract," and "stewardship contracts" mean in the legislation and the direction:

A timber sale is the sale of commercial forest products, always with return of receipts to the U.S. Treasury.

Service contracts are contracts for services (such as precommercial thinning, trail maintenance, and fuel reduction) that are funded with appropriated dollars and do not return revenues to the U.S. Treasury.

Stewardship contracts are contracts by the Forest Service and BLM for services (such as precommercial thinning, trail maintenance, and fuel reduction) in which some of the costs may be offset by the value of vegetative material removed and may not return revenues to the U.S. Treasury. In addition, any excess receipts could be used for other stewardship contracts.

Excerpted below is a portion of the handbook direction Exhibit 01, which is the Stewardship Use Matrix:

62.1 - Exhibit 01

Stewardship Contract Use Matrix

Type of Use	CONTRACTS			
	Integrated Resource Timber Contract (IRTC) FS-2400-13 Scaled	Integrated Resource Timber Contract (IRTC) FS-2400-13T Tree Measurement	Integrated Resource Service Contract (IRSC) Scaled	Integrated Resource Service Contract (IRSC) Tree Measurement
Best Value Required	Yes	Yes	Yes	Yes
Use for Premeasured Sales	No	Yes	No	Yes
Use for Scaled Sales	Yes	No	Yes	No
Trade Goods for Services	Yes	Yes	Yes	Yes
Retain Receipts	Yes	Yes	No	No
Less than Full and Open Competition Allowed	Yes	Yes	Yes	Yes
Full NEPA compliance required	Yes	Yes	Yes	Yes
Advertise Contracts	Yes	Yes	Yes	Yes
Contracting Officer	Timber	Timber	Service	Service
Maximum Length of Original Contract	10 Years	10 Years	10 Years	10 Years
Service Contract Act (SCA) wages required	No	No	Yes [5/]	Yes [5/]
Davis-Bacon Act wages required	No	No	Construction only	Construction only
Local woods wage rates applicable	Yes	Yes	No	No
Special Requirements Allowed	Yes	Yes	Yes	Yes
Payment at Flat Rates	Yes	Yes	Yes	Yes
Payment at Escalated Rates [1/]	Yes	Yes	No	No
Associated Charges (Road Maintenance, Scaling, and Slash Deposits)	Yes	Yes	Yes	Yes
KV/SSF/BD Fund Plans Allowed	Yes	Yes	No	No

Stewardship Contract Use Matrix—*continued*

Type of Use	CONTRACTS			
	Integrated Resource Timber Contract (IRTC) FS-2400-13 Scaled	Integrated Resource Timber Contract (IRTC) FS-2400-13T Tree Measurement	Integrated Resource Service Contract (IRSC) Scaled	Integrated Resource Service Contract (IRSC) Tree Measurement
Export Requirements West of 100th Meridian	Yes	Yes	Yes	Yes
Painting and Branding West of 100th Meridian	Yes	Yes	Yes	Yes
Contract Modification Allowed	Yes	Yes	Yes	Yes
Contract Term Extension	Yes	Yes	No	No
Additional Timber Allowed	Yes	Yes	Yes	Yes
Type of Bond Security	Any [6/]	Any [6/]	Any	Any
Use of Payment Guarantees	Yes	Yes	Yes	Yes
Periodic Payments Required	No	No	No	No
Downpayment Required	No	No	No	No
Bid Guarantee	No	No	Waived	Waived
Performance Bond Required	Optional [7/]	Optional [7/]	[8/]	[8/]
Cooperative Agreements Allowed	Yes	Yes	Yes	Yes
SBA Set-aside Sales	Yes [9/]	Yes [9/]	Yes	Yes
SSTS Set-aside Sales	Yes [10/]	Yes [10/]	No	No
Normal Operating Season for product removal	Yes	Yes	No	No
Normal Operating Season for completion of service work [3/]	Yes	Yes	No	No
SBA Road Option	Yes	Yes	No	No
Reimbursement of Bond Premium	Yes	Yes	Yes	Yes
Periodic Adjustment of Cost of Service Work	Yes	Yes	Yes	Yes

Stewardship Contract Use Matrix—*continued*

Type of Use	CONTRACTS			
	Integrated Resource Timber Contract (IRTC) FS-2400-13 Scaled	Integrated Resource Timber Contract (IRTC) FS-2400-13T Tree Measurement	Integrated Resource Service Contract (IRSC) Scaled	Integrated Resource Service Contract (IRSC) Tree Measurement
Market-Related Contract Term Addition	Yes	Yes	No	No
Contract Term Adjustment	Yes	Yes	No	No
Timber Subject to Agreement	Yes	Yes	No	No
Default Damage Provisions	Yes	Yes	No	No
3rd Party Agreements Allowed	Yes	Yes	Yes	Yes
Use When Special Provisions Must be Added to Protect Known Heritage Resources	Yes	Yes	Yes	Yes
Use When Special Provisions Must be Added to Protect Habitat of Threatened, Endangered, and Sensitive Species	Yes	Yes	Yes	Yes
Use When Special Provisions Must be Added to Protect Cave Resource	Yes	Yes	Yes	Yes
Report side of the FS-2400-17 [4/]	Yes	Yes	No	No
TEA Appraisal Summary (FS-2400-17)	Yes	Yes	Yes	Yes
TSA Statement of Account	Yes	Yes	Yes	Yes
Use of Transferred-in Purchaser Credit for Advance Deposits	No	No	No	No
Scheduled Rate Redetermination [2/]	Yes	Yes	No	No
Use of Performance Bond for Felled Timber	Yes	Yes	Yes	Yes
Tripartite or Bipartite Land Exchange Provisions	Yes	Yes	No	No
Catastrophic Damage Provisions	Yes	Yes	No	No

Stewardship Contract Use Matrix—*continued*

Type of Use	CONTRACTS			
	Integrated Resource Timber Contract (IRTC) FS-2400-13 Scaled	Integrated Resource Timber Contract (IRTC) FS-2400-13T Tree Measurement	Integrated Resource Service Contract (IRSC) Scaled	Integrated Resource Service Contract (IRSC) Tree Measurement
Specified Road Work	Yes	Yes	Yes	Yes
Temporary Road Construction	Yes	Yes	Yes	Yes
Incompletely Marked Timber	Yes	Yes	No	No

[1/] Except for situations that are disadvantageous to the Government, stumpage rate adjustment is required in the Western U.S. in contracts with lengths of 3 years or more, and there is an available index (FSM 2431.34). Stumpage rate adjustment may be required in contracts with lengths more than 1 year, but less than 3 years, where there is an available local market with several competitive participants to process and/or utilize included products or in other situations where it would be advantageous to the government to do so. Forests may include in solicitations to allow contractors the choice to elect stumpage rate adjustment in their technical proposals in contracts of less than 3 years in length. Evaluate the choice as part of the entire proposal that will result in the best value for the government. Contracts in the Western U.S. less than 1 year in length do not have to include stumpage rate adjustment.

[2/] Schedule a rate redetermination for contracts with a length longer than 5 years, pursuant to K/T-D/T.3.5# Scheduled Rate Redetermination.

[3/] Establish a Normal Operating Season for each service work activity. Group these into no more than two date ranges and include in the Integrated Resource Timber Contract. Follow procedure listed in I and IT.2.1 for adding days to the contract related to delays and interruptions in service operations. See 62.1 - Exhibit 02 for sample calculation of adding contract time and adjusting contract termination date.

[4/] Only the name of the successful bidder can be included on the FS-2400-17 for distribution to the public.

[5/] Service Contract Act (SCA) wages apply on contracts greater than $2,500 in value.

[6/] Secure bonds with corporate surety, deposited securities, cash, irrevocable letter of credit, or assignment of savings account or certificate of deposit (FSH 6509.11k §83.3).

[7/] See 65.12 for more information.

[8/] To be used in IRSC contracts with product removal. See 65.11 for more information.

[9/] IRTC contracts are eligible for SBA set aside.

[10/] SSTS may be used for stewardship contracts.

4.6 Rules of Thumb for Selecting Best Contract Instrument

When considering which contracting tool(s) to use for project implementation, there are three general options:

- Option 1—The first priority is to make the project "pay for itself" and use a commercial timber sale contract or personal use permit that is tailored to the size and forest product composition of the project, and also the capabilities (both equipment and financial) of the potential purchaser(s).
- Option 2—The second priority would then be to try to make the project at least partially pay for itself and utilize one of the appropriate stewardship contracts that are also tailored to the size and forest product composition of the project and also the capabilities (both equipment and financial) of the potential contractor(s).
- Option 3—If neither of the previous options is feasible to accomplish the project, the final option would be to try to find enough funding to utilize a service contract for the work. If this contracting mechanism is used, the objective should be to use this as a means to create a forest product market that could allow a transition into stewardship and commercial product sale contracts.

4.7 Considerations for Transitioning Values of Products

With the long-term objective of transitioning woody biomass forest products from "no value" to "having value," consider that as the transition is made, if free-use or personal-use authorities are being used to dispose of logging residues, at some point the biomass products will have to be offered competitively as a commercial product.

Since the Forest Service does not currently have standard rates or units of measure established for topwood, limbs, and needles that make up a large portion of logging residues, as markets for biomass are developed, the issues of whether or not to establish rates for "loose slash," chips, bundles, or whatever other form is determined by future biomass industries to be the most economical to remove from our fuels reduction, restoration, or other vegetative management treatment projects will need to be addressed.

PROJECT (SALE) PREPARATION STRATEGIES

This section focuses on on-the-ground preparation strategies, including stewardship and commercial timber sale projects. The purpose of this section is to provide cost-saving measures for those projects that are marginally feasible from an economically "sellable" standpoint. In many cases, field prep work in small-diameter doghair thickets can cost much more than traditional sale prep work due to the difficulty in walking through dense thickets and also due to having to mark more trees per acre than would be the case in more open and large-diameter timber stands.

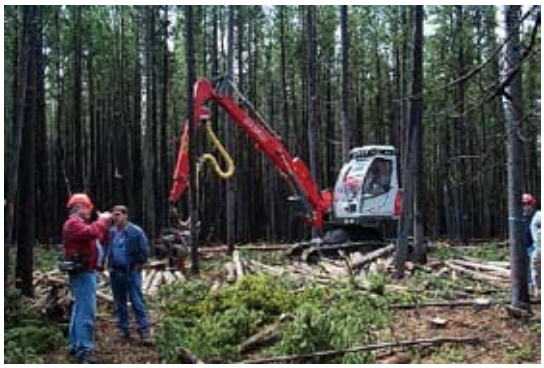

Figure 46—Care to wander through the timber stand ahead of this harvester with a paint gun in your hand and designate trees to be cut? This particular stand was leave-tree marked. Choosing the wrong method of designating timber can cost big bucks and waste time. (Dan Len photo, Arapaho-Roosevelt NF.)

5.1 Cost-Saving Measures

5.11 Methods of Designation

When attempting to treat dense thickets of timber (as well as other instances) minimizing the use of paint and the connected costs of applying it has the potential to save tens of thousands of dollars in project prep cost.

Utilizing the Designation by Description or Designation by Prescription contract provisions that are authorized for use by the Washington Office may make the difference between being able to cost effectively prepare a SDU-biomass timber sale or stewardship contract and just having to "defer" the project until stand age and values increase or until nature provides a fire or insect mortality-induced salvage sale opportunity.

Refer to the following link for the latest information and direction for use of contract designation provisions:
http://fsweb.wo.fs.fed.us/fm/contracts/tim_updates/index.shtml

5.12 Methods of Volume Determination

Direction on volume determination can be found in Forest Service Manual 2440 and Forest Service Handbook 2409.12.

The links to those directives are:
http://fsweb.wo.fs.fed.us/directives/fsm/2400/

and

http://fsweb.wo.fs.fed.us/directives/fsh/2409.12/

The main point to remember when choosing an appropriate cruising system for low-value timber sales or stewardship contracts is to be as efficient as possible. Also, strive to meet designated cruise accuracy standard as close to the maximum allowable as possible. For example, do not over-cruise just because achieving a 20-percent error is better even when the requirement is a 30-percent error.

CONVERSION FACTORS AND GLOSSARY

Conversion Factors for Woody Biomass Utilization

Here are some woody biomass conversion factors that are commonly used by natural resource managers in the Pacific Northwest:

1. The gasoline market in the U.S. is about 118 billion gallons per year. That means about 323 million gallons per day.
2. The theoretical limit of conversion of ethanol from wood is 120 gallons per ton. A high, but achievable figure is about 80 gallons per ton.
3. With 370 million tons of biomass available (dry weight), if it were all converted to ethanol, it would yield 29.6 billion gallons of ethanol.
4. Ethanol is less "energy dense" than gasoline. It takes 1.6 gallons on ethanol to produce the same energy as a gallon of gasoline. (29.6/1.6 = 18.5 billion gallons of "equivalent" gasoline)
5. So it works out that 370 million tons of biomass could be converted to 57 days worth of transportation fuel for the U.S. (18.5/.323=57.28)

To put 370 million tons of biomass into perspective, the U.S. currently consumes about 300 million tons of wood per year, interesting.

FOREST FUEL TREATMENT/BIOMASS UTILIZATION

BIOMASS CONVERSION FACTORS

1 green ton (GT) of chips	=	2,000 pounds (not adjusted for moisture)
1 bone-dry ton (BDT) of chips	=	2,000 dry pounds (assumes no moisture content)
1 bone-dry unit (BDU) of chips	=	2,400 dry pounds (assumes no moisture content)
1 unit of chips	=	200 cubic feet
1 BDT chips	=	2.0 GT (assuming 50-percent moisture content)
1 unit of chips	=	1.0 BDT chips
1 CCF (hundred cubic feet) of roundwood)	=	1.0 BDU chips

1 CCF roundwood (logs)	=	1.2 BDT chips
1 CCF roundwood (logs)	=	1.2 units of chips
1 CCF roundwood (logs)	=	1.2 cords roundwood (@ 85 cu. ft. wood/cord)
1 Board foot (BF)	=	board foot lumber measure equivalent to wood volume of 12-in by 12-in by 1-in thick
1 MBF (thousand board feet)	=	1,000 BF
1 GT (green ton) of logs	=	160 BF of lumber
6 GT (green ton) of logs	=	1 MBF

1 standard chip van carries 25 green tons, or approximately 12.5 bone dry tons (BDT) assuming 50-percent moisture content.

When woody biomass is utilized in a commercial-scale (10+ megawatt [MW] electrical output) power generation facility the following energy output rules of thumb apply:

1 BDT fuel will produce 10,000 pounds of steam.

10,000 pounds of steam will generate 1 megawatt hour (MWH) of electricity

1 MW = 1,000 horsepower

1 MW = power for approximately 750 to 1,000 homes

BONE DRY TONS CONVERSION TABLE

WOOD DENSITY

DBH (in)	HT (ft)	Stem Vol (cu. ft)	Stem Wt (BD pounds)	Crown & Tip Wt (BD pounds)	Total Weight	BDT
Douglas-fir						
2	10	0.1	2.5		2.5	0.00
4	30	1	25	40	65	0.03
6	50	4	100	64	164	0.08
8	70	10	250	97	347	0.17
10	90	20	500	137	637	0.32
12	110	35	875	184	1,059	0.53
16	120	64	1,600	301	1,901	0.95
20	120	95	2,375	482	2,857	1.43
24	120	130	3,250	725	3,975	1.99
28	130	190	4,750	1,030	5,780	2.8
Ponderosa pine						
2	10	0.1	2.5		2.5	0.00
4	30	1	25	35	60	0.03
6	50	3.7	92.5	66	158.5	0.08
8	70	9	225	113	338	0.17
10	90	17.9	447.5	177	624.5	0.31
12	110	31.1	777.5	259	1,036.5	0.52
16	120	58.3	1,457.5	478	1,935.5	0.97
20	120	88	2,200	774	2,974	1.49
24	120	123.1	3,077.5	1,150	4,227.5	2.11
28	130	178.7	4,467.5	1,620	6,087.5	3.0

BONE DRY TONS CONVERSION TABLE

		WOOD DENSITY				
DBH (in)	HT (ft)	Stem Vol (cu. ft)	Stem Wt (BD pounds)	Crown & Tip Wt (BD pounds)	Total Weight	BDT
White fir						
2	10	0.1	2.5		2.5	0.00
4	30	1.2	30	45	75	0.04
6	50	4.5	112.5	77	189.5	0.09
8	70	11.1	277.5	120	397.5	0.20
10	90	22.3	557.5	175	732.5	0.37
12	110	39.2	980	242	1,222	0.61
16	120	71.2	1,780	422	2,202	1.10
20	120	103.7	2,592.5	637	3,229.5	1.61
24	120	141	3,525	852	4,377	2.19
28	130	202.4	5,060	1090	6,150	3.08

References:

Walters, David K.; Hann, D. W.; and Clyde, M. A. 1985. Equations and tables predicting gross total stem volumes in cubic feet for six major conifers of southwest Oregon. Research Bulletin 50. Corvallis, OR: Forest Research Laboratory, Oregon State University. 37 p.

Snell, J.A. Kendall, and Brown, J. K. 1980. Handbook for predicting residue weights of Pacific NW Conifers. Gen. Tech. Rep. PNW-103. USDA Forest Service, PNW Forest and Range Experiment Station. 44 p.

Hartman, David A.; Atkinson, W. A.; Bryant, B. S.; Woodfin, R. O., Jr. 1976. Conversion factors for the Pacific NW Forest Industry.

GLOSSARY OF COMMON TERMS

Listed below are some of the more common terms/abbreviations frequently used by resource managers. These definitions are from a variety of sources including the Forest Service's Forest Products Lab, and the Society of American Foresters – Forestry Dictionary.

Biomass	Organic matter in trees, agricultural crops, and other living plant material. Carbohydrates are the organic compounds that make up biomass. These compounds are formed in growing plant life through photosynthesis, a natural process by which energy from the sun converts carbon dioxide and water into carbohydrates, including sugars, starches, and cellulose.
Board Foot	The amount of wood contained in an unfinished board 1-inch thick, 12 inches long, and 12 inches wide. Abbreviated "BF." Common units as related to sawlog-volume measurement include - 1,000 BF or MBF and 1,000,000 BF or MMBF.
Bone Dry Ton	Traditional unit of measure used by industries (pulp/paper, biomass power) that utilize biomass as a primary raw material. One bone dry ton (BDT) is 2,000 pounds of biomass (usually in chip form) at zero-percent moisture. Typically biomass collected and processed in the forest is delivered "green" to the end use facility at 50-percent moisture. One BDT (assuming 50-percent moisture content) is two green tons (4,000 pounds at 50-percent moisture content).
British Thermal Unit	The quantity of heat required to raise the temperature of one pound of water, 1 degree Fahrenheit.
Chip	A small piece of wood typically used in the manufacture of pulp/paper, composite panels, fuel for power/heat generation, and landscape cover/soil amendment.
Cogeneration	The combined generation of both heat and power at one facility using the same fuel source. Typically the heat is used to generate steam that is utilized onsite (process steam). Power generated is in the form of electricity that is utilized onsite or sold to a local utility.
Cull log	Logs that do not meet certain minimum specifications for usability or grade. A cull log typically has very little value in the production of lumber products.
Gasification	The thermochemical conversion of organic solids and liquids into a producer or synthetic gas (syngas) under very controlled conditions of heat and strict control of air or oxygen.
Gasifier	A combustion device that produces biogas from solid biomass.
Generation	The process of creating electricity. Typically generation is accomplished to supply electricity to an onsite facility and/or for sale to an electric utility.

Kilowatt	A standard unit for expressing the rate of electrical output.
Megawatt	One thousand kilowatts. Enough electricity to support approximately 1,000 households.
Moisture content	The amount of moisture contained in biomass material. Typically expressed as a percentage of total weight.
Saw log	A log that meets minimum regional standards of diameter, length, and defect, intended for sawing into lumber products.
Volume (gross)	Measurement of log content in log-scale board foot (see board foot definition) without deduction for defect.
Volume (net)	Measurement of the actual amount of merchantable wood in log-scale board foot, after deductions for defect.

REFERENCES

7.1 Web sites

Forest Service Woody Biomass Utilization:
http://www.fs.fed.us/forestmanagement/WoodyBiomassUtilization/index.shtml

Department of Energy Biomass Program:
http://www1.eere.energy.gov/biomass/publications.html

Fuels For Schools: http://www.fuelsforschools.org/

Rocky Mountain Research Station, Forestry Sciences Lab:
http://forest.moscowfsl.wsu.edu/fuels/

EPA Combined Heat and Power Program:
http://www.epa.gov/chp/project_resources/ethanol.htm

Colorado Wood Utilization and Marketing Program:
http://www.colostate.edu/programs/cowood/

Intermountain Roundwood Association:
http://www.intermountainroundwood.org/

North Idaho Post and Pole: http://www.nipostandpole.com/

Biomass Combustion Systems: http://www.biomasscombustion.com/index.html

Vaagen Brothers Lumber: http://www.vaagenbros.com/home.html

Center for International Trade in Forest Products:
http://www.cintrafor.org/RESEARCH_TAB/research_pubs_fence.htm

North Idaho Energy Logs: http://www.northidahoenergylogs.com/

Porterbuilt Post and Pole: http://www.porterbiltlog.com

Lignetics: http://www.lignetics.com/lignetics/index.html

John Deere: http://www.deere.com/en_US/deerecom/usa_canada.html

Blondin: http://www.rottneusa.com/

Neuson: http://www.neuson.com/HTML/Pages/EN/startEN.asp

Komatsu: http://www.komatsuforest.com/default.asp?id=1202

Morbark: http://www.morbark.com/

Peterson: http://www.petersonpacific.com/

National Association of Conservation Districts: http://forestry.nacdnet.org/index.html

25 x 25: http://www.25x25.org/

Timber Buy/Sell: http://www.timberbuysell.com/

Southern Research Station, Machine Rates: http://www.srs.fs.fed.us/forestops/mach_costs.htm

7.2 Publications (coming soon)