Utilization of Forest Biomass to Restore Forest Health and Improve US Energy Security

Originally adopted by the SAF Council on October 19, 2005. This position will expire on October 19, 2010 unless, after subsequent review, it is further extended by the SAF Council.

Position

The Society of American Foresters (SAF) supports policies that promote utilization of forest biomass,[1] together with those that assist communities, forest owners, public forest managers, and local entrepreneurs in accomplishing urgent wildfire prevention and forest health improvement projects. In the western states, expanded opportunities to increase utilization of forest biomass are needed to help reduce the accumulation of hazardous fuels and restore healthy forest conditions, particularly on public lands. Increased utilization of forest biomass can also improve forest conditions in the eastern and southern states, where additional markets for low-quality and small-diameter trees will enable forest managers to improve the quality of hardwood forests and reduce overstocking in coniferous forests. America's forests provide watershed protection, wildlife habitat, and numerous forest products, as well as employment and recreational opportunities that our citizens depend on and enjoy. Therefore, it is in our national interest to reduce the threat of wildfire, control insect and disease damage, and improve forest health, thereby ensuring that the nation's forests will continue to provide these benefits for generations to come.

Increased utilization of forest biomass will also help improve the nation's energy security by providing an abundant, renewable fuel resource as a substitute for imported fossil fuels in both public utility and industrial power generation facilities, as well as a potential domestic source of transportation fuels. Ensuring that the necessary research and technology is provided to develop cost-effective production, delivery and processing systems, and new value-added products will lead to increased utilization of forest biomass. Currently, much of the potentially available forest biomass is not economical to harvest because it is distant from existing power generation facilities or other markets. Other barriers that discourage the removal and use of forest biomass must be identified and mitigated to the extent possible. To promote increased utilization of this energy resource, public agency policies must facilitate siting and permitting of biomass-using facilities, encourage long-term power purchase agreements, and authorize contracts to supply forest biomass in dependable quantities sufficient to attract investment in both processing facilities and delivery systems.

SAF supports strategies and policies, including those authorized in the Energy Policy Act of 2005 (PL 109-190), that promote development of economically viable forest biomass production,

[1] Forest biomass: Non-merchantable materials or precommercial thinnings that are byproducts of preventative treatments, such as trees, wood, brush, thinnings, chips, and slash, that are removed to reduce hazardous fuels, to reduce or contain disease or insect infestations, or to restore forest health.

delivery, and processing capabilities in regions where the needs and opportunities are greatest. Public energy and natural resource agencies, and private sector organizations, are encouraged to expand their capabilities and adopt both nationwide and state-specific strategies to increase utilization of forest biomass, including providing support for demonstration projects, funding for targeted research and development opportunities, and inclusion of forest biomass as a qualifying fuel in federal and state renewable energy portfolio policies.

Issue

The unhealthy condition of many of the nation's public forests is an issue that is currently being addressed with urgency by forest managers. On western public lands, many of the silvicultural treatments prescribed to reduce the risk of catastrophic wildfire and improve forest health will generate large volumes of forest biomass. Increased utilization of this material through investment in processing facilities and development of viable markets for biomass-based fuels would contribute to improved forest health, reduce the costs and risks of controlling wildfire, and augment the nation's renewable sources of energy.

A wide range of opinions exist on how to manage at-risk forests in the western states to alleviate unsatisfactory forest health conditions, including the appropriate level of emphasis on removal of hazardous fuels and insect- and disease-damaged timber through pre-commercial and commercial thinning, as well as the use of prescribed fire under controlled conditions. To avoid unacceptable risks to homes, communities, and forest resources, thinning is needed in many areas before prescribed fire can safely be reintroduced to forests with high fuel loads. However, environmental policies often make it difficult to remove hazardous fuels on federal lands or to develop land stewardship contracts that are economically viable for private sector contractors.

At the same time, many forests in the hardwood region of the eastern and southern states exhibit the effects of irregular natural regeneration following exploitive harvesting practices and recovery of abandoned farmland during the 19th and early 20th centuries, together with the later effects of repeated defoliation by the gypsy moth. These forests are often characterized by large numbers of low-quality trees, rather than the higher-quality trees and stands that would be present if these forests were managed using appropriate silvicultural practices. Overstocked coniferous forests in these states would also benefit from thinning, which additional markets for small-diameter trees and forest biomass can help support. Expanded opportunities for utilization of forest biomass would enable forest owners and resource managers in the eastern and southern states to restore these forests to a more productive condition, thereby providing an enhanced economic incentive to retain these lands in forest cover and reducing the likelihood that such forests will be converted to non-forest land uses.

Many localities, east and west, lack economically viable markets, or sufficient utilization capacity, to utilize low-quality or small-diameter trees that are designated for removal during thinning or stand improvement harvests. Modern technology provides opportunities to reduce production and delivery costs, and extend raw material supplies, by utilizing small-diameter trees and other non-merchantable wood fiber as raw material for new, innovative products including biomass-based fuels, polymers, and other chemicals.

Forest biomass-based fuels are now recognized as an important substitute source of energy for public utility and industrial power generation facilities, and potentially for transportation fuels. Our current dependence on non-renewable energy sources and foreign supplies of fossil fuel poses a threat to our nation's energy security. Continued reliance on non-renewable energy sources, particularly foreign imports, can have environmental, economic, and national security implications (US Department of Energy 2004). Increasing our ability to utilize forest biomass can help reduce our dependence on non-renewable energy sources.

However, several structural and public policy barriers exist that discourage investment in biomass-using facilities. Air quality regulations, for example, do not adequately recognize that removing and burning forest biomass in power generation facilities results in substantially reduced emissions, under controlled conditions, as compared to having large volumes of forest biomass consumed through uncontrolled wildfire. Other barriers include complex facility siting and permitting processes, uncertainty in securing long-term power purchase agreements, inequitable classification of forest biomass in renewable energy portfolio policies, and limitations on long-term contracts for production and delivery of forest biomass from federal lands. Each of these uncertainties represents risks that discourage private sector investment in biomass-using energy facilities.

Background

Forests and the production and utilization of forest products have been a major contributor to the economic growth and social well-being of our country. After over 350 years of our nation's settlement and development, about one-third of the land area of the United States, 747 million acres, remains forested (USDA Forest Service 2001). However, our forest landscapes have changed greatly over the years, as has the importance of, and emphasis on, managing other forest resources, including watersheds, wildlife habitat, and recreational opportunities.

Since the early 20th century, aggressive fire suppression and other forest management policies have contributed to a large buildup of small-diameter understory trees in many of our forests, which would not have occurred to the same degree without the intervention of humans (Laverty and Williams 2000). Consequently, half of our nation's forests and rangelands, particularly the western national forests and other public lands, face a moderate to high risk of losing ecosystem components (Schmidt et al. 2002). Unless fuels management techniques are appropriately employed, many forests will continue to be subject to uncharacteristically severe fires (Stephens and Ruth 2005). The hazardous fuels situation affects not only watersheds, wildlife habitat, and timber resources, but in many localities poses a direct threat to communities and to human lives and property.

In the eastern and southern United States, many hardwood forests have, since the time of European settlement, been subject to periodic harvesting, followed by irregular natural regeneration, where the most valuable, high-quality trees and tree species were removed, leaving forests comprised of lower-quality trees with less commercial value (McWilliams et al. 2005). In addition, abandoned farmland that has now regenerated naturally often exhibits irregular stand development that can be substantially improved over time through thinning and stand-improvement practices. Restoration of these forests to more productive and ecologically desirable conditions through appropriate silvicultural practices requires the ability to gradually

remove poor quality trees, with retention of larger-diameter, higher-quality growing stock of the desired species. Currently, the rate at which improved silvicultural practices can be employed in the hardwood region is greatly limited by the inability to market substantial volumes of low-quality trees. In addition, coniferous forests in the eastern and southern states, including those established through planting or natural regeneration of formerly agricultural land, often exhibit overstocking as they grow older. Such excess stand density, if not controlled through periodic thinning, makes these stands more vulnerable to insect attacks, thereby increasing tree mortality and risk of wildfire loss.

In the western states, after decades of fire suppression, many forest stands are overstocked, which together with epidemic levels of insect damage in some regions has resulted in conditions where approximately 70 million acres of America's federal lands are at risk of catastrophic wildfires (USDA Forest Service 2003). Wildfire suppression and past forest, woodland, and rangeland management activities have contributed to these changes (USDA/USDI/USDOE, 2003). In recent years, the wildland fire issue has come to public attention through large-scale wildfires that have occurred in Arizona, California, Colorado, Florida, Idaho, Montana, Oregon, and Washington. In 2000, nearly 8.4 million acres burned. This devastating wildfire season prompted development of the National Fire Plan and accelerated interagency efforts to step up, coordinate, and concentrate efforts on reducing fire risks. The issue of increased risk of fires at the wildland-urban interface was graphically demonstrated in the fall of 2003 when wildfires in Southern California destroyed 750,000 acres, an area larger than the state of Rhode Island, causing 14 fatalities and destroying about 3,500 homes.

Reduction of fuel loading in at-risk forests through thinning and biomass removal is one means to reduce wildfire risk. In the 15 western states, there are at least 28 million acres of forest that could benefit from some type of mechanical treatment to reduce hazardous fuel loading (USDA Forest Service 2005). While removal of small-diameter trees is important to reduce ladder fuels, research indicates that there is a range of stand conditions where thinning only small material, without changing crown density, does little to reduce crown fire spread. In many stand conditions, a comprehensive selection treatment that removes some trees from all diameter classes has a more significant effect on reducing fire risk than removing only small trees (Keyes and O'Hara 2002, Fiedler et al. 2004). It also greatly improves the economics of fuel treatment projects, while retaining a diverse and more healthy forest structure. Prescribed burning, another fuel reduction method, cannot be used in many circumstances and is not necessarily effective unless used in combination with thinning (Graham et al. 2004).

To assist communities and federal and state agencies in addressing urgent wildfire and forest health risks, the Healthy Forests Restoration Act (HFRA) was enacted by Congress and signed into law in 2003. This law contains provisions aimed at expediting the preparation and implementation of hazardous fuels reduction projects on federal land and assisting other forest managers in restoring healthy forest conditions on state and private lands. Title II of this law specifically addresses forest biomass and authorizes a number of programs to encourage biomass utilization. This section of the HFRA ties directly to the Biomass Research and Development Act of 2000, which emphasized that additional research was needed to better utilize our forest resources and to develop value-added wood products, including biomass-derived energy. The

Healthy Forests Initiative and the National Fire Plan also have provisions that encourage the reduction of hazardous fuels and the utilization of forest biomass.

The United States currently utilizes forest biomass to provide about 3% of the nation's total energy needs. Most of this energy generation is accomplished by direct combustion to provide steam for heating and electricity generation (Bain and Overend 2002). At the same time, the United States has been increasingly dependent on foreign sources of petroleum. The use of renewable energy sources, including forest biomass, has the potential to reduce our dependence on foreign sources of oil. Other uses of forest biomass for energy or energy fuels can augment non-renewable energy sources. These include:

- conversion to ethanol to replace transportation fuels,
- partial combustion to produce a synthetic gas similar to natural gas, and
- co-firing in power boilers with coal, oil, or gas.

The use of forest biomass for energy generation provides potential opportunities to use large amounts of material, but currently also presents a challenge because the value of the final product is low compared to other fuels (Morris 1999). Emerging technology is changing this cost differential.

The vast majority of forest biomass removed to reduce stand density in overstocked stands would include trees that are less than 10 inches in diameter at breast height (dbh). There are nearly 2 billion trees in the 2-inch diameter class alone. Although 86% of the trees that would be cut are less than 10 inches in diameter, half of the cubic volume that would be treated would come from trees greater than 13 inches dbh, because smaller trees have little volume (Fried et al. 2003.) In addition to biomass fuels, this material could potentially be used for a variety of forest products—flooring, paneling, fencing, posts, pulp, and composting (LeVan-Green and Livingston 2001). Several companies have formed in recent years that are capable of using smaller-diameter material, but a much larger infrastructure will be required to utilize the additional volumes of material generated from expanded fuel reduction and forest health treatments.

Recent estimates indicate that over 368 million bone dry tons (BDT) of forest biomass can be produced annually on a sustained basis. This estimate includes logging residues, urban wood wastes, fuel treatment of forest lands, traditional fuelwood sources, and forest products manufacturing residues. In order of magnitude, 368 million BDT, if converted into electrical power, could supply over 40 million households annually (Perlack, R.D., et al. 2005).

Today, significant barriers exist to the increased utilization of the smaller diameter (less than 10-inch dbh) forest biomass. Some of these barriers are interrelated:

- Long-term guaranteed supply—Authority for most timber and biomass removal contracts on public lands have been limited to terms of a few years. Recently, authority to enter into 10-year stewardship contracts has been given on national forests and on Bureau of Land Management (BLM)-administered public lands. Even with such extended contracting authority, the ability of the Forest Service and BLM to provide a guaranteed supply of forest biomass has been very uncertain due to appeals and legal challenges of many federal timber sale contracts. Lending institutions and wood products companies

are generally unwilling to invest in biomass production equipment or processing facilities without a guarantee of a dependable long-term supply of forest biomass (GAO 2005).

- Lack of infrastructure—In many parts of the country, especially in the western states, the basic elements that sustained the wood products industry have been substantially reduced or eliminated with the reduction in federal timber sales that occurred during the 1990s. Experienced contractors have gone out of business, and basic harvesting equipment is not available in many locations. People skilled in harvesting and manufacturing forest products have moved to other locations or begun new careers. Many pulp and paper and lumber and plywood mills have closed, resulting in fewer processing options and greater hauling distances for all forest products, including forest biomass.

- Accessibility of material—Much of the potentially available forest biomass is located in remote areas where there are a limited number of roads or originates on steep slopes that require specialized and costly harvesting systems. Most forest roads were not designed to accommodate longer chip-hauling vans. Material near urban-forest interface areas can be difficult to access because of local conditions and ordinances. Hauling distances to deliver biomass materials to processing facilities have become longer, adding cost to the delivered price of raw material.

- Costs and profits—The major barrier to the increased use of forest biomass is financial. Each of the above barriers contributes to the increased cost of biomass delivered to a processing facility. Compared to larger-diameter sawtimber, forest biomass produced from small-diameter trees is more expensive to harvest, transport, and process and yields lower end-product returns. Recognizing these inherent low product value and high production cost risks, companies willing to enter this business need an acceptable return on investment to build facilities capable of utilizing forest biomass; in most parts of the country the projected return to date on these types of investments have not been attractive (GAO 2005).

Increased utilization of forest biomass will provide forest managers with the ability to alleviate hazardous fuel and wildfire conditions on western public lands, and improve the quality and productivity of forests in the eastern and southern states, while providing a valuable alternative source of energy to help meet the nation's electrical power generation and transportation fuel requirements.

References Cited

BAIN, R.L., AND R.P. OVEREND. 2002. Biomass for heat and power. *Forest Products Journal* 52(2), 12-19.

FIEDLER, C., C.F. KEEGAN III, C.W. WOODALL, AND T.A. MORGAN. 2004. *A Strategic Assessment of Crown Fire Hazard in Montana: Potential Effectiveness and Costs of Hazard Reduction Treatments*. General Technical Report PNW-GTR-622, USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

FRIED, J.S., J. BARBOUR, AND R. FIGHT. 2003. FIA Biosum: Applying a multi-scale evaluation tool in southwest Oregon. *Journal of Forestry* 101(2):8.

GOVERNMENT ACCOUNTABILITY OFFICE. 2005. *Natural Resources: Federal Agencies Are Engaged in Various Efforts to Promote the Utilization of Woody Biomass, but Significant Obstacles to Its Use Remain*. GAO-05-373, Washington, DC.

GRAHAM, R.T., S. MCCAFFREY, AND T.B. JAIN (tech. eds.). 2004. *Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity*. Genernal Technical Report RMRS-GTR-120,: USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

KEYES, C., AND K. O'HARA. 2002. Quantifying stand targets for silvicultural prevention of crown fires. *Western Journal of Applied Forestry* 17(2):101-109.

LAVERTY, L., AND J.T. WILLIAMS. 2000. *Protecting people and sustaining resources in fire-adapted ecosystems: A cohesive strategy*.. Response to General Accounting Office Report GAO/RCED-99-65, USDA Forest Service, Washington, DC.

LEVAN-GREEN, S.L., AND J. LIVINGSTON. 2001. Exploring the uses for small-diameter trees. *Forest Products Journal* 51(9):10-21.

MCWILLIAMS, W.H., C.L. ALDRICH, AND T.W. LISTER. 2005. *Setting the Big Picture for Pennsylvania: Past, Present, and Future—1955-2005*. USDA Forest Service, Northeastern Research Station. Presentation delivered at Pennsylvania's Forest Resources Forum, State College, PA, April 26-27, 2005.

MORRIS, G. 1999. *The Value of the Benefits of U.S. Biomass Power*. NREL/SR-570-27541. National Renewable Energy Laboratory, Golden, CO.

PERLACK, R.D., L.L. WRIGHT, A. TURHOLLOW, R.L. GRAHAM, B. STOKES, AND D.C. ERBACH. 2005. *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-ton Annual Supply*. US Department of Energy and US Department of Agriculture. Oak Ridge National Laboratory, Oak Ridge, TN.

SCHMIDT, K.M., J.P. MENAKIS, C.C. HARDY, W.J. HANN, AND D.L. BUNNELL. 2002. *Development of Coarse-scale Spatial Data for Wildland Fire and Fuel Management*. General Technical Report RMRS-87. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

STEPHENS, K.M., AND L.W. RUTH. 2005. Federal forest-fire policy in the United States. *Ecological Applications* 15:532-542.

US DEPARTMENT OF AGRICULTURE, US DEPARTMENT OF ENERGY, AND US DEPARTMENT OF THE INTERIOR. 2003. *Memorandum of Understanding on Policy Principles for Woody Biomass Utilization for Restoration and Fuel Treatments on Forests, Woodlands, and Rangelands*. Washington, DC.

US DEPARTMENT OF ENERGY. 2004. *National Energy Security*. Available online at www.eere.energy.gov/biomass/national_energy_security.html.

USDA FOREST SERVICE. 2001. *2000 RPA Assessment of Forest and Range Lands*, FS-687. USDA Forest Service, Washington, DC.

USDA FOREST SERVICE. 2003. America's Forests, 2003 Health Update. Available online at www.fs.fed.us/forest health.

USDA FOREST SERVICE. 2005. *A Strategic Assessment of Forest Biomass and Fuel Reduction Treatments in the Western States*. General Technical Report RMRS-GTR-149. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

ABOUT THE SOCIETY

The Society of American Foresters, with over 15,000 members, is the national organization that represents all segments of the forestry profession in the United States. It includes public and private practitioners, researchers, administrators, educators, and forestry students. The Society was established in 1900 by Gifford Pinchot and six other pioneer foresters.

The mission of the Society of American Foresters is to advance the science, education, technology, and practice of forestry; to enhance the competency of its members; to establish professional excellence; and to use the knowledge, skills, and conservation ethic of the profession to ensure the continued health and use of forest ecosystems and the present and future availability of forest resources to benefit society.

The Society is the accreditation authority for professional forestry education in the United States. The Society publishes the *Journal of Forestry*; the quarterlies, *Forest Science*, *Southern Journal of Applied Forestry*, *Northern Journal of Applied Forestry*, and *Western Journal of Applied Forestry*; *The Forestry Source*, and the annual *Proceedings* of the Society of American Foresters national convention.