A NATIONAL Wood-to-Energy ROADMAP

A guide for developing sustainable woody biomass energy solutions

June 1, 2011

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A National Wood-to-Energy Roadmap

In 2010 and 2011, the "25x25"Alliance and the Federal Interagency Woody Biomass Working Group convened a Wood-to-Energy Workgroup, consisting of representatives from landowner groups, professional forestry organizations, environmental organizations, traditional forest industries, emerging renewable energy industries, and academia. Together they explored four topics vital to the future of biomass energy in America: wood demand and supply, sustainability of forest resources, carbon and climate change, and related policies. This paper summarizes the key findings and recommendations for each forum topic. The 25x'25 Alliance gratefully acknowledges the Energy Foundation and the Better World Fund for their funding assistance in helping to make this National Wood-to-Energy Roadmap a reality.

25x'25
AMERICA'S ENERGY FUTURE

June 1, 2011

A National Wood-to-Energy Roadmap

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Executive Summary

As policy is established to encourage investments in biomass energy, a thoughtful national deliberation on the use of woody biomass is of paramount importance.

The use of biomass for energy production has recently captured widespread interest as the United States strives to replace both domestic and foreign fossil fuels with home-grown, renewable energy. Biomass—including woody material from forests—is the only renewable energy source that can potentially provide a combination of heat, electricity and liquid transportation fuels.

Both need and opportunity suggest that forests can play an important role in the nation's energy portfolio. However, the use of wood for energy is currently a point of discussion and debate. Many wholeheartedly promote woody biomass as a feedstock that can help provide energy security, reduce greenhouse gas emissions, create job opportunities, and support rural development. Others denounce the use of wood for energy as a source of potential harm to our nation's forest resources. They are concerned that forests may be unable to meet the demands for both energy and traditional wood products, while simultaneously supporting wildlife, clean water, clean air, recreation, and our national heritage.

As policy is established to encourage investments in biomass energy, a thoughtful national deliberation on the use of woody biomass is of paramount importance. The discussion should embrace and balance the full range of viewpoints to derive some agreement on the issues and shape a collective vision for the future.

Chris Evans, River to River CWMA, Bugwood.org

This paper resulted from a collaborative effort to advance the national discussion. It is the product of a thoughtful process—identifying, understanding, and deliberating the issues; developing a vision; and setting a course to achieve the proper use of our forest resources for bioenergy while still meeting the demands for other goods, values, and benefits that Americans desire from their present and future forests.

Stephen Jolley

The "25x25"Alliance and the Federal Interagency Woody Biomass Working Group convened a Wood-to-Energy Workgroup, consisting of representatives from landowner groups, professional forestry organizations, environmental organizations, traditional forest industries, emerging renewable energy industries, and academia. Together they explored four topics vital to the future of biomass energy in America: wood demand and supply, sustainability of forest resources, carbon and climate change, and related policies. This paper summarizes the key findings and recommendations for each forum topic.

1. Wood demand and supply addresses the role of the nation's forests in the traditional market for forest products and the developing market for energy. What is the potential and expected demand for traditional wood products and for wood as an energy feedstock? How large could the demand become and how likely is that demand to materialize? How much wood can the United States provide sustainably for energy production?

Estimates of both demand and supply change substantially based on assumptions. There are no truly assured estimates of the demand for wood as an energy feedstock in the near or more distant future. Many factors will affect demand, including local supply concerns, competition with other feedstocks, and the use of wood for other products. The most significant drivers are mandates and incentives from federal and state governments and strong, reliable markets—but even existing initiatives may not play out as planned. There have been hundreds of announcements for new facilities producing bioenergy for heat, electricity, and transportation fuels, but very few have broken ground or been completed.

Supply estimates depend on assumptions regarding technology, policy, and market changes. Fortunately, the United States has abundant forest resources and a largely untapped potential to increase wood growth, yield, and availability (and therefore biomass potential) on existing private and public forestlands.

There is, however, a conceivable sustainable supply limit. Management practices and reasonable policies must be used to ensure that our forests are not jeopardized by surpassing the sustainable limit.

Key findings for wood supply and demand include the following:

- Merchantable wood will continue to be used primarily for conventional forest products for decades.

- Demand for the use of woody biomass for renewable energy will be largely driven by public policy in the short term.
- While there may be the appearance of an over-developing biomass industry that cannot be sustainably supported by the local forest resources, in reality a large majority of these projects will not be built.
- The primary forest resource for biomass energy is mill residues (bark, sawdust, shavings, etc.), with additional potential capacity coming primarily from forest residues and other non-merchantable tree removals.
- Preliminary findings of the forthcoming RPA show that (1) the supply of low-quality material for energy purposes is strongly tied to sawtimber demand; (2) supply will be inelastic in the short term (10 years); and (3) population growth may impact supply from both private and public forestlands.
- The role of public forestlands in producing wood for energy production is expected to be modest.
- Yields per acre could double or quadruple through long-term management techniques.
- Marginal crop and pasture lands offer great potential for the use and expansion of short-rotation woody cropping systems specifically designed for the production of wood for energy.

2. Sustainability speaks to the long-term ability of the nation's forests to provide multiple benefits. Sustained healthy forestlands are needed not only to provide wood for energy and traditional uses, but also to provide wildlife habitat, clean water, clean air, recreation, and to preserve our national heritage.

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Fortunately, modern forestry is deeply rooted in conservation, long-term site productivity, and sustainability of the resource. Private forest owners, the forest industry, and state and federal governments strive to produce wood and other services while maintaining the health and productivity of the land and forest ecosystems. Demonstrating the success of these practices is critical to ensuring public acceptance of the wood-to-energy process and the long-term health of the industries involved.

Key findings for sustainability include the following:

- The U.S. Forest Service (2008) draft report on sustainability demonstrates that our forests are sustainable for the production of timber and that declining timber output is not driven by resource restraints.
- Land conversion—not the demand for forest products— is the major threat to our nation's forests.
- Sustainable forest management is an existing, widespread ethic, reinforced by requirements in many states' renewable energy policies.
- Forest landowners and managers appreciate the importance of sustainable management and employ the best science and technology.
- The removal of woody biomass for energy production may improve forest health and help prevent or reduce wildfires.

3. Carbon and climate change explores the role of forests in sequestering carbon, which in turn reduces carbon emissions that contribute to climate change. In terms of energy production, questions have been raised about the long-term presumption that energy from woody biomass is carbon neutral, citing concerns that the potential for degrading and clearing natural forests could actually increase atmospheric carbon. Others postulate that forest carbon stocks are always depleted by harvesting but that carbon stock depletion is reversed gradually over a period of years by regrowth of the harvested stands.

The absolute carbon footprint of biomass energy depends on a variety of factors, including the condition of the forest before harvest (stock, disease, fire), types of forests and their growth and regeneration potential, the products made from the wood harvested, amount of material from the forest used for energy, pre-combustion emissions (conversion, processing, transport), efficiency of the energy conversion technologies, type of fossil fuel (grid mix) replaced, management of the forest after harvest, and the ratio of biomass used for energy to forest growth.

Darlene Robbins

Key findings for carbon and climate change include the following:

- Working forests have long been recognized as a source of real and verifiable reduction in greenhouse gases and a cost-effective source of industrial greenhouse gas offsets.
- The EPA has concluded that there is "scientific consensus" that the carbon dioxide emitted from burning biomass for energy will not increase atmospheric carbon dioxide if done on a sustainable basis.
- Discussion of carbon and climate change implications must include the relationship between biomass, wildfires, and carbon emissions on public forest lands.
- Scientifically sound and credible carbon life-cycle analyses are needed to demonstrate the superiority of using wood for energy when compared to other energy pathways, particularly from fossil fuels.

4. Policy initiatives have led to a large number of laws and regulations that lay out a patchwork of mandates, incentives, and barriers to the use of woody biomass for energy. This collection of sometimes conflicting legislation represents the current "policy" with respect to wood-for-energy. Clearly, energy and carbon policies can have dramatic economic impacts as well as energy and environmental impacts.

Key policy recommendations include the following:

- Set realistic renewable energy goals with properly designed and scaled mandates and incentives.
- Treat all biomass energy facilities the same, regardless of age.
- Keep forests as forests.
- Increase domestic supplies of wood.

- Ensure sustainability in all uses of wood.
- Reward appropriate scale and efficiency.
- Maintain a simple, consistent definition of biomass.
- Achieve reliable carbon accounting for all energy sources, including wood.
- Maintain accurate feedback mechanisms on the use of forest resources over time.

When addressing the role of agriculture and forestry in renewable energy production, the 25x'25 Alliance has always adhered to the philosophy of "yes if" rather than "no because." "Yes," woody biomass can be an important feedstock for renewable energy "if" we are willing to:

- Take the necessary steps to ensure that the use of biomass occurs in a wise and sustainable manner with appropriate feedback mechanisms
- Choose the most efficient uses for wood in producing energy
- Take the necessary steps to restore our private and public forestlands to reach their productive potential for wood as well as the many other benefits they provide to society
- Invest in research and technology development

Our forests and the woody biomass they produce can be sustainable for energy and traditional forest products, as well as myriad other public uses and benefits. The use of wood for energy, far from decimating our nation's public and private forestlands, should be considered an opportunity to enhance and expand both the extent and productive capacity of those forestlands.

Stephen Jolley

Prologue

The use of biomass for energy production has recently captured widespread interest as the United States strives to replace both domestic and foreign fossil fuels with home-grown, renewable energy. Biomass—including woody material from forests—is the only renewable energy source that can potentially provide a combination of heat, electricity and liquid transportation fuels.

Forests, a source of both multiple forest products and woody biomass, are one of America's most abundant natural resources. For centuries, wood from the nation's forests has been a primary source of energy for heating, cooking, and industry. Over the past forty years, industrial wood residuals have provided much of the heat and electrical power for the forest products industry. Now, the interest in using wood as a feedstock for heat, electricity, and transportation has increased sharply beyond the forest products industry.

Meanwhile, the forest products industry strives to remain competitive because of the downturn in the economy and global competition. Existing biomass-to-electricity producers are disadvantaged by low fossil fuel pricing and the lack of a level playing field with other renewable technologies. The end result has been the build-up of biomass in our forests and the inability of landowners to invest in or expand their existing forests. Large volumes of forest material remain unused after harvest; when left on site, this material reduces productive growing space, decays and respires greenhouse gases, and/or becomes fuel for wildfires. The situation is exacerbated on public lands, where forest health continues to deteriorate as epidemic insect and disease infestations and wildfires take an ever increasing toll. Fire suppression and management costs on federal lands continue to escalate.

Stephen Jolley

Both need and opportunity suggest that forests can play an important role in the nation's energy portfolio. However, the use of wood for energy is currently a point of discussion and debate. Many wholeheartedly promote woody biomass as a superb alternative feedstock that can promote energy security, reduce greenhouse gas emissions, create job opportunities, and support rural development. Others denounce the use of wood for energy as a source of potential harm to our nation's forest resources. They are concerned that forests may be unable to meet the demands for both energy and traditional wood products, while simultaneously supporting wildlife, clean water, clean air, recreation, and our national heritage.

Undoubtedly, the use of wood for energy carries opportunities, challenges, and responsibilities. On one hand, forests that are managed sustainability can have a desirable and significant role in a renewable energy future. On the other hand, expanding the use of wood feedstocks too rapidly could have negative social and environmental consequences.

The initial objective was to assess interest in collaborating on a strategic roadmap for the use of wood for bioenergy and traditional forest products while sustaining the health and productivity of America's forest resources.

Public policy initiatives to address energy production and climate change often overlook or misrepresent the role of the nation's forests and can potentially lead to unintended consequences on both private and public forest lands and the multiple economic and environmental benefits they provide. Currently, neither public nor private forests are achieving their full potential to provide energy, wood products, and environmental services. Environmental services will likely degrade unless there are markets that provide economic incentives for forest owners and managers to invest in and manage their land and to maintain it as forest. Forests can play a key role in mitigating climate change and providing for our domestic energy needs. However, a thorough, thoughtful, and science-based approach must be employed to balance the use of wood for energy with the economic health of existing wood products industry and the health, vibrancy, and resiliency of the forest resource.

As policy is established to encourage investments in biomass energy, a thoughtful national deliberation on the use of woody biomass is of paramount importance. The discussion should embrace and balance the full range of viewpoints to derive some agreement on the issues and shape a collective vision for the future.

This paper resulted from a collaborative effort to advance the national discussion. It is the product of a thoughtful process—identifying, understanding, and deliberating the issues; developing a vision; and setting a course to achieve the proper use of our forest resources for bioenergy while still meeting the demands for other goods, values, and benefits that Americans desire from their present and future forests.

The process began in October of 2009. Two organizations—the "25x25"Alliance and the Federal Interagency Woody Biomass Working Group—organized a meeting of representatives from landowner groups, professional forestry organizations, environmental organizations, traditional forest industries, emerging renewable energy industries, and academia. The initial objective was to assess interest in collaborating on a strategic roadmap for the use of wood for bioenergy and traditional forest products while sustaining the health and productivity of America's forest resources. A "Wood-to-Energy Work Group" was formed to explore the issues and to craft recommendations that would overcome these challenges.

The vision set forth by the Wood-to-Energy Work Group was to *"Unlock the nation's potential to sustainably produce woody biomass for energy and traditional uses while providing balanced multiple benefits from public and private forests for the American public."* The underlying assumption behind this vision was that a prudent and sustainable approach to the use of wood for energy is good for the United States:

- National security and economic concerns demand that the United States create a path towards the sustainable domestic production of energy.
- Domestic forests are perhaps the most important renewable option for meeting the nation's need for heat, electric power, and transportation fuel.

- Expanded markets for the use of wood-based energy will in turn create incentives for landowners to improve forest management practices, leading to better forest health and resiliency with long-term increases in the total supply of wood.
- Increasing the supply of wood is critical in maintaining a balance between supplies for wood products, energy, and the environmental services that forests provide as demand increases; the supply from private lands can be boosted through strong markets and the supply from public lands can be increased by lowering the cost of needed restoration treatments.
- Optimizing the use of each product from our forests will maintain the proper balance and priority.

In order to explore the above premises, the 25x'25 Alliance sponsored forums on four topics: (1) wood demand and supply, (2) sustainability, (3) carbon and climate change, and (4) related policies.

Presenters with diverse perspectives and comprehensive knowledge on these topics were invited to the respective forums (see appendices). They included representatives from universities, government agencies, research organizations, policy organizations, consultants, advanced seedling producers, and biomass producers. The process included presentations, question-and-answer sessions, discussions, and informal interaction between the presenters and the Wood-to-Energy Work Group.

The Wood-to-Energy Work Group discussed and analyzed the collective information from the presenters and used their findings to better frame the issues and develop recommendations. This paper summarizes the key findings and recommendations for each forum topic.

Tim Volk, SUNY ESF

Wood Demand and Supply

The economics of supply and demand suggest that an increase in demand for forest biomass resources will result in an increase in the value of the resource.

Introduction

Contrasting views on the use of wood for energy raise serious questions about demand and supply. What is the potential and expected demand for traditional wood products and for wood as an energy feedstock? When looking at existing and proposed national and state mandates such as renewable fuel standards and renewable electricity standards, how large could the demand become and how likely is that demand to materialize?

From a supply perspective, there are also a number of questions to be answered. How much wood can the United States provide sustainably for energy production? If more wood is needed, what kinds of incentives and technology advances would be required to sustainably increase wood supplies on forest lands and from other areas such as marginal croplands? What are the potential roles and benefits for public and private lands in providing wood feedstocks?

General Observations on Wood Demand and Supply

There are both opportunities and challenges to using wood for energy. As the opportunities are developed and the problems overcome, certainly the demand will increase.

However, there are no truly assured estimates of the demand for wood as an energy feedstock in the near or more distant future. Increased demand will depend on new and expanded markets for wood for energy. Many factors will affect demand, including local supply concerns, competition with other feedstocks, and the use of wood for other products. The most significant drivers are mandates and incentives from federal and state governments and strong, reliable markets—but even existing initiatives may not play out as planned. There have been hundreds of announcements for new facilities producing bioenergy for heat, electricity, and transportation fuels, but very few have broken ground or been completed. As a consequence, the massive demand increases forecasted may not materialize.

Subjective projections on the demand for wood feedstocks range from only the use of currently unused wastes as fuel to significant shifts in forest production. For example, the Biomass Research and Development Initiative (2008) reported that wood could provide four billion gallons per year in 2022 of the 36 billion gallons per year of ethanol required by the Energy Independence and Security Act of 2007.This requires approximately 47 million dry tons per year of wood without a contribution from woody crops.

The Energy Information Agency (2007) analyzed renewable energy requirements to meet both a 25% transportation fuels and 25% electricity produc-

tion renewable portfolio standard by 2025.According to Sample and others (2010), this analysis would require 800 million dry tons of biomass annually, of which only about 500 million dry tons are available from agricultural and forestry wastes and energy crops (per specific assumptions on wastes availability, conversion rates, moisture content, etc.). The remainder would come from other forestry resources.

The economics of supply and demand suggest that an increase in demand for forest biomass resources will result in an increase in the value of the resource. An increase in value will spur development of biomass resources and supply. Fortunately, the United States has abundant forest resources and a largely untapped potential to increase wood growth, yield, and availability (and therefore biomass potential) on existing private and public forestlands. Strategies to boost the supply of woody biomass include:

- Increasing recovery of biomass from the current forest inventory as part of integrated harvesting
- Increasing reforestation and afforestation
- Extending the resource through end-use efficiency
- Enhancing forest productivity

There are great opportunities to increase wood supplies through technological advances on existing timberlands, improved management treatments, and by planting trees or short-rotation woody crops on marginal crop and pasture lands. The Biomass Crop Assistance Program is an example of a federal incentive to develop energy feedstocks. Integrated logging, in which biomass for energy is a by-product of conventional harvesting, can help make forest wastes more competitive. High-yield plantations reduce transport cost and reduce risk of inadequate supply.

There is, however, a conceivable sustainable supply limit. Management practices and reasonable policies must be used to ensure that our forests are not jeopardized by surpassing the sustainable limit.

Estimates of both demand and supply change substantially based on assumptions. Supply estimates depend on assumptions regarding technology, policy, and market changes. Demand estimates are shaped by a wide range of drivers and responses. The best that can be done is to generally assess alternative assumptions and outcomes, and use the various projections to predict future supply and demand under common, readily available, or widely accepted assumptions.

While there may not be accepted definitive estimates and projections of either total biomass demand or supply, there are recent enhanced efforts to better estimate both. The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) directs the U.S. Forest Service to conduct periodic assessments of present and anticipated uses, demand, and supply of forestry resources (U.S. Forest Service 2010b). The 2007 analysis (Smith et al. 2010) will be updated in 2011 with estimates on the demand and supply of biomass.

Stephen Jolley

Although designed primarily for merchantable timber, the analysis provides significant information about the biomass resources in the United States. The RPA assessment, combined with the Timber Product Output database, provides comprehensive background data on harvest products, forest residues, standing inventory, and wood processing wastes.

The Billion Ton Study (Perlack 2005) used these resources, along with the Forest Inventory & Analysis data and further analysis, to develop a national strategic assessment of woody biomass availability. The "Billion Ton Report" is currently being updated with spatial/economic refinements along with the incorporation of new state and regional biomass data. Other national, regional, and state analyses are typically based on this type of background information (Jackson et al. 2010).

Findings and Discussions Relative to Wood Demand

- **Merchantable wood will continue to be used primarily for conventional forest products for decades** (Haynes 2007; Wegner et al. 2010). Energy feedstocks cannot consistently economically compete against sawtimber, veneer logs, and higher value forest products. At expected levels of fossil fuel supply and cost—and without support from the federal and local governments—biomass generally cannot compete with fossil fuels on a strictly economic basis.
- **Demand for the use of woody biomass for renewable energy will be largely driven by public policy in the short term**. Concerns over greenhouse gases and energy independence initially resulted in government support for the use of biomass in the heat, power, and liquid transportation fuel sectors. The Energy Independence and Security Act of 2007 set a mandatory renewable fuel standard requiring transportation fuel sold in the United States to contain a minimum of 36 billion gallons of renewable fuels by 2022, including advanced and cellulosic biofuels and biomass-based diesel. In addition, more than half the states and the District of Columbia have some form of electricity renewable portfolio standard promoting the use of biomass electric power as a sustainable form of renewable energy.
- **The Energy Information Agency (EIA 2010) expects wind and biomass to provide the greatest increase in renewable energy by 2035, with biomass providing nearly half of the projected non-hydro renewable energy by 2035**. Forestry-derived wood would be the initial biomass resource with agriculture residues and dedicated energy crops tripling forestry's contribution by 2035.In 2035, EIA projects that forest biomass could contribute three quads of energy to the estimated 12 quads from all forms of biomass. EIA projects that wood use for energy peaks early in the 2010 to 2035 period and then flattens out. EIA's projection of the early contribution of forest biomass for energy is due to the existing forestry infrastructure producing wood for energy at a competitive price, primarily from the residual materials from forest management. Demand for higher value products such as pulp and saw timber will cap the amount of wood entering the biomass energy market and set a price high enough that agricultural residues and

energy crops will be able to enter the biomass energy market.

Han-Sup Han, Humboldt State University

- **EIA projects that forest biomass will be primarily used in combined heat and power applications that most efficiently utilize low value wood**. EIA has only included the use of wood for electricity and heat in their analysis to date. EIA has not considered wood to be cost-competitive with other biofuel feedstocks. The 2011 Energy Outlook does include projections for the use of wood for biofuels with some restrictions. Next-generation biofuels technology utilizing wood is still in the developmental stage and only a few demonstration-scale facilities are in operation. As a consequence, the timetable for broad-scale commercial application of cellulosic fuels is uncertain.
- **While there may be the appearance of an over-developing biomass industry that cannot be sustainably supported by the local forest resources, in reality a large majority of these projects will not be built**. The economics and fiscal constraints of a free market will place additional controls on resource demands from the biomass industry. A 2010 analysis conducted by Forisk Consulting, LLC, estimated that only 40% of the 129 announced bioenergy projects in the southeastern United States had a reasonable chance of being built (Mendell and Land 2010).A more recent report from Forisk looked at 441 announced and operating bioenergy projects that consume wood in the continental United States. In total, these projects represent a potential incremental wood use of 122 million dry tons per year by 2020.Based on the most recent Forisk (2010) analysis, 55% of the projects representing only 67million dry tons per year pass basic viability screening. Likewise, the Manomet Study (Walker et al. 2010) identifies 243 projects announced in the northeastern United States, but only one that has been completed.

Findings and Discussion Regarding Wood Supply

- **Forest resources currently provide 147 million dry tons of biomass for energy production and are capable of an additional 226 million dry tons** (Perlack et al. 2005). Logging residues and urban wood available for energy production is estimated at 150 to 190 million dry tons per year. However, the role of public lands is critical—without a meaningful contribution from public lands, 190 million dry tons per year is unattainable and even140 million tons per year is problematic.

- **The primary forest resource for biomass energy is mill residues (bark, sawdust, shavings, etc.), with additional potential capacity coming primarily from forest residues and other non-merchantable tree removals**. To be economic, logging residues will likely be produced as part of an integrated harvesting system producing multiple products. There is also the potential for the direct harvest of merchantable trees for use as energy, but economics of energy production, competition from other renewable technologies and the needs of the existing forest products industry limit this option in most regions of the country.
- **Preliminary findings of the forthcoming RPA show that (1) the supply of low-quality material for energy purposes is strongly tied to sawtimber demand; (2) supply will be inelastic in the short term (10 years); and (3) population growth may impact supply from both private and public forestlands**. The RPA analysis is scenario-based and includes the effects of climate change, changes in the forest products industry, and the impact of legislation.
- **The role of public forestlands in producing wood for energy production is expected to be modest**. According to the Billion Ton Study, federal lands are highly unlikely to contribute anywhere near their potential, even though annual forest growth has far exceeded removals for decades. This is especially true in the West, where the increased removal of forest materials that heighten wildfires could substantially improve forest health and lessen the risk of catastrophic fires. Federally owned forest resources will likely remain largely unavailable due to policy restrictions and litigation, but this material could be available for use in large quantities with thoughtful changes to public land policies and further refinement of sustainable management guidelines.
- **The level of wood supply from private forests depends on numerous factors**, such as the current state of the forest, the health and vitality of the forest products industry, changes in land use, public forest policy, sustainability, and future forest productivity.
- **Increased utilization of forest residues and non-merchantable trees for energy is a near term "low hanging fruit."** These biomass resources are typically left in the woods or burned. By taking an integrated approach, this material can be collected and processed into fuel at the same time higher value logs are harvested for traditional forest products. While equipment and harvesting methods exist to collect forest residues and non-merchantable trees, it takes place only in isolated markets. Wood-based energy markets in most regions of the United States do not yet create enough demand or price incentive to feasibly collect this material.
- **Yields per acre could double or quadruple through long-term management techniques** that include commercial and precommercial thinning, fertilization, interplanting, and the use of improved planting stock. Planted hardwood stand productivity has the potential to increase as much as 20-fold over stands that are naturally regenerated.
- **Marginal crop and pasture lands offer great potential for the use and expansion of short-rotation woody cropping (SRWC) systems specifically designed for the production of wood for energy**. The man-

agement intensity for these crops is similar to that of row crops and far exceeds even that for intensely managed multi-product plantations. At the present time, the cost of wood produced using SRWC systems is too expensive to compete with other woody biomass resources. As demand increases for woody biomass and SRWC production efficiencies improve, the commercial applications of SRWC will increase, reducing the demand on the natural forest resource.

Concluding Observations on Wood Demand and Supply

Market forces will play an important role in the growth of the biomass energy industry and its demand on the forest resource, both public and private. Policy may create market place opportunities for biomass, but it does not determine specifics like who, what, where, how and when. There will be far more projects proposed and announced than actually built (Mendell and Lang 2010).The necessity to obtain private financing for any given project is a weeding out process that maintains the supply/demand balance for the wood resource that is so crucial to long-term policy success.

In order to obtain financing, a project developer must convince a lender that the financial risk is acceptable for the expected returns. Technology and market risk must be acceptable, as must biomass supply risk, regardless of the fuel source. For an acceptable fuel supply risk, a project must convince financiers that the supply is sustainable for the life of the project, even considering potential competition from other projects, and that the cost of that biomass supply will allow for an acceptable return on investment under all market conditions.

Last, and certainly not least, the most significant drivers for woody biomass as a feedstock source for renewable energy are mandates and incentives from federal and state governments.

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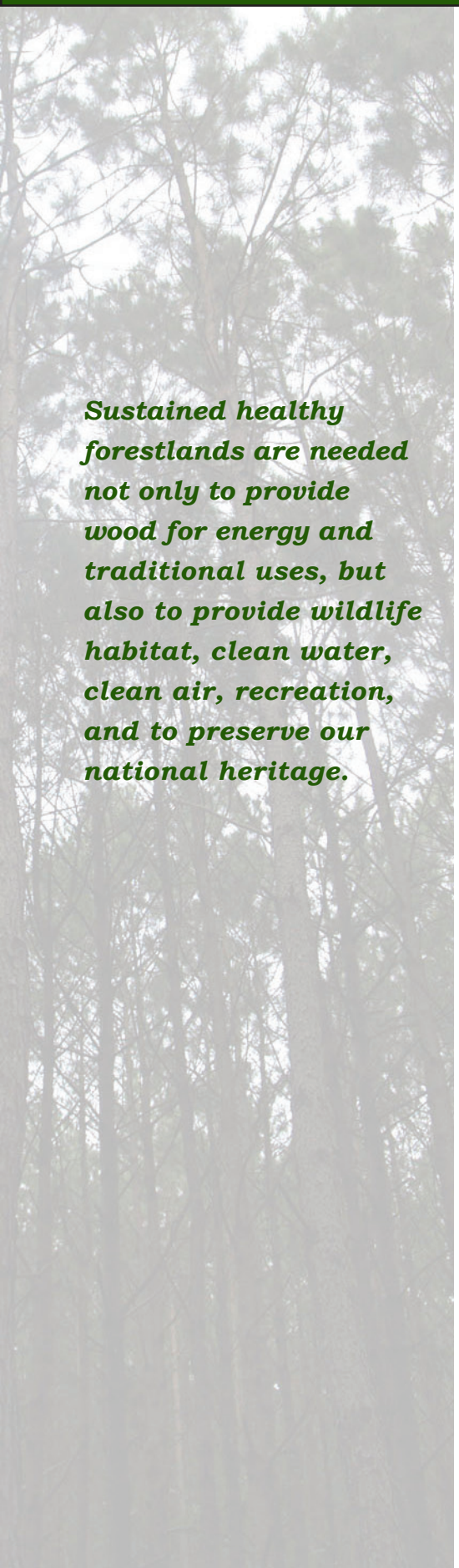
Sustainability



Sustained healthy forestlands are needed not only to provide wood for energy and traditional uses, but also to provide wildlife habitat, clean water, clean air, recreation, and to preserve our national heritage.

Introduction

Given the contrasting views on the use of woody biomass for energy, important questions relating to sustainability must be explored and answered. Everyone recognizes that forestlands are valuable for outputs other than wood products and energy, so how can society ensure these values are being protected under increasing demands for wood as an energy feedstock? Can the use of woody biomass for energy play a role in the reduction of fuel loading and catastrophic wildfires, particularly on public forestlands in the West? If the demand and use of woody biomass for renewable energy increases significantly, what sustainability parameters should or could be measured? Also, are tools available to assure that forests and their many benefits are being sustained?

General Observations on Forest Sustainability

Forests provide a range of services, values, and benefits—often referred to as ecosystem services. The Millennium Ecosystem Assessment (2005) defines these services as: (1) *provisioning services* such as food, water, timber, and fiber, (2) *regulating services* that affect climate, floods, disease, wastes, and water quality, (3) *cultural services* that provide recreational, aesthetic, and spiritual benefits, and (4) *supporting services* such as soil formation, photosynthesis, and nutrient cycling.

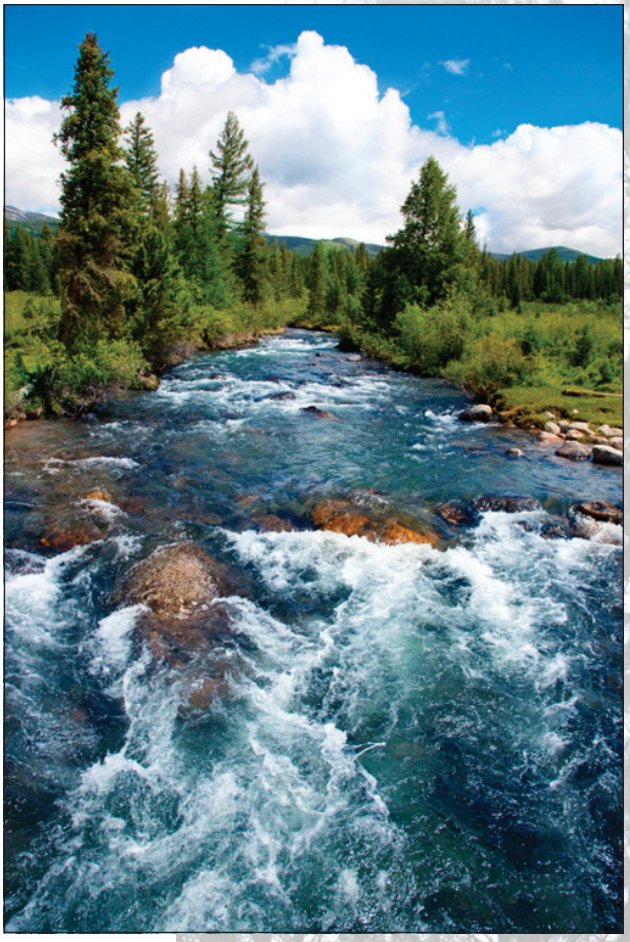
In short, forests are an integral part of life on earth and directly relate to the quality of life. About 80 percent of the freshwater in the United States originates from forestlands, which provide the primary functions of precipitation interception, absorption, filtration, and storage. Forested watersheds also reduce erosion and flooding, promote biodiversity through habitat for fish and wildlife, provide abundant recreational opportunities and aesthetic values, and deliver an abundant water supply for human consumption.

Forests are especially important in mitigating climate change. They reduce carbon levels in the atmosphere by (1) providing carbon sinks, and (2) providing feedstock for renewable energy. Both are accepted roles, although the latter has recently come under closer scrutiny (see the Carbon and Climate Change section of this report).Forests that are managed to provide an array of ecological services and timber products sequester more carbon in the ecosystem, through long-life products, and provide carbon offsets through the substitution of wood for fossil-based energy. Keeping our forests in forests, replacing and adding new forests, and improving the health and vigor of our forests are critical to the global carbon cycle. Healthy forests contribute significantly to reducing climate change and are more resilient to its effects.

In the face of increasing demands on the nation's forestlands to meet projected requirements for renewable energy, as well as the need for traditional

products from existing forest products industry, it is absolutely essential to assure the availability and sustainability of sufficient forest resources. Sustained healthy forestlands are needed not only to provide wood for energy and traditional uses, but also to provide wildlife habitat, clean water, clean air, recreation, and to preserve our national heritage.

Fortunately, modern forestry is deeply rooted in conservation, long-term site productivity, and sustainability of the resource. Private forest owners, the forest industry, and state and federal governments strive to produce wood and other services while maintaining the health and productivity of the land and forest ecosystems. Demonstrating the success of these practices is critical to ensuring public acceptance of the wood-to-energy process and the long-term health of the industries involved.



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Findings and Discussion on Forest Sustainability

- **The U.S. Forest Service (2008) draft report on sustainability demonstrates that our forests are sustainable for the production of timber and that declining timber output is not driven by resource restraints**. However, forests are continually at risk from a variety of factors, including land conversion, fragmentation, insect/disease infestations, overcrowded stand conditions from lack of treatment, and catastrophic wildfire.
- **Land conversion—not the demand for forest products— is the major threat to our nation's forests**. In 2007, the United States had about the same amount of forestland (755 million acres) as existed in 1907.This means that the nation has maintained forests despite an increase in population from 87 million to more than 300 million people. However, the population will continue to grow by over another one hundred million people before 2050, and there will be increased stress on our forests.

  The greatest impact will not result from an increased demand for goods and services, but from the conversion of forests to other uses as people move from the city to the suburban landscape. More than 60 percent of housing units built in the 1990s were constructed in or near the edge of the wildland/urban interface. As many as 50 million acres are expected to be deforested as part of this continued expansion, especially in the east, in the next few decades (Alig et al. 2010).Such conversion removes forestland from production, modifies forest function, and reduces or eliminates ecological values. The preliminary 2010 RPA analysis indicates that all regions of the United States will lose a small fraction of forestlands to urban development, with the total loss by 2050 projected to be 4% of the total acreage.

  While the forest cleared for land use changes provides a "one shot" source of potential wood for energy, the long-term impact of land conversion has a negative effect on long-term wood availability, wildlife habitat,

plant and animal populations, water storage and filtering systems, aesthetics, and recreational opportunities.

A slow economic recovery combined with increased value of low quality wood for energy uses will slow fragmentation of forestlands and increase the conversion of unproductive cropland and pasture to forestlands.

- **Sustainable forest management is an existing, widespread ethic, reinforced by requirements in many states' renewable energy policies. A study by the Pinchot Institute suggests that full implementation of a national 25% mandate for both renewable fuel and energy could require a doubling of current removals from the nation's forestlands**. This potential demand has raised concerns that a combination of well-intentioned and yet seemingly uncoordinated state and federal policies will result in an unsustainable increase in the use of forest resources. However, many states' renewable fuel and energy standards have sustainability clauses, and many producers in the forest products industry produce their products only from sustainable forest operations. Practical experience also demonstrates that markets will develop more gradually than originally anticipated, significantly reducing the likelihood of near-term fiber shortages or conflicts with traditional uses.
- **Forest landowners and managers appreciate the importance of sustainable management and employ the best science and technology. Best management practices(BMPs) are a combination of practices that are determined by a state or designated planning agency to be the most effective and practicable means of controlling non-point source water pollution to achieve overall environmental goals**. The overall use of BMPs in the forest industry covers 91% of total acres (U.S. Forest Service 2008). The application of state-level BMPs provides an excellent track record of success in terms of reduced soil erosion and the protection of streams and wildlife habitat. Federally sponsored biomass support programs like the Biomass Crop Assistance Program require sustainability as part of the program qualification criteria. In effect, all these efforts consider sustainability as an integral part of their charter and success. Many states also have specific forestry practices that must be adhered to in the management and use of forestlands. The forestry industry and some states use forest certification systems such as the Forest Stewardship Council, Sustainable Forest Initiative, and American Tree Farm System. Federal lands are managed under stringent regulations to ensure their sustainability.
- **The removal of woody biomass for energy production may improve forest health and help prevent or reduce wildfires**. Miller and others (2010) synthesized and modeled the impacts of wildfire, prescribed fire, and biomass removal using historical and field data in western forests. Their conclusion was that, over the long term, controlled burning in conjunction with mechanical harvest may potentially improve the quality of runoff water by reducing nitrogen and phosphorus litter mass pools and improving the overall health of forest ecosystems without the danger of wildfire.

  There have been studies on federal lands to show the effectiveness of fuel-reduction treatments, which remove excess woody material in forest stands to prevent and/or reduce the severity of wildfires. In 2007, wild-

fires in Idaho burned around and through 8,000 acres of fuels treatments within a 500,000 acre burn and only burned two structures out of the nearly 70 protected by the treatments (Graham et al. 2009). The outcome was largely due to the fuel treatments and their interaction with suppression activities. In addition to modifying wildfire intensity, the treated areas had less burn severity to vegetation and soils.

Other studies have also shown that fuel treatments, especially ones in which the biomass levels are reduced by removal, can reduce fire risks. Reinhardt and others (2010) reported that the removal of excess biomass affects subsequent fuel dynamics and fire potential, influencing the intensity and severity of subsequent fires. Their conclusion was that fire characteristics depended on the nature of the treatment, as well as time since treatment. Biomass removal decreased fire potential in the short term, but not always in the long term.

Concluding Observations on Forest Sustainability

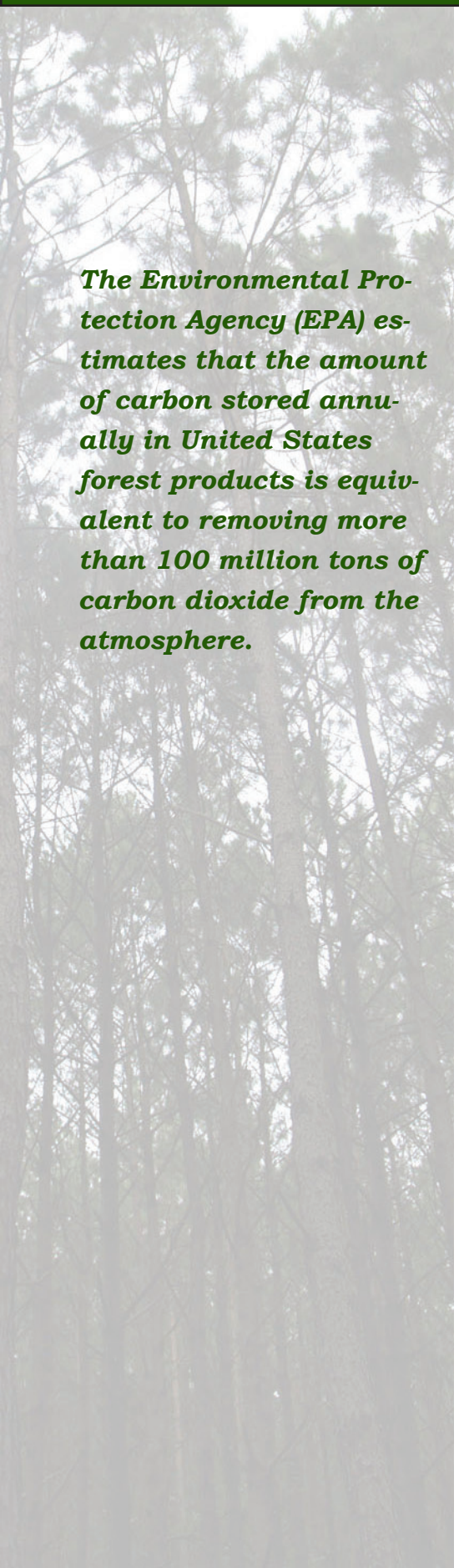
Certification, state BMPs and other safeguards provide the United States with one of the most stable and legally secure forest tenures in the world. Forest landowners and managers operate within a well-established framework of federal and state laws, regulations, and BMPs, as well as private sector sustainability programs. These provide a variety of highly tailored management tools, including state environmental review and permitting laws, credible certification systems, effective state forestry programs, habitat conservation plans, conservation program participation, and other federal, state, and private sector related measures that help assure the sustainability of soil, water, wood inventories, and species diversity over time. These tools give forest landowners and managers a variety of ways to demonstrate local sustainability to the public, resource agencies, and the investment community.

Andrew J. Boone, South Carolina Forestry Commission, Bugwood.org

As forests are asked to provide more services, it is important that the nation strive for efficiency in the use of wood. More energy can be produced by a smaller increase in wood output if the uses are more efficient. The economics of other renewable technologies will limit the use of wood for electrical generation, and virtually all state renewable portfolio standards include maximum incremental amounts that utilities must pay for renewable sources. In transportation fuels, there will always be fossil alternatives that limit price. Any mandate or incentive put in place by public policy can always be altered or rescinded if sustainability of the resource is threatened. There are mechanisms in place that provide feedback on sustainability, such as the RPA, Forest Inventory & Analysis system, and periodic sustainability reports; the use of approved management plans; and voluntary certification programs.

Last, but not least, managing for sustainability includes managing forest biomass at proper levels of inventory to retain multiple benefits. If and when significant markets develop for biomass, they could actually provide the necessary incentives to better manage over-stocked forests and forests with high mortality. Thus, healthy forests can be managed sustainably so that they can make positive contributions to the environment and be resilient to a changing climate.

Carbon and Climate Change



The Environmental Protection Agency (EPA) estimates that the amount of carbon stored annually in United States forest products is equivalent to removing more than 100 million tons of carbon dioxide from the atmosphere.

Introduction

Recently questions have been raised about the long-term presumption that energy from woody biomass is carbon neutral, citing concerns that the potential for degrading and clearing natural forests could actually increase atmospheric carbon. Others postulate that forest carbon stocks are always depleted by harvesting but that carbon stock depletion is reversed gradually over a period of years by regrowth of the harvested stands.

Given the differing views on the use of woody biomass for energy, some significant questions relating to carbon and climate change must be explored and answered. What is the role of forests in storing and releasing carbon? How do catastrophic wildfires affect atmospheric carbon levels and climate change? What are the carbon and climate change implications from using wood-based energy compared to the use of fossil fuels?

General Observations on Carbon and Climate Change

Trees absorb carbon dioxide from the air through photosynthesis and store it in the roots, bole, limbs, and leaves of the tree. This process is called carbon sequestration. Sequestered carbon is stored in the forest not only in the trees, but in the soil and the wood debris on the forest floor; carbon is also stored in long-lasting products made from harvested wood.

Carbon storage in forestry is significant. The Environmental Protection Agency (EPA) estimates that the amount of carbon stored annually in United States forest products is equivalent to removing more than 100 million tons of carbon dioxide from the atmosphere. Land use, land-use change, and forestry activities in 2008 resulted in a net carbon sequestration of 940.3 Tg CO_2 eq. and represented an offset of 16% of total United States carbon dioxide emissions, or 14% of total greenhouse gas emissions in 2008 (EPA 2010).Forests in the United States, 57% of which are privately owned, are a net carbon sink, offsetting about 15% of the nation's annual emissions from burning fossil fuels. This amount represents 86% of the carbon sequestered by all land uses.

In forests, changes in carbon stocks depend on rates of harvesting, growth, and mortality at larger spatial scales (typically measured at a national scale). In any given year, carbon stock depletion on harvested stands is offset by carbon accumulation on stands that are not disturbed. Thus, carbon stocks in forests have continued to increase across the nation for decades, despite the ongoing harvesting of trees. Under sustainable management, forest growth exceeds timber harvest across the nation, which results in the accumulation and/or maintenance of stored carbon.

The absolute carbon footprint of biomass energy depends on a variety of factors, including the condition of the forest before harvest (stock, disease, fire), types of forests and their growth and regeneration potential, the products made from the wood harvested, amount of material from the forest used for energy, pre-combustion emissions (conversion, processing, transport), efficiency of the energy conversion technologies, type of fossil fuel (grid mix) replaced, management of the forest after harvest, and the ratio of biomass used for energy to forest growth.

Findings and Discussion on Carbon and Climate Change

- **Working forests have long been recognized as a source of real and verifiable reduction in greenhouse gases and a cost-effective source of industrial greenhouse gas offsets**. The United Nations 2007 Intergovernmental Panel on Climate Change highlights forest management as a primary tool to reduce greenhouse gases, stating "In the long-term, a sustainable forest management strategy aimed at maintaining or increasing forest stocks, while maintaining an annual sustained yield of timber, fiber, or energy from the forest, will generate the greatest mitigation benefit." Research on private forestlands has shown that more intensively managed forests and their products can sequester and store as much as 150% more tons of carbon per acre than less intensively managed forests (NAFO 2010).
- **The EPA has concluded that there is "scientific consensus" that the carbon dioxide emitted from burning biomass for energy will not increase atmospheric carbon dioxide if done on a sustainable basis**. This position is supported by the International Panel on Climate Change, Energy Information Administration, World Resources Institute, and other credible scientific bodies. Wood sources of renewable transportation fuels significantly reduce greenhouse gases when compared to their fossil counterparts. The Department of Energy determined that for every BTU of gasoline replaced by cellulosic ethanol, the total life-cycle emissions that would have been produced from that BTU of gasoline would be reduced by 86 percent.
- **Discussion of carbon and climate change implications must include the relationship between biomass, wildfires, and carbon emissions on public forest lands. In the past several decades, wildfire loss across the continental United States has increased significantly.** One reason has been the over accumulation of biomass because of the decrease in prescribed fire and a lack of harvesting and thinning treatments. Droughts in the West have added to the problem. The resulting wildfires are themselves a large source of carbon emissions. For the period 2002-2006, carbon emissions from the wild and prescribed fires on forests, range land, and agriculture land averaged from 4% to 6% of total human-derived emissions from fossil fuel sources for the same period (Wiedinmyer and Neff 2007). The report concludes that very large wildfires in a severe fire season can release as much carbon as the annual emissions from the entire transportation or energy sector of an individual state.

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Studies have shown that increasing woody biomass accumulations in the forests contribute to the severity of the wildfire and therefore the increased emissions. The underlying causes are the past history of fire suppression, changes in climate, and the lack of fuel-reduction treatments. It is expected that the risk of high severity wildfires in western forests will increase. There are not sufficient appropriations to treat all federal lands and many private landowners have neither the funds nor the markets to provide fuel treatments. Wood-based energy could provide a market-driven reason to reduce the accumulating fuel load for wildfires and make a further contribution to the reduction of carbon emissions.

- **Scientifically sound and credible carbon life-cycle analyses are needed to demonstrate the superiority of using wood for energy when compared to other energy pathways, particularly from fossil fuels**. There is currently spirited debate as to proper carbon emissions accounting from biomass. The long-standing presumption has been that energy from biomass is carbon neutral. However, some recognize no difference between biogenic carbon emissions from biomass and anthropogenic carbon emissions from fossil fuel. Others argue that on a small spatial scale, the removal of carbon from long-term storage in standing inventory represents a carbon "debt" that can only be repaid over an extended time frame. Still others maintain that measuring change on a small spatial scale is not relevant, when carbon stocks continue to increase over a much larger spatial scale. This debate can only be informed by scientific life-cycle analyses of biomass carbon, conducted by credible scientific organizations over large spatial scales using various feedstocks (roundwood vs. residuals) for different species of trees and landscapes, and considering appropriate timeframes.

Concluding Thoughts and Observations on Carbon and Climate Change

As shown in the section on sustainability, U.S. climate policies need not translate into the degradation and clearing of the nation's forests. Conversely, the additional markets for wood-based energy can lead to the retention and expansion of the nation's forests, and thus more opportunities for carbon capture and storage. Most likely a scientifically sound and credible life cycle analysis over large spatial scales will demonstrate the superiority of using wood for energy when compared to fossil fuels. However, while it is widely accepted that energy from wood has a positive carbon benefit, particularly when compared to fossil fuels, this whole topic area would benefit significantly from large-scale, long-term scientific analyses conducted by credible national scientific organizations.

Policy

Introduction

There are a large number of recent laws and regulations that lay out a patchwork of mandates, incentives, and barriers to the use of woody biomass for energy. This collection of sometimes conflicting legislation represents the current "policy" with respect to wood-for-energy. The more significant national policies include the:

- Biomass Research and Development Act of 2000 (Biomass Act) [Pub. L. No. 106-224]
- American Jobs Creation Act of 2004 Energy Policy Act (EP Act) of 2005
- Energy Independence and Security Act (EISA) of 2007
- Food, Conservation, and Energy Act of 2008(Pub. L. 110-246)
- American Recovery and Reinvestment Act of 2009
- Prevention of Significant Deterioration/Title V Greenhouse Gas Tailoring Rule proposed by EPA

General Observations on Existing Policies

Clearly, energy and carbon policies can have dramatic economic impacts as well as energy and environmental impacts. A recent study completed by English and others (2010) on the implications of energy and carbon policies on agriculture and forestry demonstrates this economic impact. Using the EISA renewable fuel standard (RFS) and the proposed 25 percent renewable energy standard (RES), they projected significant economic impacts to agriculture and forestry. The RES could generate $14 billion in accumulated additional revenues for agriculture and forestry. An RFS and a RES would also increase the demand and production of dedicated energy crops for biomass feedstocks without significant changes to cropland use and commodity prices. There would be shifts to more intensely managed pasture land. Forest residues, thinnings, and tree harvest would play a significant role in meeting feedstock demands. The impact of an RES on the total economy, according to the study, is an additional $215 billion of economic activity, more than 700,000 jobs, and $84 billon to the nation's gross domestic product (GDP). Similarly positive economic benefits occur if carbon payments are included in the RFS and RES. Under the RFS, RES, and carbon payment scenario, the net returns to agriculture climb to $57 billion above what the RFS is expected to generate alone. The national impact is the addition of $226 billion in economic activity, another 800,000 jobs, and $87 billion to the nation's GDP.

Concluding Thoughts on Policy

The Wood-to-Energy Work Group offered up the following policy recommendations to help guide policymakers toward reasonable long-term approaches to the use of wood for energy.

Clearly, energy and carbon policies can have dramatic economic impacts as well as energy and environmental impacts.

- **Set realistic renewable energy goals with properly designed and scaled mandates and incentives**. Production mandates for renewable energy, along with accelerated timetables, will create significant new demands for the existing, and as of yet underutilized, supplies of woody biomass. Provided sufficient time, realistic mandates and proper incentives send market signals to private and public land managers that increasing supply is an investment that will be rewarded; they will respond accordingly. Incentives can be used to establish and track the pace of increasing demand for woody biomass, with feedback to policymakers such that, over time, supply can respond to demand and the two can move in concert. Unrealistic short-term mandates, coupled with large fixed incentives, can upset the balance of wood products, carbon management, environmental services, and energy necessary for long-term acceptance by the American public and its policymakers.
- **Treat all biomass energy facilities the same, regardless of age**. Existing and new bioenergy facilities provide the same services in terms of converting wood into useful energy as an offset to fossil fuels, as has been done for decades in the forest products industry. Wood currently comprises nearly one-half of all renewable energy in the United States, with approximately three-quarters coming from forest products manufacturers. With bioenergy development at all scales on the horizon, existing bioenergy facilities should not be placed at a disadvantage against new entrants in terms of tax incentives or renewable energy production credits. Likewise, the incentives for wood-based energy production should be at least on par with other renewable technologies (wind, geothermal and solar) in the context of an RES or tax policy, as woody biomass alone has an ongoing fuel expense.

DOE NREL

- **Keep forests as forests. Investment in forestlands has lagged for more than a decade as traditional markets have disappeared or been captured by imported wood products**. This, in turn, has made forest ownership less economically competitive with other land uses in parts of the country. A key legislative goal should be to keep forests as forests by creating the proper incentives. With sustainability as an overarching principle, the use of wood for renewable energy can be a key driver in not only expanding the supply of biomass for energy but also sustaining the nation's forestland-base and the myriad environmental services provided.
- **Increase domestic supplies of wood**. The domestic supply of wood can be increased substantially on public and private forestlands without impairing the productive capacity of these lands or degrading the varied environmental services they provide. There are many ways to achieve this goal. Private forests can increase production per acre substantially using management techniques such as commercial and precommercial thinning, fertilization,

interplanting, and the use of improved planting stock. Reforestation, afforestation and, where appropriate, the use of short rotation woody crops on marginal agricultural lands can greatly contribute to biomass supply on both short- and long-term horizons. The intensification of management on operable private land through the application of fertilization, improved genetics, and other science-based tools reduces pressures on wetlands, other forests, and sensitive sites.

The biomass market also presents significant opportunities to benefit public forestland. The harvest of woody biomass can offset the cost of restoration and wildfire prevention, while simultaneously addressing insect and disease problems and the oversupply of small trees and brush that have built up over decades. Removal of this excess vegetation often leads to a doubling, or more, of total wood yields per acre. These potential supply increases are so large that the nation need not consider entering public lands that have been administratively or legislatively set aside to preserve unique or sensitive values, unless the management plan for those areas concludes that those values could actually be enhanced or preserved by treatment and can be accomplished within established legal guidelines.

New England Wood Pellet

- **Ensure sustainability in all uses of wood**. Sustainability is a "given" when future forest uses and levels are discussed by knowledgeable parties. Within the forest sector, legal and socio-economic frameworks exist that encourage sustainable forest management on public and private lands. These established frameworks must be recognized and considered explicitly in the evaluation of biomass policy options.

  Bioenergy facilities, in partnership with the harvesters and suppliers of biomass and state resource agencies, should be responsible for sustainable procurement practices consistent with the legal and regulatory framework of the applicable state(s). Of necessity, very small installations, such as an institutional heating system, could be exempt from this requirement. A sustainable procurement process should be based upon regional conditions so as to take into consideration the nation's many different forest types. This process can likely rely on information and guidance provided by state forestry agencies.

  The demonstration of local sustainable procurement by the project developer in partnership with biomass harvesters and suppliers and the state resource agencies is one of two levels of sustainability assessment. The second is a national demonstration of forest sustainability as a combined source of woody biomass, traditional wood products, and environmental services. This "three-legged stool" must not be allowed to develop one short leg as energy use expands. The primary tool for demonstrating sustainability is an enhanced Forest Inventory & Analysis system administered by the U.S. Forest Service in conjunction with review and input from many diverse collaborating parties. This tool must be able to demonstrate forest sustainability at national and landscape scales as well as provide insight into the carbon balance of this path.

- **Reward appropriate scale and efficiency**. All wood energy is local, and energy facilities should be scaled appropriately to ensure sustainability of the local natural resources and the marketplaces in which the facilities operate. For example, with fuel transportation cost a major issue in the expanded use of biomass, a series of smaller distributed facilities may be more appropriate, particularly if done on a combined heat-and-power, or heat, power and biofuels basis, whereas other locations may have the resource capability to support larger facilities strictly for electricity generation or liquid biofuels production. Existing facilities should be incentivized to begin or expand their on-site use of wood for energy in order to leverage existing resources, accelerate wood energy production, and efficiently utilize capital resources. In addition, incentives should ensure that opportunities for small-scale production, down to the individual homeowner, are not overlooked as these may be the most efficient use of the wood resource. Incentives should be structured in a way that is neutral with respect to the energy technology pathway and reward efficiency in the use of the wood resource. The incentives should be placed at levels that bring substantial quantities of new wood fiber into the marketplace and thus result in the increase of supply for all users.

  Incentives for the use of wood on a combined heat-and-power (CHP) basis should be supported. With major new demands for wood-based energy, helping wood supplies go further in offsetting fossil fuel use through enhanced efficiency is an important national objective. If one of the pathways selected to increased wood use is a national RES, then a logical addition to that program is the awarding of renewable energy certificates for the electrical equivalent amount of thermal energy used in CHP applications. This likely is the best incentive for developers to pursue CHP opportunities. Where efficiency enhancements are reasonably available through CHP, policy should attempt to capture them. It would be counterproductive to require minimum efficiency standards for participation, however, as that could lead to no development in areas with excess fuel, but with no realistic CHP opportunities. Rather, project developers can be encouraged to look for CHP applications, where appropriate, in order to increase wood use efficiency. Incentive programs put in place for use of woody biomass in each energy pathway should also encourage energy efficiency in the use of capital. The principle of the most fossil fuel displacement with the least capital assets should be encouraged.

Darlene Robbins

- **Maintain a simple, consistent definition of biomass**. Biomass has been defined in recent policies and legislation in conflicting ways. When sustainability issues are addressed locally and nationally, and carbon impacts are scientifically addressed, a simple scientific definition of biomass is preferable. Attempting to incorporate sustainability and carbon language into a scientific definition of biomass is problematic. It will slow progress towards the goals of expanded biomass energy and wood supply, wood for traditional uses and an expanded suite of environmental services. We should, as a nation, assure ourselves that our resource use is sustainable, that we are fully accounting scientifically for the carbon footprint of wood energy, and thus allow for a simplified

definition of the wood that qualifies to be counted in various programs.

The definition agreed upon in future legislation establishing goals, incentives, and other programs must, however, respect those public lands that have been previously set aside or will be in the future due to unique characteristics and values (wilderness areas, historic parks).Biomass removal in such reserved areas should be permissible only when the approved management plan for the area calls for biomass removal as a means to accomplish the goals of the reserved area (e.g. protection from fire, habitat improvement, and forest restoration).

- **Achieve reliable carbon accounting for all energy sources, including wood**. A reliable carbon accounting system must use scientifically sound and credible life-cycle analyses for various categories of energy sources, conducted by a qualified third party (such as the National Renewable Energy Laboratory, U.S. Department of Agriculture, or universities).This accounting system should not be the responsibility of the individual landowner or developer, but take place at a national scale for the entire category of wood-based energy. Such scientifically sound and credible life-cycle analyses should clarify where and how wood energy can play a valuable role in carbon emission mitigation as compared to other energy pathways, particularly when combined with opportunities to sequester and store carbon in both long-lived wood products and in the standing wood inventory. Given the number of narrowly focused studies performed recently, the need for immediate broad categorical studies is critical to carbon policy decisions.
- **Maintain accurate feedback mechanisms on the use of forest resources over time**. As the use of wood for renewable energy evolves, the need for information and feedback regarding the sustainability and carbon balance of biomass feedstocks is crucial. The incentives and programs to emerge from policy decisions will maintain credibility and appropriate support and direction only by using current and verified wood inventory data. Continued adequate investment in developing such databases is critical. For instance, as forest landowners respond to market signals and increase investments in forest productivity, it is imperative to know the effectiveness of these investments over time.

  A major functional tool in this regard is the Forest Inventory & Analysis system administered by the U.S. Forest Service in collaboration with numerous national, state, and private organizations. When maintained and further enhanced to focus on carbon management, this system provides the necessary data and feedback to make informed national energy and carbon policy decisions regarding the pace and outcome of using wood for bioenergy. As such, Congress should make the continued operation and enhancement of the Forest Inventory & Analysis system a funding priority.

  In addition, state environmental review and permitting laws, credible certification systems, effective state forestry programs, habitat conservation plans, conservation program participation, and BMPs also serve as effective feedback mechanisms to help assure sustainability on private forestlands.

Epilogue

When addressing the role of agriculture and forestry in renewable energy production, the 25x'25 Alliance has always adhered to the philosophy of "yes if" rather than "no because." "Yes," woody biomass can be an important feedstock for renewable energy "if" we are willing to:

- Take the necessary steps to ensure that the use of biomass occurs in a wise and sustainable manner with appropriate feedback mechanisms
- Choose the most efficient uses for wood in producing energy
- Take the necessary steps to restore our private and public forestlands to reach their productive potential for wood as well as the many other benefits they provide to society
- Invest in research and technology development

Our forests and the woody biomass they produce can be sustainable for energy and traditional forest products, as well as myriad other public uses and benefits. The use of wood for energy, far from decimating our nation's public and private forestlands, should be considered an opportunity to enhance and expand both the extent and productive capacity of those forestlands.

Stephen Jolley

Appendix A.

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Appendix B.

Wood Demand and Supply Forum Topics and Speakers

January 2010

Forum Organizer – Bob Emory, Weyerhaeuser Company

Energy demand outlook for the United States.
Marie LaRiviere, Analyst, U.S. Department of Energy, Energy Information Agency, Knoxville, TN.

2010 RPA supply/demand analysis.
Dr. David Wear, Project Leader, USDA Forest Service, Washington, DC

"Billion-Ton" study update.
Dr. Robert Perlack, Lead Analyst, Oak Ridge National Laboratory, Oak Ridge, TN

Wood energy and forest sustainability.
Dr. V. Alaric Al Sample, President, Pinchot Institute, Washington, DC

A developing bioenergy market & its implications on forests and forest products markets in the U.S.
Dr. Mike Clutter, Dean, Warnell School of Forestry, University of Georgia, Athens, GA

Viability of pending of wood-to-energy projects in the southeastern U.S.
Brooks Mendell, President, Forisk Consulting, Inc., Athens, GA

Increasing wood growth and biomass yields from non-intensively managed forests.
Neil Sampson, President, The Sampson Group, Alexandria, VA.

Increasing wood growth and biomass yields on current and future forests through intensive forest management.
Dr. Eric Vance, Project Manager, National Council on Air and Stream Improvement, Raleigh-Durham, NC

The role of short rotation forestry in producing feedstock to meet U.S. biomass energy needs.
Jake Eaton, Director of Global Acquisitions and Resource Planning, GreenWood Resources, Inc., Portland, OR

Increasing wood yields via genetics and breeding.
Dr. Maude Hinchee, Chief Technology Officer, ArborGen, LLC, Summerville, SC

Appendix C.

Sustainability Forum Topics and Speakers

April 2010

Forum Organizer – Michael Goergen, Society of American Foresters

Stage Setting: Sustainability - The issues and the opportunities.
Dr. Virginia Dale, Director for BioEnergy Sustainability, Oak Ridge National Laboratory, Oak Ridge, TN

Panel 1: Biomass for energy - Managing for long-term soil productivity and sustainability.

Managing for long-term soil productivity in natural forests.

Dr. Andy Scott, Research Soil Scientist, Ecology and Management of Southern Pines, Southern Research Station, U.S. Forest Service, Normal, AL

Managing for long-term soil productivity in intensively managed forests.

Dr. Howard Duzan, Forestry Research Team Leader, Weyerhaeuser Timberlands, Columbus, MS

Panel 2: Biomass for energy – Managing for water quantity and water quality.

Options to achieve water quality and quantity goals as part of forest management for bioenergy.

Dr. George Ice, Principal Scientist, National Council for Air and Stream Improvement, Inc., Corvallis, OR

Managing water quantity and water quality on intensively managed forests.

Dr. Jami Nettles, Forest Hydrologist, Weyerhaeuser Timberlands, Columbus, MS

Panel 3: Biomass for energy – Managing for biodiversity in natural forests and forest plantations.

Rob Olszewski, Vice President, Environmental Affairs, Plum Creek Corporation, Atlanta, GA

Paul Trianosky, Director of Forest Conservation, Eastern Division, The Nature Conservancy, Mountain City, TN

Dr. Tim Volk, Professor, State University of New York, Syracuse, NY

Panel 4: Biomass for energy – Managing for social and economic sustainability.

Robert Fledderman, Manager, Emerging Issues, Corporate Safety, Health and Environment Department, Mead Westvaco Corp., Richmond, VA

Tom Deponty, Director, Public Affairs, ADAGE, Bethesda, MD

Dr. Dennis Becker, Asst. Professor, Department of Forest Resources, College of Forestry and Natural Resources, University of Minnesota, St. Paul, MN.

Panel 5: Biomass for energy – Strategies for insuring forest sustainability.

John Heissenbuttel, President, Phoenix Strategic Solutions, Inc.

Bob Perschel, Northeast Region Director, Forest Guild, Sutton, MA

Nathan McClure, Chief Forester, Forest Utilization Department, Georgia Forestry Commission, Dahlonega, GA

Allison Welde, Director, Conservation Partnerships & Communications, SFI, Inc. , Washington, DC

Appendix D.

Carbon and Climate Change Forum Topics and Speakers

April 2010

Forum Organizer – Jimmie Powell, The Nature Conservancy

Stage Setting and Overview – The role of U.S. forests, forest production, and forest products in the global carbon cycle.
Dr. Richard Birdsey, U.S. Forest Service

Panel 1: Projections on changes in land-use and carbon stocks/flows resulting from the increasing use of biomass for energy and proper accounting for land use change emissions in climate protection regimes.

Dr. Daniel G. De La Torre Ugarte, University of Tennessee

Steve Hamburg, Environmental Defense Fund

Life cycle assessment and accounting for carbon in forests, forest production, and forest products under proposed climate change and bioenergy policies.

Reid Miner, M.S. Chemical Engineering, National Council for Air and Stream Improvement, Inc., Research Triangle Park, NC

Panel 2: Energy pathways and technologies and their impacts on net carbon emissions.

Neal Rossmiessl, U.S. Department of Energy

Greg Morris, Green Power Institute

Dr. Michael Wang, DOE-Argonne Laboratory

Panel 3: Forest management systems for the production of renewable energy and global carbon management.

Wood energy and… carbon management: meeting the challenge.

Dr. Marilyn Buford, National Program Leader for Silvicultural Research, U.S. Forest Service

Dr. David Ganz, The Nature Conservancy

Short-rotation woody crops: greenhouse gases and land ownership.

Dr. Tim Volk, State University of New York

Panel 4: Carbon neutral strategies for agriculture and forestry in an uncertain policy environment.

Dr. Jeffrey Frost, Agrifresh, Inc.

Bill Carlson, Carlson Small Power Associates

Appendix E.

Policy Forum Topics and Speakers

July 2010

Forum Organizer – Charlie Niebling, Biomass Thermal Energy Council

Current issues in federal biomass energy policy.
Bill Imbergamo, Majority Staff, Senate Agriculture Committee

A vision for federal energy policy as it relates to biomass.
Chris Recchia, Executive Director, Biomass Energy Resource Center

Panel: Leaders of major biomass energy trade organizations and NGO interests respond to vision presented by previous speaker.

Robert Cleaves, Biomass Power Association

John Ackerly, Alliance for Green Heat and Biomass Thermal Energy Council

Ben Larson, Union of Concerned Scientists

Eric Myers, Duke Energy

About 25x'25

25x'25 is a diverse alliance of agricultural, forestry, environmental, conservation and other organizations and businesses that are working collaboratively to advance the goal of securing 25 percent of the nation's energy needs from renewable sources by the year 2025. 25x'25 is led by a national steering committee composed of volunteer leaders. The 25x'25 goal has been endorsed by nearly 1,000 partners, current and former governors, state legislatures and the U.S. Congress through The Energy Independence and Security Act of 2007.

25x'25 is a special project of the Energy Future Coalition, a broad-based non-partisan public policy initiative that seeks to bring about change in U.S. energy policy to address overarching challenges related to the production and use of energy. The Energy Future Coalition is organized as a project of the Better World Fund, which acts as its fiscal agent. The Better World Fund is a tax-exempt organization under section 501(c) (3) of the Internal Revenue Code and shares a common board of directors with the United Nations Foundation.

For more information, please go to the 25x'25 Website at www.25x25.org.

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