Sustainable Forest Biomass: Promoting Renewable Energy and Forest Stewardship

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Executive Summary

Woody biomass from forest management is a renewable, low-carbon feedstock that can substitute for fossil fuels in the production of energy and other products — a potentially important tool in the national strategy to reduce greenhouse gas emissions and resist global climate change. Markets for logging residues, small diameter trees, and other low-value forest products can add value to working forests, help provide financial alternatives to land clearing and development, and create incentives for investing in sustainable forest management. Forest thinning and removal of small-diameter, low value trees are integral parts of forest management for a number of values and objectives — biodiversity conservation, ecological restoration, wildfire prevention, and timber stand improvement. However, there is also the potential for increased demand to drive unsustainable levels of harvesting, with negative consequences for biodiversity, soil, and water conservation. Federal policies should strive to ensure the *sustainability* of woody biomass harvesting; this will go a long towards winning the public trust that is so essential if bioenergy is to be become a trusted and utilized component of the national energy system.

Although sustainability should be a cornerstone of federal biomass policy, it is important that federal laws and programs do not include highly prescriptive (or proscriptive) rules for where biomass can be harvested, for what purposes, or in what quantities. The United States possesses a huge diversity of forest types, representing a wide variety of ecological conditions and managed for an array of social values and objectives. A sound management prescription for one forest could be wholly inappropriate for another (even, at times, a few miles away). Instead, federal policies must promote informed site-level decision making that views biomass harvesting as one tool among many for achieving holistic forest stewardship objectives. Management plans, harvesting guidelines, conservation easements and collaborative decision making are important tools for developing creative and sustainable management directives, as well as ensuring that biomass harvesting will contribute to maximizing the full spectrum of ecological and social values that forests provide.

Despite the many benefits of woody biomass, the costs associated with harvesting, transporting, storing, and utilizing the material often exceed its value on the energy market. Some of this is due to the fact that the lower ticket price of fossil fuels does not include the negative social costs associated with climate change, and more cost-effective tools, equipment, and logistical processes are currently being developed. In the meanwhile, federal incentives are available that improve the economic feasibility of bioenergy projects. These incentives are costly, and can create unintended distortions in wood-fiber markets, but they will likely continue to be a part of federal energy policy for some time. In order to get the most from limited biomass feedstocks, it is preferable that these incentives treat all biomass applications (electricity, transportation fuels, thermal energy, and biobased products) equally, in proportion to the efficiency with which they reduce greenhouse gas emissions and substitute for high-carbon petroleum products. Federal policies also have an important role to play in promoting research and furthering the science of sustainable bioenergy. R&D programs, resource assessments, and extension funding are essential to realizing the full potential of woody biomass as a renewable, low-carbon energy source. Such investments will help ensure that woody biomass utilization will contribute to healthy, diverse forest ecosystems.

Introduction

Global climate change is widely seen as one of the greatest environmental problems facing the 21st century (Brown 2008, MacCracken 2008, Hansen et al. 2006). The impacts resulting from this period of profound change are beginning to be felt and will affect the entire globe, every ecosystem, every nation, and every human endeavor (Stern 2006). What is more, the speed and scope of these changes may be unprecedented in human history (Greene et al. 2008). Scientific consensus points to emissions of greenhouse gases, largely from the burning of fossil fuels, as the primary culprit behind this problem (IPCC 2007). If we wish to reduce atmospheric concentration of greenhouse gases, it will be essential that we move immediately to begin replacing fossil fuels with renewable energy resources (MacCracken 2008).

One such renewable resource is biomass, particularly woody biomass from land clearing, landscaping, industrial byproducts, and especially our nation's abundant forest resources. Wood is one the oldest energy sources and one that has remained in constant use throughout the modern era, despite the widespread adoption of fossil fuels. According to the Energy Information Administration (2008), the United States consumed 3.6 quadrillion Btu of biomass energy in 2007 or 3.6% of total energy consumption in that year. Of this total, 2.2 quadrillion Btu were generated from wood fuels - an amount only slightly less than the contribution from hydropower (2.5 quadrillion Btu). Moreover, EIA's number does not include all of the localized and small-scale uses of woody biomass. Wood can serve as a substitute for fossil fuels in many applications, including the production of electrical power, heat, liquid transportation fuels, and a number of other chemicals and products. Not only is wood a ready substitute for fossil feedstocks in these applications, but it is a renewable, low carbon resource (Domke et al. 2008). If developed carefully, this resource can contribute substantially to the renewable energy portfolio in the United States, aid in the efforts to halt global climate change, revitalize rural economies, and, most importantly, provide a valuable tool for sustainable, science-based stewardship of our diverse forests and woodlands for a full range of environmental and social values. However, if developed incorrectly, there is a risk that expanded markets for woody biomass will encourage overharvesting and other bad management practices, leading to nutrient depletion, soil damage, and loss of biodiversity and forest complexity.

Founded by a bipartisan Congressional caucus, the Environmental and Energy Study Institute (EESI) is a non-profit policy think tank and congressional outreach organization working on policies related to climate change, renewable energy and energy efficiency, and sustainable communities. Over the past two years, EESI has undertaken a project to assess the state of woody biomass utilization and to develop a suite of policy recommendations intended to promote woody biomass as part of the sustainable forestry paradigm. To this end, we have brought together a diverse group[1] of foresters, researchers, NGOs, and civic officials, as well as those involved in the production of wood-based energy and biobased products, to participate in a discussion series on sustainable forest biomass. Through a series of focused conference calls, this group has discussed a number of issues relating to the future of woody biomass, especially the potential for these industries to complement and facilitate sustainable forest management.

To synthesize and build upon the information gained from the discussion series, we developed a structured research methodology to help focus our investigations. We began with a literature review including peer-reviewed papers as well as government publications and other pieces of the gray literature. Biomass technologies are a rapidly emerging field, however, and there is a great wealth of experience and understanding not yet encapsulated in the literature. To get at this knowledge we developed a series of stakeholder questionnaires designed to elicit pointed information from key stakeholders. The questionnaires were administered to a group of stakeholders and experts (including discussion series participants) as well as members of the Woody Biomass Utilization Group (Woody BUG), a federal interagency working group comprised of representatives from those federal agencies involved in woody biomass utilization, such as the U.S. Forest Service, the Department of the Interior, and the Environmental Protection Agency. A number of follow-up interviews and additional research helped to crystallize information gained through the questionnaires. The results from the discussion series, the literature review, and the questionnaire process shed light on the most current issues facing forest bioenergy today and provide a basis for guiding the development of effective federal policies to promote a thriving and sustainable use of woody biomass.

[1] This group contained a number of state foresters, private foresters, conservationists, forest scientists, research faculty, industry representatives, representatives of the private sector, members of state and federal government agencies, community development professionals, engineers and other technical experts. In addition, the network was deliberately overlapped with a similar network developed by the Pinchot Institute for Conservation.

This paper serves two purposes. First, we have attempted to identify the major opportunities and issues associated with the use of woody biomass from forests as a renewable substitute for fossil fuels in the production of electricity, thermal energy, liquid fuels, and biobased products. Secondly, we provide a suite of policy recommendations that we feel will direct the growth of these technologies in a way that will contribute substantially to the renewable energy portfolio in the United States, address public concerns over global climate change, revitalize rural economies, and, most importantly, improve sustainable, science-based stewardship of our diverse forests and woodlands for a full range of environmental and social values.

EESI's primary audience is the United States Congress. To best serve this audience, we have focused this paper on the policies and situations most relevant to national policymaking. However, many of the issues, conditions, and recommendations identified in the paper also have relevance at state and local levels, as well as to federal agencies. Decision makers at these levels form an important secondary audience. From national to local venues, strong leadership is needed to ensure that woody biomass is able to play an important role in meeting our combined needs for affordable renewable energy and productive forest ecosystems.

Background

The discussion series, the stakeholder questionnaires, and the literature provided insight into the key issues that stakeholders and experts feel will be of the greatest importance in the development of bioenergy from forest biomass. These are the broad issues that will be most instrumental in determining the feasibility of expanded bioenergy as well the willingness of society to embrace this technology.

Sustainability was found to be the most important issue for an overwhelming majority of stakeholders. These individuals considered it of paramount importance that the use of forest biomass does not adversely impact biodiversity, ecosystem integrity, forest soils, or water resources. Furthermore, many felt that it would not be enough to simply avoid doing harm - forest biomass must be developed as a positive tool for achieving forest stewardship objectives such as habitat management, hazardous fuels reduction, forest restoration and other activities intended to improve forest structure or ecological function. Most of the stakeholders with whom we talked felt confident that biomass utilization could and would be used in this way. On the other hand, a small number of individuals felt that biomass harvesting is not a necessary management tool and that increased harvesting poses a great risk to a number of forest values, including biodiversity, recreation, water quality, and wildlife habitat. Although they acknowledged that biomass harvesting could be useful to meet some specific management objectives, these individuals felt that the risks of harm involved in biomass harvests outweigh any potential gains.

Many stakeholders identified a number of forest types and ecosystems where they felt biomass harvesting should be excluded. Old growth forest and lands designated as wilderness were particularly common responses (although many of these lands are by law already off-limits to harvesting). In addition, stakeholders listed wetlands, public forests, national parks, roadless areas, and forests containing rare or endangered elements of biodiversity. In many other instances, such as wildlife refuges, stakeholders felt that the appropriateness of biomass harvesting would need to be determined on a case-by-case basis. A small number of stakeholders felt that biomass harvesting could be an appropriate and valuable tool on most or all forests. Overall, however, there was a strong consensus that biomass harvesting should be limited to those forests where it will complement and improve the functional integrity of the ecosystem.

The distinction between privately and public-owned forests was an important one for many stakeholders. Several individuals expressed the feeling that greater restraint should be exercised in promoting biomass utilization on public lands, such as national forests, wildlife refuges, and lands managed by the Bureau of Land Management (BLM). These individuals felt that biomass harvesting should be pursued less aggressively on these lands or avoided altogether. They drew attention to the fact that these are common resources managed in trust for all citizens, and that biomass harvesting

could conflict with public objectives for water quality, wildlife habitat, and recreation. In contrast to this, however, the majority of stakeholders felt that biomass could (and, in many cases, should) be harvested on both public and private forests wherever this activity would complement local management objectives and ecological conditions. In either regard, most stakeholders see private landowners as being under less of an obligation to the public good. In fact, a small number of respondents went so far so as to express the feeling that sustainability concerns should not impede a private landowner from pursuing biomass harvesting in his/her forests. These issues are at core philosophical property rights issues, but they will have a strong effect on how sustainability efforts will be viewed.

Best management practices (BMPs), sustainability standards, silvicultural guidelines, and forest certification systems were widely seen as being important tools to ensure sustainable use of forest biomass (Kelty et al. 2008, Robertson et al. 2008, Evans and Perschel 2009). These systems all provide specific direction to land managers and most include some form of objective performance measures, as well. There is a lot of variability among these tools, however, when it comes to the level of detail, scientific rigor, applicability and enforceability. Some stakeholders felt that voluntary guidelines, such as those included in the Minnesota Forest Resources Council's Forest Management Guidebook (Minnesota Forest Resources Council 2007), would be sufficient to ensure sustainable management. Others felt the need for a certification system predicated on third-party oversight, such as Forest Stewardship Council (FSC) certification. In either respect, it is clear that science-based standards are seen as a fundamental component of any strategy to ensure truly sustainable use of forest biomass.

It is important to point out, however, that sustainability encompasses more than just sustainable land management. Many stakeholders also insist that bioenergy facilities be held to rigorous standards when it comes to air emissions and water pollution. The climate change ramifications of using forest biomass are seen as being of primary importance, especially as bioenergy and other renewable energy sources are being touted largely as a climate change solution. In this regard, it is key that the use of forest biomass not impair the ability of forested landscapes to sequester carbon or result in substantial carbon losses from standing biomass or forest soils. Woody biomass provides a renewable substitute for fossil fuels, but against this must be weighed the carbon emissions incurred during production from the use of heavy equipment and petroleum fuels, as well as from the removal or decomposition of vegetation (Finkral and Evans 2007, Morris 2008, Domke et al. 2008). For woody biomass to be seen as a sustainable source of renewable energy, it must be demonstrated to have a net low or no carbon impact.

After sustainability, the issue of greatest importance to most stakeholders is the economics of using forest biomass. Many forest managers see biomass markets as an opportunity to offset the high costs of timber stand improvement (i.e., pre-commercial thinning) and forest stewardship activities, such as habitat restoration or hazardous fuels reduction. Others see biomass becoming an important revenue stream for forest landowners. This additional revenue could become an important part of strategies seeking to add value to working forests with the intention of slowing the rate of development and urban sprawl. Unfortunately, the high costs associated with the harvest, collection, and transport of biomass often renders bioenergy noncompetitive compared to fossil energy and other renewables (Hummell and Calkin 2005, Li et al. 2006). These costs increase with longer transportation distances, rough terrain, inappropriate harvesting equipment, and operator inexperience with biomass harvesting. Additionally, costs associated with thinning of small-diameter and low grade trees are higher than those associated with collecting slash and logging residue. All in all, the real or perceived inability to harvest biomass cost-effectively is seen by many stakeholders as the biggest barrier to greater use of bioenergy (GAO 2006).

There are, however, quite a number of examples of projects where biomass harvesting has proven cost-effective (Han et al. 2008, Arnosti et al. 2008). These have tended to be projects where haul distances were short, operating conditions were ideal, appropriate harvesting equipment was available, and in which biomass was being harvested simultaneously with higher value wood products. Even these situations, though, have generally been profitable only within a very narrow

margin. These margins are gradually improving, however, as more effective harvesting methods and appropriate-scale, purpose-built equipment are being developed. Technologies for the collection, storage, and conversion of biomass into energy also are rapidly being improved. For example, a flurry of research is gradually bringing down the price of cellulosic ethanol to where it could approach that of conventional ethanol (BRDI 2008). Torrefaction (essentially 'roasting') of wood is being developed as a way to reduce the water content, improve combustion chemistry, and increase the energy density of woody biomass – to ultimately rival coal in cost-effectiveness (Bergman and Kiel 2005).

In the interim, stakeholders indicated that federal and state incentives for renewable energy and forest restoration serve an important role in improving the competitiveness of energy from forest biomass. Depending on who receives them, incentives such as tax credits and grants can reduce overall costs and allow energy producers to offer a higher price for feedstocks. Stakeholders also felt that these incentives help correct externalities and provide for public goods that are not provided for in the current marketplace, such as climate change mitigation and forest health. In order for these market signals to be most effective, however, many stakeholders stress the importance of providing a level playing field for *all uses* of woody biomass that achieve intended goals – electric power, heat, and biobased products, as well as liquid fuels (Gustavsson et al. 2007). Without this parity, communities and forest owners may not have the freedom to choose the most appropriate use of their biomass resources. The lack of a federal thermal (i.e. heating and cooling) incentive is often mentioned as a particularly troublesome omission in this regard, leaving out many communities with need for small-scale renewable heating but no markets for biopower or biofuels.

An economic issue of importance to many stakeholders is wood fiber supply and demand. A number of existing products currently are made from sawdust, wood residues, and low-grade timber, including pulp and paper, animal bedding, oriented strand board (OSB), and a number of other manufactured wood products. Elevated demand from a growing bioenergy sector could increase feedstock costs for these existing industries, closing some of them and driving others overseas. Representatives of these existing industries often express frustration with having to compete against subsidized industries for the same raw materials. Additionally, bioenergy itself could ultimately be priced out of the market if increased demand were to result in wood fiber price spikes. In response to this concern, many in the biopower industry point out that the current industry largely functions as a 'bottom feeder', making use of residues and wastes with no other value in local markets.

From an environmental perspective, many stakeholders are worried that additional fiber demand could drive unsustainable levels of harvesting, especially where two or more wood-using enterprises are aggregated in a small area. Many individuals feel that the most effective way to avert this outcome is to emphasize the importance of appropriately scaled projects. Appropriate scale is determined through careful assessment of the quantity of biomass that the local forest resource can be expected to produce without compromising other values, taking into account existing wood fiber demand. This assessment will aid project developers in understanding exactly how much biomass will be available on a sustainable, annual basis. Careful attention to scale should result in energy applications that are economically viable in the long term and which do not degrade or exhaust the forest resource. For many stakeholders, appropriate scale is synonymous with small scale, particularly as small scale wood energy applications (especially combined heat and power (CHP) systems) can be incredibly fuel-efficient. On the other hand, many small facilities in a given location can generate demand for biomass as great as one or two large ones. Although scale is important, ultimately it is the *overall* fiber demand from a given land base that will determine whether unsustainable levels of harvesting may occur.

A third topic that comes up regularly in discussions with stakeholders is the lack of scientific and practical knowledge about many aspects of using forest biomass for energy. There is a large and well-founded body of knowledge surrounding forest management and ecology, but information is thin on many issues particular to biomass utilization (Hacker 2005). Many of these 'missing pieces' are important from a sustainability perspective. For instance, there have been comparatively few studies on how increased removal of small-diameter trees could impact wildlife habitat, soil structure,

or nutrient cycling. There is strong agreement that research efforts to understand these impacts must be expanded in the near future. In the meanwhile, stakeholders are divided on whether or not to expand bioenergy capacity in the absence of complete knowledge. The majority of stakeholders feel comfortable that we know enough about basic sustainable forest management to move forward, learning and refining our methods as we progress. In contrast, some stakeholders feel that we are missing fundamental pieces of information, without which we risk doing damage to the forest resource. Nor is it only ecological knowledge that was felt to be lacking - stakeholders indicated a fundamental lack of knowledge regarding biomass economics (including reliable supply curves) and practical know-how for forest managers, community groups, and landowners. On the other hand, a number of countries, mainly European, have long been using forest biomass as a substitute for fossil fuels — we should take advantage of their knowledge and experience.

For many stakeholders, especially those in western states, there is a great deal of interest in utilizing biomass from public forests, especially in the context of hazardous fuels reduction, treatment of insect infestations, and other forest restoration objectives. The Forest Service, the Bureau of Land Management, and other federal agencies see commercial demand for low-grade trees as a critical tool in the achievement of national restoration objectives for public lands (Patton-Mallory 2008). There is widespread appreciation among stakeholders, however, for the difficulties involved in accomplishing these objectives on public lands. The size and scope of the issue dictate that public-private partnerships (such as stewardship contracts) and strong commercial demand for biomass will be essential for success. There is not enough money or manpower available within the agencies to achieve restoration objectives on the federal dollar, especially given the increased commitment needed for wildfire control. Many felt that there are a number of issues limiting the success of public-private partnerships (Davenport et al. 2007a, GAO 2008). One of the most cited issues is the difficulty in negotiating multi-year stewardship contracts. Long-term contracts are essential to ensure adequate supply of biomass to bioenergy facilities and other end users. However, existing regulations require agencies to set aside funds in the event of a project's cancellation, a requirement that limits the feasibility of contracts lasting more than a year or two — the so-called 'cancellation ceiling' problem (GAO 2008).

Many stakeholders indicated that the reluctance of federal field personnel is often an effective barrier to public-private partnerships and restoration projects. Stakeholders attributed some of this reluctance to the traditional focus placed on timber production, lack of restoration experience among field personnel, and an ingrained management culture that emphasizes a conventional, 'tried-and-true' management approach. Others suggested that federal operating protocol tacitly encourages field personnel to see public-private restoration projects as carrying too much personal risk. Holding field officers liable for project failures is a strong disincentive to embark on innovative management schemes in a collaborative environment. A number of stakeholders placed the blame on traditional performance metrics based on the value or quantity of wood products harvested as opposed to the number of acres thinned or the number of restoration objectives achieved. As long as management for traditional wood products is seen as being a safer alternative, line officers and field personnel will have an incentive to avoid partnerships and restoration activities.

The issue of public trust is another issue that has enormous bearing on the success of public-private partnerships, as well as biomass harvesting and forest restoration on public lands. Whether implicitly or explicitly, issues of public trust tend to dominate the debate surrounding public land management (McCool et al. 2000). Stakeholder input corroborated this fact. There are many factors that help determine whether a given stakeholder trusts federal agencies to manage public resources responsibly. Personal experience is instrumental in creating (or destroying) trust in those individuals who have experienced public land management firsthand, or even in those who hear about these experiences secondhand (Moote and Becker 2003, Cvetkovich and Winter 2008). More commonly, however, this distrust is predicated on a fundamental disagreement about how public lands should be managed. For many stakeholders, public lands should be managed so as to maintain as far as possible a 'natural' landscape — one that is not directly influenced by human activities. Wildlife habitat, biodiversity, old growth preservation, wilderness protection, water resources, and recreation are felt to be the most

appropriate uses of public lands according to many of those holding this worldview. Commercial logging, road building, mining, grazing, and other economic uses are generally seen as the least appropriate. In contrast, many stakeholders feel that public lands should be managed for a multitude of social, economic, and ecological objectives, including production of wood products, livestock grazing, recreation, and wildlife management. This latter view is often associated with the Forest Service (an early advocate of multiple-use conservation) and other land management agencies, whereas the former is often associated with environmental organizations. Like most issues, however, it is not an either-or situation; most stakeholders fit somewhere on a sliding scale between a strict preservationist viewpoint and one espousing utilitarian conservation. More than ever before, environmental and conservation groups are willing to work with loggers and forest managers to restore historical forest conditions, wildlife habitat, and ecological processes. At the same time, the federal government has taken great strides to give greater consideration to biodiversity, habitat management, old growth preservation, and other non-use values of public forests. Despite this improvement, perception that the federal government does not share the same values as stakeholders is one of the biggest causes and drivers of public distrust.

An excellent example of the importance of public trust is the current focus on hazardous fuels reduction. The Forest Service, BLM, state forestry agencies and other public entities see hazardous fuels reduction as a fundamental component of the national effort to reduce damage from catastrophic wildfires. Using many of the same tools and approaches as commercial logging, federal agencies see intensive (and extensive) thinning as part of an effective solution to a problem and one that will generate beneficial side effects for rural communities in the form of skilled jobs and new products from forest biomass (including bioenergy). On the other hand, a number of environmental groups see hazardous fuel reduction as an unnecessarily intensive and unnatural approach, drawing into question the efficacy of hazardous fuels reduction and even the motive behind its proposal. Some groups have accused the federal government of perpetuating a timber 'give-a-way' under the guise of ecological restoration. To further complicate the picture, hazardous fuels reduction is currently a very active area of research, and there have been many studies that support aspects of both arguments (Kalabokidis and Omi 1998, Pollet and Omi 2002, Odion et al. 2004, Agee and Skinner 2005, Rhodes and Baker 2008). In such an environment, it is not surprising to see an erosion of trust between those who support intensive hazardous fuels reduction and those who support it infrequently or not at all. Stakeholders are divided on this issue, although a majority seems to support hazardous fuels reduction when backed by sound science and used for ecological restoration or to reduce the likelihood of wildfire.

Public trust is an important issue above and beyond the public lands debate. Mistrust of the private sector, the wood products industry, and forest management as an avocation is by no means a rare position among environmentalists. This mistrust can erode support for bioenergy even among those who acknowledge its technical and theoretical potential. This mistrust, whether directed towards federal agencies or the private sector, often finds an outlet in support for restrictive and inflexible legislation. The definition of renewable biomass in the national *Renewable Fuel Standard* (RFS) is a case in point. This definition excludes public forests entirely and attempts to exclude those private forests on which biomass harvesting *might potentially* conflict with other sustainable forestry objectives. Implicit in this approach is a lack of trust for those managing the nation's forests and their abilities to serve as good stewards of the land. Mistrust also frequently finds an outlet in the judicial system. Stakeholders are divided on how effective litigation (or the threat of litigation) is at delaying restoration projects or biomass harvesting, but it is clearly understood that the federal government (as well as many timber companies) spends a substantial amount of time and financial resources in court (Keele et al. 2006).

Fortunately, trust can be improved among agency representatives, industry, environmental NGOs and other stakeholders through collaborative efforts. Collaborations can be invaluable in breaking down barriers between different perspectives and value systems (Moote and Lowe 2007, Evans 2008, Davenport et al. 2007b). Stakeholders who have participated in successful collaborations often report that increased communication and transparency are effective in getting participants to see and respect the many complex issues and values involved in land management projects. Furthermore, a

collaborative environment allows all participants to have their voices heard and to become invested in the process and outcome of the project. Successful collaborations often result in reduced (or absent) litigation and greater community support. Collaborative projects are often more successful as well, as a larger number of participants brings with it a larger sphere of knowledge, skills, and experience. In fact, one of the most consistent indicators of overall success among biomass harvesting and forest restoration projects is good collaboration. Collaborative projects represent a key opportunity to develop sustainable bioenergy projects that are socially acceptable, economically viable, and promote sustainable stewardship of forest resources.

Policy Recommendations

Based on the results of the literature review and the stakeholder input outlined above, as well as extensive outreach to knowledgeable experts, we have identified a number of policy options to promote the sustainable use of forest biomass as a renewable source of energy, while improving the sustainability of forest biomass utilization, and encouraging the use of biomass harvesting as a forest stewardship tool. The policy options are divided into five sections: Forest Sustainability; Renewable Energy Incentives; Bioenergy Incentives; Feedstock Development; and Research, Development, and Outreach.

Section 1 - Forest Sustainability

Sustainably managed forests provide a number of important public benefits, and most stakeholders feel strongly that increased utilization of forest biomass must not detract from biodiversity conservation, ecosystem function, the protection of soil and water resources, or other environmental objectives. In fact, improved markets for woody biomass have potential to reduce costs associated with hazardous fuels reduction, wildlife habitat management, ecosystem restoration, and other proactive stewardship activities. In order to realize the benefits of expanded markets without risk of overharvesting our forests, it is essential that biomass harvesting be incorporated into the existing political framework, practices, and culture of sustainable forestry. Harvest levels, diameter limits, and other specific management practices, however, should not be prescribed at the national level, because of the enormous regional variability in ecology, geography, economics, and political culture, as well as differences in state and local laws. Rather, sustainable forestry is something that must be built from the ground up, through policies that enable thorough risk assessments, make available science-based management guidelines, and incorporate biomass harvesting considerations into programs and policies that promote site-level environmental decision-making in forest management. The following policies will help to install biomass harvesting as one element in a holistic sustainable forestry paradigm, in order to minimize negative environmental impacts and maximize the utility of biomass markets as a tool for achieving stewardship goals.

- **Fund Section 201 (Assessment of Renewable Energy Resources) of the *Energy Policy Act of 2005* (P.L. 109-58).** A high-quality renewable resource assessment that includes woody biomass is an essential prerequisite for assuring sustainability in the context of bioenergy. Without a firm understanding of how much biomass our forests can sustainably produce, it is not possible to be certain that bioenergy mandates and incentives will not drive unsustainable levels of biomass harvesting. Existing assessments encompass only portions of the country (Western Governors' Association 2008, Sherman 2007) or are otherwise inadequate for resolving issues of regional variability or differing management objectives (ORNL and USDA 2005). This assessment should include forest biomass along with other biomass feedstocks and renewable technologies (such as wind and solar), have a regional or state-level resolution, and should include transparent and well-vetted criteria for determining the quantity of biomass that can be removed sustainably (i.e., without harming long-term productivity, biodiversity, soil and water conservation, and ecosystem function) as opposed to a simple physical inventory.

- **Establish a high-quality system of national environmental indicators.** In order to understand how biomass harvesting is impacting overall environmental quality, it is necessary to have in place a rigorous system of environmental indicators that tracks trends in forest condition, water quality, air quality, soil resources, biodiversity,

etc. Without such a system, policymakers are forced to rely on a patchwork of studies and reports (often with inconsistent methodologies) in order to resolve environmental conflicts or to determine the effects of policies. A high-quality information system would provide policymakers with accurate data and trend information to serve as essential context for understanding assessments and policy impacts, much as the national economic indicators have done for understanding economic trends (The H. John Heinz Center III Center for Science, Economics, and the Environment 2008).

- **Expand 'look back' provisions in bioenergy legislation.** Sections 203 and 204 of the *Energy Independence and Security Act of 2007* (EISA, P.L. 110-140) require federal agencies and the National Academy of Sciences to assess and report back to Congress on the impacts of the *Renewable Fuel Standard* on commodity markets, other industries, resource conservation, and a host of additional environmental issues. Although it is important to understand the impacts of particular policies (such as the RFS), there is value in expanding these 'look back' provisions to look at the *combined* impacts of total biomass use — for liquid fuels, heat, power, and biobased products. The final reports should include a thorough assessment of the impacts of additional biomass harvesting on biodiversity, ecosystem structure and function, and soil and water resources. Such an assessment would allow policymakers to monitor the consequences of bioenergy incentives and adapt future policies to correct for unintended consequences. Combined with the resource assessment and environmental indicator network mentioned above, the three would provide a detailed picture of the size of the sustainable resource, the impacts of using it on ecosystems, and the larger environmental context within which it is taking place. 'Look back' assessments could also be tied to waiver provisions or other safety valve mechanisms built into renewable energy mandates, to ensure that mandates are reduced or suspended in the face of environmental harm.

- **Fund the Forest Stewardship Program.** Long-term planning is an essential component of sustainable forest management, and management plans are one of the simplest and most effective tools for ensuring that management activities remain in line with management objectives. A good management plan is a valuable tool for helping to ensure that biomass harvesting complements other long-term stewardship objectives, such as stand improvement, timber management, habitat, biodiversity, and ecological restoration. USDA's *Forest Stewardship Program* provides technical assistance funds through state forestry agencies to help landowners in the process of creating forest stewardship plans. Since enactment in the *Food, Agriculture, Conservation, and Trade Act of 1990* (P.L. 101-624), the program has resulted in the creation of 300,000 management plans covering 35 million acres of private lands. Unfortunately, however, this amounts to less than 2 percent of the lands identified as high priority areas. The program is currently evolving in order to improve its value and effectiveness, using GIS tools to focus on the highest priority landscapes and actively encouraging projects entailing multiple landowners over larger forest landscapes. Program staff also are interested in creatively partnering with existing forest certification and management programs, to help landowners and landowner cooperatives create stewardship plans in conjunction with Tree Farm, Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), and other certification and management programs. Over the last several years, the program has received approximately $30 million per year through the appropriations process. Doubling this amount would help the program expand its efforts, especially in the area of multi-landowner and landscape level planning.

- **Encourage the creation of state-level forest biomass harvesting guidelines.** Management plans may be the cornerstone of sustainable forest management, but effective long-term planning depends on a firm understanding of the effects that particular management activities will have on forest structure and function. Although there is a large and established body of knowledge regarding forest management, there are significant gaps in understanding concerning the effects of removing larger quantities of saplings, brush, small diameter trees and other woody biomass (Hacker 2005). Many states have drafted or are in the process of drafting forest biomass harvesting guidelines (Evans

and Perschel 2009) to give landowners and foresters guidance and understanding regarding suggested management practices unique to biomass removal, or otherwise above and beyond conventional practices. It is very sensible for these guidelines to be written at the state level: it allows greater consideration to be given to regional variations in forest ecology, and it also allows states to tailor guidelines to suit existing forestry regulations in that state. Not every state, however, is currently planning on drafting guidelines. Through incentives written into bioenergy policy or the *Cooperative Forestry Assistance Act of 1978* (16 U.S.C. 2101), the rate of adoption among states could be accelerated. Based on the estimated cost of Minnesota's Biomass Harvesting Guidelines (~$150,000), one of the first, we estimate that $7.5 million would be sufficient to cover costs of preparing guidelines in all 50 states (although several states currently possess such guidelines).

- **Establish a collaborative, multi-stakeholder body to explore how biomass harvesting can serve as an ecological restoration tool on public lands.** A lack of trust between public land managers and the public is a major driver behind stakeholder support for restrictive regulations regarding public lands and is at the root of much of the litigation responsible for delaying management activities and tying up agency resources. As mentioned in an earlier portion of this paper, collaborative environments can be very effective at building trust, sharing value systems, and fostering creative management solutions. To realize these benefits, we recommend creating a collaborative body containing representatives from the land management agencies, universities, environmental organizations, and other stakeholder and community groups to explore the role of biomass harvesting on public lands. This group would determine the circumstances under which biomass harvesting could be used to promote biodiversity, reduce hazardous fuels, engage in science-based restoration, and achieve other stewardship objectives on public lands. The group would also be charged with helping to develop specific performance criteria and measures of effectiveness for hazardous fuels reduction and other restoration activities — criteria which are currently lacking (GAO 2004, GAO 2009). The group would report to both Congress and the federal agencies, providing detailed input on the appropriate use of biomass harvesting on public lands. A similar process in Arizona resulted in a well-vetted strategy for forest restoration and biomass utilization with strong support from environmental groups and other stakeholders (Hampton et al. 2008).

- **Establish a technical assistance program for biomass supply assessments at bioenergy facilities.** Resource assessments, 'look back' provisions and management plans will help provide for sustainability at the national level and on individual forest holdings, but forest sustainability at the landscape level depends on matching biomass demand to meet the amount of biomass that is available on a sustainable basis. Otherwise, local demand could drive overharvesting, supply shortages, and price spikes, resulting in bioenergy applications that are ecologically and economically unsustainable. Energy developers and engineers, however, are often unfamiliar with the many complex variables that will determine what is 'available' and 'sustainable' in a forest landscape, including geography, infrastructure, conservation objectives, and landowner willingness-to-sell, in addition to standing inventory. A technical assistance program could help facilities undertake an assessment of the woody biomass that is actually available on a sustainable basis in their local 'woodshed', by providing data, maps and access to existing inventory tools such as the Coordinated Resource Offering Protocol (CROP). Assisting facilities in looking beyond physical inventory will not only better safeguard our forest resources, it will also reduce the political and social risk associated with investment in bioenergy.

- **Fund the Forest Legacy Program.** Forest fragmentation and the conversion of forest land to other uses (urban development, agriculture) are commonly seen as two of the biggest threats to forest ecosystems in the United States today. Many stakeholders are worried that new markets for low value biomass might result in further fragmentation or drive the conversion of diverse native forests to energy plantations, 'fuel farms', or other novel ecosystems, as well as provide an additional incentive for land development and forest clearing. On the other hand, expanded biomass

markets could improve the bottom line for forest management, encourage investment in sustainable management practices, and discourage landowners from selling or developing forest lands.

There are a number of private land programs within USDA that utilize cost share, rental payments, conservation easements, and technical assistance to protect and conserve working landscapes. Although most of these programs include forests and woodlands, the majority of them have a strong agricultural focus and were not designed for conserving large tracts of predominantly forested land. One exception is the *Forest Legacy Program*, administered by the Forest Service. This program works closely with state and private partners to leverage funds for the protection of private, non-industrial forest land at risk of conversion, through the use of fee purchase agreements and conservation easements. Easements are a commonly used tool (U.S. Endowment on Forestry and Communities 2008) to cost-effectively prevent conversion of private land. The program has already protected 1.8 million acres of non-industrial private forest land, but it has been unable to keep pace with demand. The program has no set funding level and currently receives approximately $50 million annually through the appropriation process; increasing this sum to $200 million would greatly improve the ability of the program to achieve important conservation targets. Properly supported, the *Forest Legacy Program* could be an invaluable program for ensuring that biomass harvesting takes place in the context of sustainable forest management on protected working lands and does not contribute to fragmentation or conversion of forests most at risk from development pressures.

- **Authorize and fund the Woodstove Changeout Program.** Wood smoke can be a substantial source of particulate emissions (microscopic solid and liquid particles) in communities that rely heavily on wood as a heating source, particularly in mountain towns and other areas where geography concentrates smoke close to the ground. Particulate emissions are associated with a number of health problems, including respiratory and heart disease. In addition, soot from inefficient biomass combustion is itself a significant source of global atmospheric warming ('black carbon'). Since 1992, EPA has regulated particulate emissions from new woodstoves under the Clean Air Act, but there are still millions of older stoves in current use. These less-efficient units can produce up to three times the amount of particulate emissions as stoves sold since 1992. *If all the old (pre-1992) units in the United States were replaced with cleaner burning alternatives, EPA estimates that there would be $29 billion worth of health benefits each year.*

  EPA's woodstove changeout program provides technical assistance to communities (many rural and economically disadvantaged) in which heavy reliance on wood heat is a primary factor contributing to nonattainment for particulate emissions standards under the Clean Air Act. Working closely with industry, EPA assists local air and health officials in organizing campaigns to replace older polluting woodstoves with new, high efficiency models. Not only do clean-burning wood stoves improve air quality and public health, they also reduce the risk of house fires from creosote accumulation in chimneys. At the same time, they make much more efficient use of limited biomass supplies. In communities such as Libby, MT, woodstove changeout campaigns have resulted in rapid, visible reductions in smoke and measurable declines in particulate levels. Lack of dedicated funding, however, limits the ability of EPA to achieve similar successes in the 15-20 areas designated nonattainment for particulate matter, or areas near nonattainment, due in large part to significant wood smoke emissions. The *American Clean Energy and Security Act of 2009* (ACES, H.R. 2454), as passed by the House of Representatives, would authorize this program (Section 218, *Certified Stoves Program*) at $20 million each year for FY10-FY14.[2]

[2] The *Emergency Economic Stabilization Act of 2008* (P.L.110-343) authorized a tax credit for the purchase of biomass fuel stoves, such as pellet stoves and EPA-certified woodstoves. This could prove an effective incentive among individuals of middle-income who itemize their tax returns, but it is not likely to address the problem of persistent wood smoke pollution in rural, economically disadvantaged communities. The credit is worth 30 percent of the cost of qualified biomass stove or furnace, up to a maximum of $1,500. Qualified units must be at least 75 percent efficient.

Section 2 - Renewable Energy Incentives

Federal energy policy (both existing and proposed) contains a wide array of renewable energy incentives, most of which apply to energy from woody biomass. Not infrequently, however, these incentives draw distinctions between bioenergy and other renewables and also among specific biomass feedstocks, production practices, and end uses (transportation fuels, electricity, and thermal energy). If renewable energy incentives do not include equitable treatment for all forms of renewable energy, market forces are unable to act on the full spectrum of possible solutions. *Technology-neutral policies best ensure that government incentives achieve the greatest overall emissions reductions in the most efficient and cost-effective manner.* An increasing number of individuals question the effectiveness and value of existing incentives, especially tax credits, grants, and direct subsidies. Undoubtedly, current incentives are costly and unlikely to be sustainable in the long-term, but as long as they are available it is preferable that there be a level playing field among all renewables, including bioenergy. Similarly, many question the wisdom of renewable energy mandates (such as a *Renewable Electricity Standard* (RES) or the RFS), particularly when there are so many uncertainties regarding the size of the sustainable national biomass supply. This paper does not attempt to justify mandates or estimate an appropriate size or timescale. Should these policies be adopted, however, we recommend the broadest possible inclusion of feedstocks, technologies, and end uses, so that sustainable biomass resources can be used as efficiently and flexibly as possible to help meet the requirements. The following recommendations address the need to fully and broadly include all forms of bioenergy in renewable energy incentives.

- **Put a price on greenhouse gas pollutants.** Establishing a price on carbon is one of the most effective and transparent price signals that can be sent to the market. A carbon price would provide a major disincentive for fossil fuels compared to renewables, and a carbon price would be far more technology-neutral than attempting to individually enumerate, describe, and create incentives for all of the renewable technologies and feedstocks that exist. Because it does not depend on identifying specific solutions upfront, a carbon price would also be effective at driving innovation and incentivizing novel technologies, feedstocks, and applications not yet invented. There are a number of policies that could effectively put a price on carbon. Thus far, Congress has been most receptive to the idea of cap-and-trade, although there is increasing interest in a carbon tax as a more transparent, simple, and stable price signal. A gasoline tax (or gasoline price floor) could serve much of the same purpose in the context of liquid transportation fuels. There are pros and cons to all of these approaches, but regardless of which approach is taken, it is important that carbon pricing is restricted to fossil fuels, or at least is based on net carbon emissions determined by a full lifecycle analysis. Bioenergy generates significant quantities of carbon at the site of generation, but this is carbon that has been recently sequestered in the growing biomass and can be sequestered again in the next rotation. If carbon pricing is based on a simple measure of stack emissions, bioenergy will be disadvantaged as much as (or more than) fossil fuels.

- **Make biomass cofiring eligible for the Producer Tax Credit (PTC).** Section 45(c)(3)(A) of the tax code currently designates "biomass burned in conjunction with fossil fuels (cofiring)" as being ineligible for the PTC. This designation makes an artificial distinction between very similar applications that both result in the substitution of renewable feedstocks for fossil feedstocks in the production of electricity. There is no difference between cofiring 5 percent biomass in a 700 MW coal-fired power plant and producing 35 MW of bioenergy in a dedicated bioenergy facility — both generate 35 MW of renewable electricity. As long the tax credit applies exclusively to the biomass fraction of the total energy load, there is no reason to treat cofiring facilities and dedicated bioenergy facilities differently. In fact, retrofitting existing boilers to cofire biomass is generally less costly than bringing new renewables online, and cofiring represents an important tool for reducing greenhouse gas emissions in a rapid and cost-effective manner (Baxter and Koppejan 2005, NREL 2004, Veijonen et al. 2003).

- **Remove the distinction between 'open loop' and 'closed loop' biomass in the Producer Tax Credit (PTC).** Section 45(b)(4)(A) of the tax code draws a distinction between 'closed loop' biomass, defined as dedicated energy

crops, and 'open loop' biomass: wastes, residues, and forestry byproducts. Although closed loop biomass is eligible for full credit (along with wind, solar, and geothermal), open loop biomass is only eligible for half the credit. Closed loop biomass is not more energy rich or more renewable, and is not a lower carbon fuel than open loop biomass, yet they are treated differently. Section 1102 of the *American Recovery and Reinvestment Act of 2009* (P.L. 111-5) offered a partial solution to this problem. The provision allows owners of new biopower facilities the option to receive an upfront investment tax credit of 30 percent, the same as wind or solar, in lieu of the PTC. This provision, however, does not affect existing facilities or those who would prefer to receive the PTC instead of the investment tax credit.

- **Address the lack of incentives for thermal energy and combined heat-and-power (CHP).** Renewable heating and cooling represents an enormous opportunity for greenhouse gas emissions reductions in the United States (Rickerson et al. 2008) and globally, yet thermal incentives have been conspicuously absent from U.S. renewable energy policy. Thermal energy and CHP systems capture energy from wood more efficiently than either electric generation or production of liquid fuels, with some CHP facilities approaching 90 percent efficiency. New incentives for renewable heating and cooling could be created, but there are a number of ways to creatively extend existing incentives, particularly the PTC and other tax credits, to include thermal energy. Biogas legislation recently introduced in both the House and Senate (S. 306, H.R. 1158) reflects this thinking, providing a production tax credit ($4.27/mmbtu) for biogas, regardless of whether it is being used for heat, electric power, or transportation fuel. A similar approach could be taken with the current PTC, extending it to include wood pellets, woodchips, biobricks and other biomass feedstocks on an energy equivalent basis regardless of end use. A benefit to this approach is that it would provide a natural incentive for high-efficiency district energy and combined heat-and-power applications. Section 48(a)(3)(A) of the tax code currently contains an investment tax credit for combined heat and power (CHP) systems, although it covers only a specific range of CHP applications. An energy-equivalent, technology-neutral PTC would broadly incentivize cogeneration whenever possible. The existing CHP credit is also not available for tax exempt facilities, such as municipal utilities, despite the extraordinary value of CHP in a community energy context. Incentives for PTC-eligible technologies, on the other hand, are available to tax-exempt facilities in the form of Clean Renewable Energy Bonds (CREBs).

- **Give full consideration to all forms of bioenergy in future legislation.** A number of new renewable energy policies are under consideration in the 111th Congress, including a national *Renewable Electricity Standard* (RES), a *Low Carbon Fuel Standard* (LCFS), energy efficiency standards, and renewable energy payments or feed-in tariffs. In creating these policies, it will be important to include all forms of bioenergy that can help meet overall climate and energy objectives. For example, there are a number of states (most notably Arizona) that have included thermal energy as a compliance option in their state RES or *Renewable Portfolio Standard* (RPS). This is an opportunity that should be fully explored in the context of a national RES. Careful consideration also should be given to avoid excluding any potential feedstocks or producers of bioenergy. For example, a considerable quantity of distributed heat, electric and process energy is produced from biomass in the United States, much of it by the wood products industry; federal incentives should include this energy as well as commercial 'on grid' energy.

Section 3 - Bioenergy Incentives

In addition to broad renewable energy incentives, there are many incentives, both proposed and enacted, that deal specifically with bioenergy, particularly liquid biofuels. The *Renewable Fuel Standard* (RFS) is one of the largest of the bioenergy incentives. Enacted as part of the *Energy Independence and Security Act of 2007* (EISA, P.L. 110-140), the RFS mandates the use of 36 billion gallons of renewable fuels by 2022, including 16 billion gallons from cellulosic biomass such as wood. The energy title of the *Food, Conservation, and Energy Act of 2008* (P.L. 110-246) and the DOE biomass program are major sources of additional incentives, many of which are intended to help the nation meet the RFS

targets. The following recommendations address federal incentives for the production and use of biopower, heat, and biofuels.

- **Support farm bill energy programs.** Title IX of the *Food, Conservation, and Energy Act of 2008* (P.L. 110-246) included a number of programs that could provide incentives for the use of woody biomass in producing liquid fuels, heat, and power. The President's FY10 budget requested collective funding of $513 million for these programs, an increase of $242 million over FY09 appropriations levels.

  The *Biorefinery Assistance Program* (Sec. 9003) and the *Bioenergy Program for Advanced Biofuels* (Sec. 9005) provide grants, loan guarantees, and payments for producers of advanced liquid biofuels. The *Repowering Assistance Program* (Sec. 9004) is intended to reduce the carbon footprint of existing biorefineries, by providing payments in order to replace fossil fuels used for process energy with renewable biomass. The *Rural Energy for America Program* (REAP, Sec. 9007) provides funds to rural communities for energy audits, energy efficiency projects, and renewable energy, including bioenergy. Similarly, the *Rural Energy Self-Sufficiency Initiative* (Sec. 9009) provides financial assistance to rural communities in order to become more energy independent through increased production of renewable energy and energy efficiency. The *Community Wood Energy Program* (Sec. 9013) provides funds for communities to develop 'community wood energy plans' and to install small-scale woody energy systems (heat and CHP) in schools and other public buildings. The *Biomass Crop Assistance Program* (BCAP, Sec. 9010) authorizes USDA to make matching payments of $1/ton to entities harvesting, collecting, storing and transporting biomass for the purpose of producing energy.

  The *Biobased Markets Program* (Sec. 9002) is not an energy program, strictly speaking, but a program to encourage the use of renewable biomass to make products that are commonly produced from fossil fuels. The program has established a voluntary labeling program (BioPreferred) for plastics, chemicals, foams and other products made from renewable biomass, and it directs federal procurement officers to maximize use of biobased products. This program also indirectly supports the production of more traditional bioenergy products, by providing an additional incentive for adoption of the integrated biorefinery model. Integrated biorefineries attempt to maximize efficient use of biomass feedstocks by producing a combination of biobased products, heat, power, and liquid fuels where the waste products of one process become the feedstock for the next. Biobased products can provide an additional high-value source of revenue in an integrated biorefinery, improving the overall business model and providing some stability from volatile energy markets.

- **Continue support for the DOE biomass program.** Housed within the DOE Office of Energy Efficiency and Renewable Energy (EE/RE), the DOE Biomass Program has been an important source of research, development, and demonstration funding for the next generation of integrated biorefineries producing advanced biofuels and biobased products. The program has provided financial assistance for a number of innovative pilot, demonstration, and commercial biorefineries, primarily under section 932(d) of the *Energy Policy Act of 2005* (P.L. 109-58). Range Fuels, Verenium, RSE Pulp, and Lignol Innovations are just some of the companies interested in using woody biomass and other cellulosic feedstocks who have received funding through the DOE biomass program. The President's FY10 budget included requested funding of $235 million for the program, an increase of $18 million over FY09 appropriations.

- **Authorize and fund the National Biomass Partnership.** The *National Biomass Partnership* is a collaborative effort between the DOE biomass program and five regional offices (Great Lakes, Pacific, Northeast, West, and Southeast) to nurture state and regional biomass activities and to coordinate federal, state, regional and private sector biomass activities. The partnership also provides a forum for sharing technical information and policy ideas, as well as providing DOE with a regional perspective to help facilitate the production and use of bioenergy and biobased

products across the nation. The program currently has no congressional authority and no dedicated source of funding, having relied in the past on periodic funding at the discretion of the DOE Office of Energy Efficiency and Renewable Energy. Section 193 of the *American Clean Energy and Security Act of 2009* (ACES, H.R. 2454) would authorize the partnership at $7.5 million each year for FY10-FY14.

Section 4 - Feedstock Development

The economic feasibility of bioenergy is dependent on a reliable, affordable feedstock supply. In this one respect, bioenergy has more in common with coal, oil, or natural gas than with other forms of renewable energy, such as solar, wind, and geothermal. However, unlike fossil fuels, forest biomass is a living resource, subject to biological forces, climate, and natural disasters. Also, unlike fossil fuels, forests are valued for much, much more than just their energy content. People depend on forests for clean water, biodiversity, recreational opportunities, wood products, essential ecosystem services, and for their aesthetic and spiritual appeal. The challenge is to build the infrastructure for cost-effectively harvesting a reliable biomass supply without negatively impacting these other values. The following recommendations address the need to develop biomass infrastructure and markets in an atmosphere that prioritizes conservation goals, ecosystem restoration, and other forest stewardship objectives.

- **Develop a broad, uniform definition of renewable biomass.** Currently, there are more than a dozen different and sometimes conflicting definitions of renewable biomass in proposed legislation and existing laws, including multiple definitions in the tax code as well as in agriculture and energy policy. Not only is this situation confusing for foresters and energy producers, but non-germane distinctions can act as a barrier to biomass producers realizing the highest value for their products. Although most of the definitions represent woody biomass broadly, some of them exclude one or more feedstocks, forest types, or land classification.

  The most extreme example is the definition included in the *Energy Independence and Security Act of 2007* (EISA, P.L. 110-140, Sec. 201) in the *Renewable Fuels Standard* (RFS); this definition excludes the vast majority of federal forests (except for land in the 'immediate vicinity' of buildings and infrastructure threatened by wildfire), as well as commercial timber from naturally regenerated forests and several categories of rare forest types on non-federal forests. These exclusions are often promoted as sustainability measures intended to protect ecologically valuable forests. Unfortunately, narrow definitions could have the exact opposite effect, concentrating biomass demand on a greatly reduced area of forest acreage and potentially leading to localized overharvesting and shortened rotations (greater frequency between harvests). Sustainable forest management is key to making bioenergy a sustainable solution, but sustainability is a fundamentally site-specific concept. *Sustainability measures do not belong in a definition; instead, they belong in statutory provisions that encourage (or require) landowners to actively engage in science-based forest stewardship, based on concrete management objectives and taking into explicit account local ecological conditions* (see Section 1 – Forest Sustainability).

  Congress should develop a broad, simple definition of renewable biomass that is universally applicable to the wide array of biomass incentives, policies, and programs in current and future law. The definition of renewable biomass included in the *American Clean Energy and Security Act of 2009* (ACES, H.R. 2454) is an improvement over the EISA definition, although a number of problematic exclusions and overly prescriptive distinctions still remain. If passed, ACES would not only establish this definition in a new national *Renewable Electricity Standard* and as part of the cap-and-trade provisions, but would also supplant the EISA definition for purposes of the RFS.

- **Fund the Forest Landscape Restoration Act.** Title IV of the *Omnibus Public Land Management Act of 2009* (P.L. 111-11) authorized the Forest Landscape Restoration Act, which establishes a process for collaborative ecological forest restoration on federal forests, and mixed landscapes composed of federal and non-federal lands. Under this policy, restoration activities must be based on a comprehensive landscape management strategy, supported by the best

available science, and subject to multi-party monitoring. Most importantly, the policy explicitly requires collaboration among multiple parties and diverse interests in a transparent public participation process, an aspect of the process that could be instrumental in promoting greater trust among stakeholders and public land managers. For all of these reasons, the policy enjoys support from community groups, the forest products industry, and environmental NGOs (U.S. Government Printing Office 2008). In addition to cost-effectively restoring public forests and providing ecological benefits, this policy will benefit local economies by providing employment, job training, and small business opportunities in forest-dependent communities. Special consideration is given to proposals that provide for the utilization of harvested biomass for energy or other commercial products.

- **Extend and improve forest stewardship contracting.** Stewardship contracting refers to a "goods-for-services" exchange in which timber, low-value biomass and other forest materials are traded to private contractors in exchange for conservation services on public lands. Stewardship contracting (and public-private partnerships more generally) is widely seen as a critical tool for completing needed hazardous fuels reduction and ecosystem restoration activities on public lands (Patton-Mallory 2008), but the full value of this tool is not currently being realized (GAO 2008). The *Consolidated Appropriations Resolution of 2003* (P.L. 108-7) extended stewardship contracting authority within the Forest Service and the Bureau of Land Management through 2013. Making this authority permanent and extending it to all the land management agencies (including the Fish and Wildlife Service) would solidify stewardship contracting as a valuable management tool on all public lands. Finally, there are significant financial barriers for agencies wishing to engage in multi-year contracts for long-term restoration projects. Under the Federal Acquisition Regulations (FAR), federal agencies that offer multi-year contracts are required to set aside sufficient funds to cover contractors' investments in the event that a project is cancelled (the "cancellation ceiling"). Struggling with small and uncertain budgets, field offices are often unable and unwilling to commit the up-front funding needed to meet the substantial cancellation ceiling needed for most long-term projects. Combined with a lack of familiarity and comfort with the program overall, this results in very few multi-year stewardship contracts. Fortunately, there are a number of alternative approaches to addressing the cancellation ceiling that may be more accessible and attractive to public land managers (Pinchot Institute for Conservation 2008, GAO 2008). Senator Jon Kyl (AZ) introduced a bill in the 110th Congress (S. 2442) to authorize some of these alternatives. Determining the most appropriate and effective solution will require a thorough review of the FAR code and detailed input from land management agencies.

- **Expand the Woody Biomass Utilization Grants Program.** First authorized in the *Energy Policy Act of 2005* (P.L. 109-58) and first funded through the *Appropriations Act of 2006* (P.L. 109-54), this program provides financial assistance for projects that reduce the hazardous fuel load on National Forest System lands and utilize harvested materials for commercial products, including energy. The program has received annual funding of $5 million. In recent years, however, there have been enough high quality applications to justify at least twice that amount. In addition, expanding the program beyond the National Forest System to include Bureau of Land Management (BLM) lands and other public lands would help support ecosystem restoration activities (and, consequently, woody biomass production) on a larger proportion of our nation's public lands. *The Economic Recovery and Reinvestment Act of 2009* (P.L. 111-5) included a one-time appropriation of $50 million for biomass utilization grants, but this money has been primarily directed towards job creation and business opportunities in rural, economically depressed communities.

- **Fund the Rural Revitalization Technologies Program.** Section 202 (*Rural Revitalization through Forestry*) of the *Healthy Forests Restoration Act of 2003* (P.L. 108-148) established a program to revitalize rural, forest-dependent economies through commercial production of value-added products (such as energy) from woody biomass. The program focuses on technology adoption, small-scale business enterprises, and information sharing through marketing and demonstration projects. The program assists communities through the crucial early stages of planning and developing sustainable community-based business enterprises. The program was reauthorized in the *Food,*

Conservation, and Energy Act of 2008 (P.L. 110-246) for $5 million annually through 2012. Similar objectives could also be met using existing authority for the USDA Economic Action Programs (now defunct) or programs focusing broadly on developing new markets for products and services from sustainable forest management.

Section 5 - Research, Development, and Outreach

Bioenergy is currently a thriving area of research and development in the private sector as well as in universities and government labs. Particularly in the arena of advanced biofuels, an enormous amount of money and talent is being invested in researching ways to grow, harvest, and transport biomass, as well as convert it into high-performing energy products. The focus of much of this research is ultimately to bring the price of biofuels down to where it will be competitive with fossil fuels. At the same time, stakeholders and experts are keenly aware of how much we do not know about biomass harvesting and its impacts on the sustainability of forest resources. To improve the performance and cost profile of bioenergy from woody feedstocks, as well as be assured that its use will not conflict with conservation and stewardship goals, an ongoing commitment to research is essential. An equal commitment to outreach is also needed, in order to get the most up-to-date science into the hands of the landowners, foresters, business interests, and community groups that will be making the forest management and energy production decisions. The following recommendations address policies for research, development, and outreach as it relates to bioenergy from forest biomass.

- **Establish a competitive grant program for sustainable forest biomass research.** This much-needed program would provide competitive grants to researchers working to better understand the implications of harvesting greater quantities of woody biomass on the sustainability of our forest resources, with a focus on ecosystem function, soils, water, and biodiversity, as well as researchers exploring the effectiveness of woody biomass as a means of achieving silvicultural objectives and conservation goals. Not only will a greater understanding of these matters help foresters and land managers develop better management directives, but it will also help policy makers to refine and adapt national bioenergy policy in the future.

- **Fund the Biomass Research and Development Initiative (BRDI).** Section 9008 of the *Food, Conservation and Energy Act of 2008* (P.L. 110-246) reauthorized BRDI, a cooperative effort between the USDA and DOE to coordinate research, development, and outreach activities pertaining to biomass and bioenergy. The program includes a Biomass Research and Development Board as well as a Technical Advisory Committee (TAC) consisting of academics, industry representatives, engineers, trade experts, economists, conservationists, energy specialists and other experts. The board includes representatives from USDA and DOE, as well as several other federal agencies, and is tasked with awarding grants, contracts, and other forms of financial assistance based on input from the TAC. This process strategically focuses limited federal R&D funds on those projects that have the most promise to accelerate the commercialization of advanced biobased fuels and products. The program is currently authorized for $118 million in mandatory funding over four years (FY09-FY12) with an additional $35 million authorized in discretionary funding for each of those years. By funding this program at the full authorized levels, Congress can continue to support the scientific innovation that is need to make the biobased economy a reality.

- **Fund the Sun Grant Initiative.** Section 7526 of the *Food, Conservation and Energy Act of 2008* (P.L. 110-246) reauthorized the *Sun Grant Initiative*, a national network of six regional Sun Grant Centers based at land-grant universities and responsible for providing competitive grants for research into feedstock production, agricultural diversification and bioenergy technologies. In addition to focusing on regional priorities, the centers coordinate with R&D efforts at the federal level (through BRDI) and at other land-grant institutions. The program is authorized at $75 million annually for FY08-FY12.

- **Fund the Forest Biomass for Energy Program.** Section 9012 of the *Food, Conservation and Energy Act of 2008* (P.L. 110-246) established a competitive research and development program within the Forest Service to improve

tools for using low-value forest biomass as a source of energy. Unlike existing R&D programs, this program focuses specifically on biomass derived from forest management activities, including biomass produced in the pursuit of national forest objectives such as hazardous fuels reduction and ecosystem restoration. This R&D funding provides a natural complement to the project funding available under the *Woody Biomass Utilization Grants Program*. The program is authorized for $15 million annually for FY09-FY12.

- **Support outreach and extension efforts.** Research is vital to understanding and improving the sustainable production and use of forest biomass for energy, but research is only as effective as it is accessible and available to the foresters, landowners, and engineers who will be producing and using the biomass. USDA's Cooperative State Research, Education, and Extension Service (CSREES) is the agency responsible for coordinating agricultural extension efforts across the country, by partnering with land-grant universities, experiment stations, and an extensive network of state, regional, and county extension offices. *CSREES currently has no dedicated funding source for extension activities related to the production and use of forest biomass.* Congress should correct this oversight through the appropriations process, a new statute, or through existing sources of extension funding, such as the *McIntire-Stennis Cooperative Forestry Act* (16 U.S.C. 582a1) or the *Renewable Resources Extension Act of 1978* (16 U.S.C. 1675.)

Conclusion

As part of a commitment to improve energy security and address climate change, the U.S. government has invested heavily in a number of programs and incentives to promote development of renewable energy, including bioenergy from woody biomass. The majority of these investments have been (and continue to be) in the production of cellulosic transportation fuels. To use this resource as flexibly and effectively as possible, it will become increasingly important for federal policies to address the full spectrum of ways in which low-carbon woody biomass can serve as a substitute for high-carbon fossil fuels. This includes production of electric power, thermal energy, combined heat-and-power (CHP), and biobased products at a variety of scales. In addition, policies should prioritize improving the sustainability and economic feasibility of bioenergy applications and feedstock development. Federal incentives should encourage site-level assessment of potential biomass projects in order to determine the appropriate scale and to select management practices that will minimize negative impacts and maximize the effectiveness of biomass harvesting as a means to engage in forest stewardship activities, such as stand improvement, habitat management, and restoration forestry. Without cost-effective and profitable methods for harvesting and utilization of woody biomass, it is unlikely that this resource will achieve its potential as a renewable solution to climate change. A continued commitment to research will be needed to achieve the two goals above – there is much to be learned regarding environmental impacts, harvesting methods, cellulosic conversion technologies, and the economics of biomass markets. Finally, policies that promote community projects, public-private partnerships, and stakeholder collaboration will be instrumental in achieving social acceptance for bioenergy, building public trust, and developing bioenergy projects that will be equally beneficial to our climate, our forests, our communities, and our economy. These activities will be necessary to overcome much of the skepticism and opposition that is directed towards wood-based bioenergy.

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