

Sustainable Woody Bioenergy in the U.S. Regional Outlook – Intermountain West

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Summary. This paper integrates perspectives from around the intermountain west to form a regional outlook as it relates to advancing sustainable woody bioenergy. A unique set of variables must be addressed in this region of the country in order to proceed with sustainable development. The predominance of federal land ownership is the most salient and influential factor, as much of the woody biomass supply is found on or near federal lands. This federal land overlay creates a political dynamic which complicates and sharpens decisions around woody biomass development. As new, evolving challenges appear on the horizon, such as climate change, the prospects for sustainable woody bioenergy in the intermountain west over the next 5-10 years will depend upon agreement between communities, industry, stakeholders and government. Sustainable woody bioenergy development success will depend upon finding the “sweet spot” around collaborative community-scaled bioenergy which includes building upon the existing forest products industry infrastructure. While there may be other paths to woody bioenergy development, community-scaled efforts will see the most near-term success and are the best way to address sustainability concerns.

Keywords. *Interior West, biomass, bioenergy, forestry*

Introduction

Woody bioenergy is receiving large amounts of attention from elected officials, land managers, private investors and the public at-large who care about forests and renewable energy. With heightened sensitivity to U.S. foreign oil dependence, growing concern over climate change impacts, forest health conditions in general and economically struggling rural communities, proponents see an amazing alignment of opportunity in woody bioenergy to tackle these challenges. While opportunity certainly exists everywhere that there are forests and trees in this country, the intermountain west² holds a unique position. That is, a position of tremendous potential, with significant challenges.

Woody bioenergy development faces a number of obstacles such as limited investment capital, a limited skilled workforce, a bias toward other renewable energies, and low commodity prices to name a few. Yet, beyond these factors common to all parts of the country looking to develop their biomass resource, the intermountain west has some fairly pointed problems that come in the form of costs, supply and a dominant federal lands ownership which make for a challenging backdrop. The generally mountainous and dry geography of the intermountain west, layered with the federal government as the predominant landowner, are particularly vexing ecological, economic and socio-political obstacles to achieve sustainability. This particular combination has the effect of making it very difficult to get solutions up to scale to address the landscape issues in the region.

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² For the purposes of this paper, the intermountain region will be loosely defined by those states characterized with dry forest resource types. Specifically, the states of Arizona, California (portions), Colorado, Idaho, Montana, Nevada, New Mexico, Oregon (portions), South Dakota (Black Hills), Utah, Washington (portions) and Wyoming.

Federal agencies are the predominant landowner in the region and this interjects a socio-political dynamic which can muddle decision making that has the ultimate effect of increasing risk of investment. Federal forest lands are governed by a tangled web of regulatory and statutory frames. They have a poor track record of supply timeliness, reliability and cost. The reasons for this may be debated, but looking at history and recent trends it is difficult to state otherwise. This is not to say that these federal forest lands issues cannot be addressed and overcome. It is more to acknowledge this unique socio-political dynamic that plays out on the nation's forestlands in the name of sustainability.

And yet, there are opportunities. Starting locally, engaging the existing forest products industry and collaboratively working at the community-scale are the secrets to sustainable woody bioenergy development in the region.

This paper is predicated on varied and disparate interests from around the region. It was built with input from multiple stakeholders and from the author's own public policy working experience. Input was garnered from individuals from government, academia, community groups, non-governmental organizations and industry. It represents the author's integration of those perspectives into a regional outlook and coherent record intended to shed light on sustainable woody bioenergy development in the region in the hopes that more informed and timely decision making can occur.

Intermountain West Region Context

The forests of the intermountain west and the people who depend on them are at a time of significant challenge, one that is characterized by diminishing forest health. Many of the intermountain forests are overstocked, basically overcrowded, stressing trees to compete for limited resources and making them more susceptible to pests and pathogens. Others are within the historical range of variability, but continuing drought, insect and disease and land development pressures threaten to change their condition for the worse. Factor in climate change, and both forest health and wildfire threats become exacerbated. To this point, nearly every western state over the past decade has recorded its largest wildfire in modern history. To name a few:

- Arizona's Rodeo-Chedoke fire burned 467,000 acres in 2002
- Utah's Milford Flat Fire burned 363,000 acres in 2007
- Colorado's Hayman fire burned 138,000 acres in 2001

Combined, this number is approaching an area the size of Delaware and it represents only a sampling of intermountain states.

And with those large, uncharacteristic and catastrophic wildfires come degradation of watershed and ecosystem functioning as well as serious air and smoke problems that risk human health often times far from the forest itself. Add on top that more and more people are surrounding, living within and using the forests for recreation and other pursuits in record numbers³, the region's forests are facing increasing pressures (National Visitor Use Monitoring Results 2008).

With all these stressors, intermountain forests are in need of management more than ever to optimize the forest goods and services the people of the region and the nation expect. But just like elsewhere in the country, costs are up and management capacity is down. Some interests have purported an estimated \$8.4 billion backlog in road maintenance needs alone on U.S. Forest

³ 178.6 million visits.

Service (USFS) lands (Taxpayers for Common Sense). Whether such projections are inflated or real, public and private sector solutions are needed and sustainable woody bioenergy development represents perhaps the region's best opportunity. This is where sustainable woody bioenergy enters.

Why Woody Bioenergy?

The short answer is it provides market-based opportunities to improve forest health, extend forest productivity, create jobs and simultaneously tapping a renewable resource that diminishes our dependency on foreign oil. A key premise to this discussion is that private investment is needed to expand acres treated and reduce management costs. The public dollar alone will not be enough to fund the forest management needed to solve many of the intermountain west's forest challenges:

- declining forest health (as one measure, 22 million estimated acres at-risk to bark beetle tree mortality over the next 15 years) (Western Forestry Leadership Coalition 2007), and
- increasing wildfire danger (nationwide, 132 million acres estimated at-risk of catastrophic wildfire (USDA 2006), much of that in the intermountain west).

Combined with a diminishing rural community vitality and management capacity (between 1972 and 2007 the entire west has lost 75 percent of its mills, going from 800 mills to 200 mills) (Haynes 2009), and it's clear of the challenges ahead. And all of this will be exacerbated as the effects of climate change compound these problems (Westerling 2008).

While some advocate for a new amenity based economy in the west, few would disagree that a diversified portfolio is the best prescription in the long-run. Many see a natural and obvious solution to the region's forest problems in the application of woody bioenergy. However, the reality is that with the status quo and federal land overlay, the intermountain west may be slow to develop. Public policy intervention is required to accelerate and optimize the rate at which the region develops sustainable forms of wood bioenergy.

While daunting, interestingly the recent economic downturn may actually present some good opportunities for public-private partnerships to create "green jobs" around sustainable woody bioenergy and provide a lifeline to forest dependent communities. Some of woody bioenergy development's best chances for success may be when it can partner and be coupled with existing forest product infrastructure so cost efficiencies are maximized.

In sum, woody bioenergy has tremendous potential to spur innovative forest management options. It is a gateway to encourage much needed investment in our forests, create jobs and be a significant contributor to diminishing the nation's dependence on foreign oil. Pursued sustainably, it is a vital new market tool that can help to restore unhealthy forests by reducing forest management costs, while simultaneously creating and supporting family wage jobs. And on top of all, sustainable woody bioenergy is the only renewable energy where co-benefits, things like clean water, wildlife habitat, and recreation, can be maximized simultaneously.

What Type of Woody Bioenergy?

There is variety and diversity offered by woody biomass (from municipal solid waste to closed loop plantation grown fiber), but this paper will focus on woody biomass derived from forests,

both “in-forest” wood residues⁴ and wood processing residues.⁵ Further, for the purposes of this paper, references to woody bioenergy refer to the following energy solution applications:

TABLE 1: Woody biomass energy applications

Woody Biomass Energy Application	Description	Scale⁶
<i>Power Generation</i>	Stand alone electricity producing facilities (includes biomass only and co-firing with coal or natural gas)	Medium to Large Scale
<i>Thermal Energy</i>	Stand alone heating applications (e.g. district heating)	Small to Medium Scale
<i>Combined Heat and Power (CHP)</i>	Produces thermal and electrical energy together (most efficient of all bioenergy applications)	Small to Medium Scale
<i>Biofuels/Biogas</i>	Most obvious is use as a transportation fuel, but many other by-products can be derived	Large Scale

While potential exists for all energy applications of woody biomass in the region, some applications may prove to be more realistic than others. The type of woody bioenergy application to pursue in a given project will be driven by questions around sustainability. Because of this, project time horizon, ability of industries to partner and cluster, a processing facility’s supply footprint, land ownership and scale are key variables in determining success within the intermountain west context. It also important to highlight here that a key assumption in this exploration is that sustainability is best achieved through social dialogue and agreement. Because of this, woody bioenergy will be pushed as a largely dispersed and localized opportunity as it tends to be the community- level where people can find common ground and agreement relating to the forests they depend upon.

Woody Biomass Supply Considerations

Woody biomass supply will make or break any woody bioenergy project. Fortunately, like many parts of the country, the intermountain west has a vast storehouse of woody biomass.

There are numerous studies, assessments and projections outlining the woody biomass feedstock picture, such as the fairly well-known USDA Billion Ton Report (U.S. Department of Energy 2005) and some recent work by the USFS Research branch (Nicholls, et. al. 2008)

. But perhaps the best available for the intermountain west is the body of work put out by the Western Governors’ Association (WGA) around renewable energy. Starting with their Clean and Diversified Energy Initiative (Western Governors’ Association 2006) and following with their Transportation Fuels for the Future Report (Western Governors’ Association 2008), a fairly comprehensive picture of woody biomass supply in the twelve intermountain states can be ascertained.

⁴ Defined as residues left over from mechanical treatments (thinnings, hazardous fuel reductions, harvesting, etc.).

⁵ Defined as leftover fiber from wood product processing such as bark, sawdust, trimming and shavings.

⁶ Column represents typically scaled applications. You can find examples of all scales, but these are the most common.

WGA's Strategic Assessment for Bioenergy in the Western U.S., taken from its Transportation Fuels for the Future Report, puts a base estimate of 20.4 million dry tons of biomass available per year. This estimate is based on five sources:

- Hazardous fuel reduction
- Logging residue
- Pinyon-juniper expansion thinning
- Private timberland contributions
- Unused mill residue

They run other more optimistic scenarios, which put that figure closer to 28 million tons, but it is wise to assume conservative numbers when dealing with woody bioenergy in this region largely due to the federal land overlay to be discussed more in depth in a later section. While figures specific to the intermountain west for current woody bioenergy usage are not available, the existing forest products industry nationwide uses 96 million dry tons per year for bioenergy purposes (U.S. Department of Energy 2005). Clearly, the 20.4 million dry ton projection shows how the region could provide a significant additive contribution.

To provide some context for this number, those WGA projections translate into 20.4 million megawatt hours of useable power using conversion factors from the University of California Cooperative Extension (Shelley 2007). While conversion can be an imprecise exercise because of the many location and event specific variables that affect power output, this "rule of thumb" translation equates to enough electricity to support approximately 1.5 million average households⁷ per year. There are an estimated 111.1 million households in the U.S. (2005 Residential Energy Consumption Survey). Put into a heating context, 20.4 million bone dry tons is equivalent to 69.600 septillion Btu / year⁸, or enough to heat 683,000 households.⁹

This is a significant amount. However, these numbers represent how much unused woody biomass resides in the intermountain west, but not necessarily how much is realistically available, nor sustainable. We must take into account the economic and socio-political considerations which govern sustainability when trying to get a better feel for how much is realistically available. Unfortunately, there is no easy way to broadly quantify these sort of value laden conclusions because sustainability means different things to different people. To get at sustainability, it requires people to roll up their sleeves and collaboratively and cooperatively seek agreement. This to say, it is not a far stretch to conclude that while the supply on the land may be 20.4 million dry tons, the amount of woody biomass available for removal is less.

Considerations – Sustainability

For many, in the simplest sense sustainability means providing for today's needs while not diminishing the opportunities for tomorrow's generations. A traditional and typical forestry interpretation of this takes form in the concept of sustained yield. The sustained yield notion being that as long as you are not harvesting more trees or biomass than grows each year, you are sustainable. But today's notions demand more than just a growth increment.

Today's concept of sustainability generally speaks to the interdependency of three variables, the ecologic, the economic and the social. Scientific research and monitoring can tell us the ecological carrying capacity of the forest, and we also can develop a spreadsheet to ascertain the

⁷ One household = 14MWh (Wiley 2007)

⁸ One megawatt is equivalent to 3.413 million Btu/h (British thermal units) (Bergman 2008).

⁹ One household uses 101 million Btu / year (Battles 2001).

fiscal viability of any forest management action. So where the ecologic and the economic can usually be ascertained and quantified in some fashion, it is the social which can be very elusive to nail down. But there is rarely an easy, nor definitive, way to write down the social contract under which our forests are governed. It is this social contract which defines the sustainability of woody bioenergy, a factor of significant import in this region dominated by federal lands because establishing the social contract on lands owned by all is no small feat.

This is why so very often you hear supporters of woody bioenergy development talk about it being done at the “appropriate scale.” It is couched in these terms largely because the scale and location of a woody bioenergy project will determine the ability of concerned interests to come together and define in some manner this social contract. Generally speaking, the larger the size, the harder it is to find common understanding as a larger geographic area invites more interests and concerns to the table. To point, while the industrial forestry community might espouse larger scale to tap economies of scale, there is a general feeling in the environmental community that a business model where scale drives supply is not sustainable. Interestingly, the type of woody bioenergy solution to be pursued as described in table 1 tends to be a significant driver of the “appropriate scale.”

The intermountain region has pursued this concept of social agreement in varying fashion, reflective of the unique challenges facing each community of interest and community of place. Perhaps recognizing that sustainability is most lasting when built organically and from the grassroots where those most connected to the land own the solutions, each state and interested locality has agreed upon sustainability through different, but very defined, standards. As one scans the intermountain west, we have seen a proliferation of various state-level sponsored collaborative forums where often conflicting interests have come together to hammer out the social contract needed to determine what is and what is not sustainable. New Mexico has its Forest & Watershed Health Planning Committee. Colorado has its Front Range Fuels Treatment Roundtable. Idaho has established a State Fire Plan Working Group. In Arizona there is the Governor’s Forest Health Advisory Council. And in Montana, there is the Forest Restoration Committee. Collaboratives such as these are occurring in nearly all intermountain west states and they are becoming key ingredients for broadly outlining agreement on sustainability. Typically these collaboratives focus on creating some sort of strategy or plan where agreement on management principles and sometimes specifics can be hammered out. Once these sort of social agreements are in place, woody biomass begins to flow more readily from agreed upon projects, be they hazardous fuel reductions, stewardship contracts or timber sales.

Interestingly, we are finding that state-level collaboration is typically just an opening step, as further conversations often continue at the community-level where each social contract is fine tuned. This often times allows the individual community to refine a woody bioenergy project, locking down agreement on sustainability and thus providing greater certainty. For example, an Arizona collaborative based out of Northern Arizona University calculated that 4 million bone dry tons of woody biomass is available and socially agreed upon from 2 million acres of northern Arizona forests. This sort of study adds certainty for investors and lenders. These state-level and community-level sponsored collaborative forums are proving to be a very important first step and catalyst for action.

Considerations - Costs

Woody biomass is heavy and bulky. That may be an obvious statement, but it is a significant factor in evaluating woody bioenergy potential. Woody biomass processing from the forest is an

expensive prospect, known to cost anywhere between \$400-\$1600/acre for mechanical removal¹⁰. It is the transportation costs which make up the bulk of those figures. Basically, the processing and transportation of the material add significant economic hurdles.

With such high costs, it does not make much economic sense to transport woody biomass very far from the source for relatively low valued end products like bioenergy. This very much limits the circles from which a processor might source its woody biomass.

Another factor influencing these sourcing circles is the type of woody bioenergy solution being pursued. As described in table 1, woody biomass can be put to use in primarily four different energy solutions: electrical power generation, thermal energy, combined heat and power and biofuels/biogas. Each of these solutions has a size or scale that is most efficient or, put another way, circles will be large or small depending on which woody bioenergy solution being applied. Therefore, when choosing which woody bioenergy solution to pursue, supply costs and the potential scale within a sourcing circle must be realistically evaluated.

Of course, sourcing circle radii will be highly reflective of the size of the market with bigger communities, towns and cities pulling from longer distances. But in general, sourcing circles tend to be limited and are yet another factor which influences the fact that woody bioenergy solutions tend to be very distributed and localized across the landscape. This distributed characteristic is one of the key reasons why woody bioenergy is well situated to address community scale problems.

A third cost consideration are the efficiencies afforded to global competitors who have access to cheaper labor pools and more relaxed environmental safeguards compared to the United States. They can harvest and move woody biomass cheaper than we can domestically, gaining a significant cost advantage.

Evaluating these processing cost, scale and global competition factors, one concludes that woody bioenergy solutions will have the best success rate when business models are pursued at the regional (multi-state) to local/community scales.

Clustering

One concept that has potential to really boost a hatchling woody biomass industry is to cluster development. The idea is to cluster different woody product industries with different specifications and supply needs, creating a sort of investment zone. These companies, with their different niches, would support each other to create economic efficiencies by using different parts of the tree. A lumber mill could use the bole of the tree, a post/pole operation could use limbs and branches and an oriented strand board or pellet plant could use the remaining biomass. Attached to all this could be some type(s) of woody bioenergy solutions to power and/or heat the cluster and/or community. This could be a huge competitive edge for industry, requiring what may be uncharacteristic collaboration between sometimes antagonistic entities in the wood products industry. But we are seeing burgeoning interest in the concept as evidenced by the recent clustering program launched by the U.S. Endowment for Forests & Communities (U.S. Endowments for Forestry & Communities, Inc. 2008a,b).

Federal Forestland Ownership Influence

¹⁰ Synthesis of Knowledge from Woody Biomass Removal Case Studies (Evans 2008)

Although there is a significant amount of woody biomass across the region, the real question comes down to how much of that biomass is actually available as a long-term, guaranteed and sustainable supply?

It is quite well known that the eastern U.S. is dominated by private forestlands and that western U.S. forestlands are dominated by public land ownership. The intermountain west has the distinction of being the region of the country with the highest percentage of public land ownership, standing at approximately 78% of all lands, for a total 105 million acres (Alig et. al. 2003). Of those public lands, the federal government is the largest forest landowner by far (*see TABLE 2*), with the U.S. Forest Service being the majority forest landowner. There are woody biomass opportunities on private forestlands in the region, but they typically are not large enough to attract and maintain an enduring woody bioenergy infrastructure. Federal forest lands are the key to supply needs in the intermountain west. And as things stand now, for all intents and purposes, woody biomass is not reliably nor significantly flowing off intermountain west federal forest lands.

TABLE 2: Intermountain forest resources (Smith et. al. 2004)

State	Total Forestland (million acres)	Federal Ownership (million acres)	Percentage
Arizona	19.427	10.192	52.5%
California ¹¹	40.233	22.371	55.6%
Colorado	21.637	15.075	69.7%
Idaho	21.646	17.129	79.1%
Montana	23.293	16.512	70.9%
Nevada	10.204	9.608	94.2%
New Mexico	16.682	9.522	57.1%
Oregon ²²	29.651	17.741	59.8%
South Dakota ²²	1.619	1.004	62.0%
Utah	15.676	11.913	76.0%
Washington ²²	21.790	9.422	43.2%
Wyoming	10.995	8.832	80.3%

The ongoing USFS roadless area debate is a great example of policies and regulations which cloud the intermountain west landscape. Similarly, the recent 2007 Energy Independence and Security Act is a great case in point worth delving deeper into. Congress codified a goal of 36 billion gallons of biofuels by 2022 via a Renewable Fuels Standard (RFS), to provide biofuel development incentives. Environmental groups, fueled by worries over unchecked development of the federal forest resource, successfully lobbied for a limitation which essentially removes all woody biomass sourced from federal lands from counting toward the RFS. This means those in a region dominated by federal lands will not be able to access the RFS incentives. Clearly this is a major hurdle for bioenergy development in the region and although just one example, it demonstrates the tone and tenor surrounding management of federal lands and sustainable development of woody bioenergy.

Such blunt instruments as this RFS definition often established in the name of sustainability and seemingly for the right reasons, are fleeting and only serve to stoke and fan conflicts as they tend

¹¹ This paper addresses intermountain forests for which portions of these states qualify. This table is meant to quickly capture the percent of public federal landownership and unfortunately it is difficult to specifically delineate intermountain dry forest types from available data.

to over-reach. Basically, one-size fit all solutions do not work in a forestry context where prescriptions are better driven by local forest considerations, such as forest type and geography, as well as by the interested communities of place and interest. It is from within this forestry context that we will better define truly lasting and sustainable solutions.

Given that supplies from federal lands are uncertain, businesses and entrepreneurs are less likely to invest and make million dollar outlays for woody bioenergy infrastructure, human capital and equipment. Guaranteed time horizons of 10 years were thought to be adequate early this decade, but recent indications seem to suggest that horizons as long as 20 years might be a better benchmark. Bank lenders are skittish, made even more so by the current state of the markets, and entrepreneurs are cautious. Federal agency Stewardship Contracting provides a case in point, where even 10-year federal forestland contracts do not attract and elicit the number of investors one might expect given the amount of woody biomass potentially available in the region.

Sum total, market investment, particularly in these rough economic times, needs assurances that scarce capital will perform and such guarantees are tough to come by on federal lands.

Existing Forest Products Industry Factor

Compounding the already limited federal land woody biomass supply picture is the fierce competition for a constrained resource. Where forest products industry infrastructure already exists, woody bioenergy development is very much a direct competitor and efforts are sometimes launched to block such development.

Woody bioenergy use increases demand and can oftentimes raise the supply price, putting added pressure on existing industry. Higher supply prices might be good for the forest landowner and manager as higher supply purchase prices can help offset management project costs, but for the existing industry, these higher supply prices can damage an already low margin business operating on shaky ground.

Efforts should be made to avoid direct competition with existing industry and to enhance industry adaptation and development of woody bioenergy options. We are seeing this play out in places like Montana where the existing forest products industry is teetering on the edge of solvency due in many parts to increasing global competition and a declining residential home building market domestically. Wood products interests there have questioned, and in some cases have worked to slow expansion of the nascent woody bioenergy market in the state.

This competition with existing infrastructure factor is another which pushes woody bioenergy to be a largely dispersed and localized opportunity and solution. Basically, the larger the woody bioenergy prospect, the more real and perceived impact there is on existing supply and demand. It may seem logical to assume that increased demand for woody biomass might encourage more supply to enter the marketplace, but because of the region's federal land overlay, with its limited woody biomass source, increasing supply to meet market demand is not a given nor a straight forward calculus.

It is important to note here, that this dynamic plays very differently across the intermountain west landscape depending on the status and health of the existing industry. In the southwest, where the large, integrated industry is gone for all intents and purposes, the dialogue around woody bioenergy and sustainability is much different than it is up in the northern Rockies where the industry is still present. And as shown earlier, there is more than enough woody biomass on the

land within the region to sustain both a traditional forest products industry and an emerging bioenergy industry. Regardless of the existing industry's perceptions, the need for the existing industry to work together for their mutual benefit has never been greater.

This is where the concept of clustering introduced earlier in the paper could help cultivate partnerships. Having each individual industry member find their niche, may be a critical element of success. The idea is akin to business cooperatives, and will need to be pursued with keen awareness to avoid stepping into anti-trust and collusion allegations.

Collaborative, Community-Scaled Opportunities

Within the intermountain west a sense of urgency seems to be building with the public, driven in large part by the wildfire situation. This is drawing many to recognize that the overarching forest health problems we are facing are on a scale beyond what anyone entity can handle. In many places this is tearing down many of the old forest ideology battle lines, putting environmentalists, industry and everyone in between on the same page to seek and find solutions together. It appears the nexus is at the community-scale where people are able to find common ground and a path forward. This is because when a community collaboratively crafts a plan, solutions which flow out of that agreement are a powerful expression of the social contract, ignored at political peril. Community Wildfire Protection Plans and Resource Advisory Councils are two prime examples of these tools and constructs, both which have statutory grounding and influence over federal land management. And these communities can take shape as a community of interests or as a community of place.

Further, such community expressions also tend to be the most sustainable and durable. That is, numerous examples exist from around the region which reinforces the notion that collaborative community engagement does the best job of balancing the interplay between the ecologic, economic and social variables which govern sustainability. And in this case, woody bioenergy provides the all important rally point for communities to gather around.

It should be further noted that community scale is not necessarily limited to small scale. It can also mean landscape scale. Community agreement provides the platform to address the needs at whatever scale is agreed upon. Take for example the ongoing 150,000 acre White Mountain Apache Sitgreaves Stewardship Contract located in Arizona which began in 2004 and is predicated on a suite of Community Wildfire Protection Plans. New Mexico's Collaborative Forest Restoration Program reported in 2005 treating almost 20,000 acres and creating close to 500 full-time jobs in its first five years (A Multiparty Assessment of NM CFRP 2005). And the USFS and Bureau of Land Management's Coordinated Resource Offering Protocol (a federal lands woody biomass removal estimator tool) predicts that 909,000 bone dry tons are available within 100-mile radii of lands in Northern Utah, Southern Utah, Northern Colorado and Northern New Mexico alone (Woody Biomass Utilization Team 2007). It is clear that the acreages can be substantive.

While there may be other paths to woody bioenergy development, community-scaled efforts will see the most near-term success and are the best way to address sustainability concerns.

Public Policy Incentives

With all the challenges out there, public policy intervention is needed. Fortunately there are a number of public policy options available to encourage sustainable woody bioenergy development and job creation in the intermountain west. This discussion applies to federal level public policy, but the ideas presented can easily be adapted to state and/or local government levels as well. Furthermore, while presented within the context of the intermountain geography, all of these solutions lend themselves in some form to nationwide solutions as well.

Renewable Portfolio Standards (RPS) / Renewable Fuels Standards (RFS)

A RPS or RFS is a government mandated target for the mix of renewable energy produced within a state, nation or any administrative unit for electricity (RPS) or fuels (RFS). The last five years has seen a proliferation of these tools, particularly at the state level. A problem for woody bioenergy has been that a number of these standards do not acknowledge woody biomass within the mix, or simply are structured in a way that precludes sustainable and meaningful woody biomass contributions. Often, standards definitions will limit or even exclude woody biomass use. The earlier example of the national RFS definition for woody biomass is glaring testimony. Given that this popular standards tool¹² will continue to be used and likely be expanded, changes will need to be made to ensure that all renewables are considered on equitable footing.

TABLE 3: States in the Intermountain West with Renewable Portfolio Standards

State	RPS
Arizona	15% by 2025
California	20% by 2010
Colorado	20% by 2020
Idaho	None
Montana	15% by 2015
Nevada	20% by 2015
New Mexico	20% by 2020
Oregon	25% by 2025
South Dakota	10% by 2015 (non-binding goal)
Utah	20% by 2025 (non-binding goal)
Washington	15% by 2020
Wyoming	None

Long-Term Supply Contracts

Vital to the region is the development of workable and practical long-term supply contracts for sourcing woody biomass from federal lands. Currently the best long-term contract is the 10-year Stewardship End-Result Contracting (U.S. Forest Service 2008) authority (Section 323 Public Law 108-7). A successful example is the aforementioned 2004 White-Mountain Apache Sitgreaves 10-year stewardship contract which covers 150,000 acres and has already removed over 300,000 green tons of woody biomass. It has also enabled development of a 3MW woody bioenergy electricity generation plant in Eager, AZ and a 24 MW plant in Snowflake, AZ. It should be noted that the diversified products and markets developed from this project also include lumber from small diameter trees, laminated housing logs and wood pellets.

¹² Currently, Idaho and Wyoming are the only two intermountain west states that do not have some form of RPS or state goal (Interstate Renewable Energy Council 2009). Unfortunately, most do not provide for woody biomass.

A key to its success has been the Community Wildfire Protection Plans developed by nearby communities which enable agreement around need and sustainability. A current challenge is that current federal contracting rules require up front bonding of the project to protect against default through a “cancellation ceiling” mechanism. Austere public dollars, driven in large part by escalating federal wildfire suppression expenditures, have limited the development of similarly scaled projects in other parts of the west even though the same need exists. A stewardship contracting legislative fix is needed for longer contracts and to address these bonding issues. Further, a new federal agency wildfire budgeting model is also needed to address out of control wildfire expenditures (FLAME Act – H.R. 5541 – 110th Congress) which are limiting available forest management dollars.

Transportation Credits

As noted earlier, transportation of woody biomass is an expensive and limiting cost factor. Some form of financial assistance, be it tax credit or direct government payment, is needed to help offset the transportation costs associated with moving woody biomass from the forest to the energy facility. More than just a way to offset the direct management costs of hazardous fuel or some other forest health treatment, such a credit can be seen as a payment for a public good (reduced wildfire threat). The 2005 Energy Bill authorized such a program¹³ (Sec. 210) at \$20 million per year, but has never been funded.

10-year Comprehensive Wildfire Strategy and Implementation Plan

This strategic, multi-stakeholder blueprint lines out the steps that government, communities and interests all need to take to get ahead of the escalating wildfire problem. With some emphasis on federal land management and hazardous fuels reduction, there are a number of woody biomass utilization directives within this wildfire context that would further promotion of sustainable woody bioenergy in the intermountain west. Continued pursuit and funding of the 10-year Strategy is vital.

Tax Credits: Production Tax Credit (PTC)

The PTC is a corporate tax credit for electricity production currently set at 1cent/kWh for open-loop¹⁴ biomass (closed loop is set at 2cents/kWh) and is good for ten years. The PTC is a great help for entities considering using woody biomass to produce power, but the credit has never been reauthorized for more than two years at a time. This short planning horizon introduces uncertainty into investment decisions. Compounding, the fact that different renewables, and even different types of biomass (open and closed loop) are treated differently under the tax credit, creates confusion and adds further uncertainty. It would be better to pursue a renewable technology neutral credit to foster an equitable playfield for all renewables. Considering the intermountain west region, expanding the credit to capture thermal energy produced would be a natural evolution. The U.S. Forest Service Fuels for Schools program¹⁵ is a successful and ready example where the region is primed for thermal woody bioenergy solutions.

Another important piece of the equation are the various state and federal consumer tax credits which reward installation of woody bioenergy devices. For example, Oregon recently amended

¹³ Commercial Biomass Grants Utilization Program – provides a \$20/green ton subsidy for biomass delivered to a wood utilization facility

¹⁴ Open-loop biomass is biomass sourced from an open system, meaning biomass sourced from any feedstock available. Closed-loop biomass grows its own biomass.

¹⁵ The FFS program matches educational institutions, or any public building, with woody bioenergy solutions with technical and financial assistance (Fuels for Schools and Beyond).

its Residential Energy Tax Credit Program in 2007 to offset the purchase price of wood and pellet stoves.

Funding

As noted, sustainable woody bioenergy in the intermountain west revolves around finding reliable supply. There is plenty of woody biomass out there on the federal lands, but much of it is inaccessible. Some of the reason for that is geography. And some of that is the socio-political context explored earlier. However, a good portion of that is also due to limited funding for hazardous fuel reduction, timber sales, stewardship contracts and other management options that produce woody biomass. Adequately funded federal land management, which has been collaboratively agreed upon, would result in increased woody biomass flow.

A number of recent developments provide such opportunity, but need funding. Title IX of the 2008 Farm Bill contains multiple authorities for sustainable woody bioenergy development, such as the Community Wood Energy program (Sec. 9013). Moreover, current climate cap and trade legislative discussions include significant adaptation management funding to help forests adapt to a changing climate. Grounded in active, sustainable forest management, woody biomass will flow as by-products from forest management, while simultaneously helping to achieve climate adaptation.

All of these public policy options can and should be designed and built around the notion of providing incentives for community-scaled collaborations where sustainability concerns can get worked out into some form of social contract or agreement. Yet be aware that numerous tools and solutions that have been tried, and many bottlenecks remain, so achievement of all the aforementioned should not be viewed as the panacea, but rather important steps to undertake in the name of sustainable woody bioenergy development.

Conclusion

The forest challenges in the intermountain west forests are great. Forest health, wildfire, climate change and an expanding population living in and using the forests create competing demands, and threats, which only active and sustainable forest management can hope to balance. Sustainable woody bioenergy development is a major part of the solution. It represents the opportunity to open up management options, enabling forest managers to best optimize forest goods and services, while simultaneously meeting the regions energy needs.

It also represents an opportunity to rethink our nation's energy system. Our current system is very centralized, highly dependent on massive grids that have shown vulnerabilities in the past (the 2000-2001 California rolling blackouts and the 2003 northeast blackout). Creating a more de-centralized system based on distributed energy generation should be driving goal. The distributed nature of woody bioenergy, with its varied applications and scales (TABLE 1) is an ideal solution as the nation works to diversify and improve its centralized system.

This paper has outlined four factors which frame sustainable woody bioenergy and push development in the region to a more local, community-scale.

- The region's federal land overlay provides a limited, reliable supply of woody biomass, oftentimes just enough for the community scale.

- The high transportation costs associated with hauling woody biomass will keep new facilities smaller and grounded to the community.
- Supply competition with existing forest products industries will put pressure on woody bioenergy development to stay small.
- And perhaps most importantly, the social contract needed to govern management of forests, federal forests in particular, is most easily found at community scales.

Considering these four, there is a “sweet spot” for sustainable woody bioenergy development in the intermountain west: distributed development of new and redevelopment of existing community-scale combined heat and power and/or biofuels across the landscape. This may take form as a bioenergy expansion at existing forest products facilities, or it could take form as an infusion into existing programs such as the USFS Fuels for Schools and Community Wood Energy programs. Further, clustering of forest products industries tied to sustainable woody bioenergy is a natural complement that will help with cost efficiencies. However, the key for every type of woody bioenergy application is that social agreement needs to be reached to ensure sustainability. This will drive appropriate scale and should be a driving factor in selecting the type of woody bioenergy application to pursue. With the continuing proliferation and evolution of the region’s community scaled collaborations, such as Community Wildfire Protection Plans, a mechanism is within reach.

We must stay mindful however of the intermountain west’s landscape scale forest health problems. We should be looking to enable the broadest solution possible, and it may be smart to begin state-wide coordinating of CWPPs, or other social contracts, to address the landscape scale. Strategic analysis and assessment of CWPPs across a state, or through programs such as the Coordinated Resource Offering Protocol described earlier in the paper, would be a productive method to cultivate new and sustainable woody bioenergy markets and bring our solutions up to scale.

While challenges abound, the future is bright. With the right vision and leadership, and with a little support from the public policy options presented, the intermountain west may very well find itself as a leader in ending the nation’s dependence on foreign energy, while simultaneously creating vibrant communities and solving its forest health problems. While only a preliminary analysis, more detailed investigation is needed to further understand the hurdles and solutions to sustainable woody bioenergy development in the intermountain west.

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