

Sustainable Woody Bioenergy:
A New Organizational Foundation for Forestry in the Intermountain West

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ABSTRACT

The intermountain west region is experiencing a foundational change in the way it approaches forestry. Sustainable woody bioenergy is playing a central role in the reshaping as old organizing approaches no longer work. The lens in which we view forestry is moving from one dominated by government control, timber and a strong private industry to one with a mix of private sector and civic sector entities stepping up to meet declining public sector capacities and investments. A “sweet spot” is forming around collaborative community-scaled woody bioenergy which enables agreement between communities, industry, stakeholders and government. Public policy intervention is needed and single policy tool solutions will not be able to navigate these multi-variable fields. Successful sustainable woody bioenergy development will require a system and combination of new and existing tools. This paper explores many of these tools by integrating perspectives from around the intermountain west to form a regional outlook.

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I. INTRODUCTION

Woody bioenergy is receiving significant 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, declining forest health conditions and economically struggling rural communities, proponents see a rare alignment of opportunity in woody bioenergy to tackle these challenges. Interestingly, woody bioenergy also provides a chance to re-imagine the organizational landscape of forestry in the intermountain west. From one that has been for

decades dominated by centralized government control and private industry, to one with a growing mix of private sector and civic sector entities, such as communities and collaborative institutions, stepping in to meet declining public sector capacities and investments.

In the not so distant past, timber was the predominant organizing principle for forest management in the intermountain west. Timber has declined as an organizing principle and rally point over the last few years as the integrated forest products industry has divested itself of land holdings and infrastructure. In its place wildfire has risen as a dominant forest management theme. And while wildfire captures the spotlight, it does not provide a solid and diverse foundation for a new organizing platform for forestry. Sustainable woody bioenergy, with all its scalable applications, does provide a strong platform for greater private, public and civic sector engagement. It enables us to re-imagine the organizational landscape for forestry in the intermountain west, one based on communities and multiple stakeholders.

It all begins by starting locally, engaging the existing forest products industry and collaboratively working at the community-scale. This is the secret to sustainable woody bioenergy development in the region. When done in a sustainable manner, woody bioenergy can provide a new organizing context to deal with the long-standing forest health issues in the intermountain west, as well as satisfy the broader interest in renewable energy, carbon and climate change.

This paper is designed to shed daylight on the region's woody bioenergy context and to posit sustainable woody bioenergy as a new organizing foundation for forestry in the region as old models which are not working fade. The paper has been built with input from multiple stakeholders within the government, academia, community group, non-governmental organization and industry sectors, and from the author's own public policy working experience. It represents the integration of those perspectives in the hopes that more informed and timely decision making can occur.

II. 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 by forcing them to compete for limited resources and making them more susceptible to pests and pathogens. Other forests 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 are 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-Chedeski 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

These three combined approach an area the size of Delaware and it represents only a sampling wildfire's toll in the intermountain west.

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 to this that more and more people are surrounding, living within and using the forests for recreation and other pursuits in record numbers¹, and it is clear that the region's forests are facing increasing pressures.

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 Service (USFS) lands². Public and private sector solutions are needed and sustainable woody bioenergy development represents perhaps the region's best opportunity.

Why Woody Bioenergy?

The short answer is it provides market-based opportunities to address the region's forest challenges by improving forest health, extending forest productivity, and creating jobs, while 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 never 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 years³), and
- increasing wildfire danger (nationwide, 132 million acres estimated at-risk of catastrophic wildfire,⁴ 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 mills⁵), the challenges ahead become clear. And all of this will be exacerbated as the effects of climate change compound these problems.⁶

¹ 178.6 million visits - www.fs.fed.us/recreation/programs/nvum/nvum_national_summary_fy2007.pdf - October 2008

² Taxpayers for Common Sense - http://ourforests.org/fact/amok_factsheet.pdf

³ www.wflcenter.org/news_pdf/222_pdf.pdf

⁴ www.usda.gov/oig/webdocs/08601-6-AT.pdf

⁵ Haynes, 2009 – Western Forestry Leadership Coalition report – The Western Forest Products Industry: Status, Issues and Implications for the Future (yet to be published)

⁶ Westerling, 2008 - http://meteora.ucsd.edu/cap/pdffiles/westerling_fire08.pdf

While some advocate for a new amenity based economy in the west, few would disagree that a diversified portfolio of options is the best prescription for long-term forest and community health. 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 dominant federal land overlay in the region, 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 and diversify 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 this, sustainable woody bioenergy is the only renewable energy where incidental benefits, things like clean water, wildlife habitat, carbon sequestration and recreation, can be maximized while simultaneously pursuing development.

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 residues⁷ and wood processing residues.⁸ Further, for the purposes of this paper, references to woody bioenergy refer to the following energy solution applications:

⁷ Defined as residues left over from mechanical treatments (thinnings, hazardous fuel reductions, harvesting, etc.)

⁸ Defined as leftover fiber from wood product processing such as bark, sawdust, trimming and shavings.

TABLE 1: Woody biomass energy applications

Woody Biomass Energy Application	Description	Scale⁹
<i>Power Generation</i>	Stand alone electricity producing facilities (includes biomass only and co-firing with coal or natural gas)	Small 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 of sustainability. Project time horizon, ability of industries to partner and cluster, a processing facility's supply footprint, land ownership and scale become key variables in determining sustainability success within the region. It is also important to highlight that a key assumption in this exploration is that sustainability is best achieved through social dialogue and agreement. This is one reason why woody bioenergy is a largely dispersed and localized opportunity as experience has shown that it is the community- level where people more readily find common ground and agreement relating to the forests they depend upon.

Challenges

While opportunity certainly exists everywhere that there are forests and trees in this country, the intermountain west¹⁰ has a unique set of factors that will dictate how woody bioenergy can be developed.

Common to all parts of the country, woody bioenergy development faces a number of obstacles such as limited investment capital, a limited skilled workforce, a bias toward other renewable energies, and a relatively low valued

⁹ Column represents typically scaled applications. You can find examples of all scales, but these are the most common.

¹⁰ 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.

commodity. For the intermountain west, additional variables include; high transportation costs, consistent and available supply, competition from the existing and diminishing forest products industry, and a dominant federal lands ownership struggling to manage its lands, all of which make for a challenging backdrop. Further, the generally mountainous and dry geography of the intermountain west, layered with the federal government as the dominant landowner, create particularly vexing ecological, economic and socio-political roadblocks to achieve sustainability. The federal lands nexus will be further investigated later in the paper, but the combination of these factors has the effect of making it very difficult to get solutions up to size to address the landscape scale issues in the region.

These unique challenges demand that the public, private and civic sectors work together to find solutions. And it will demand a combination of traditional policy tools and new tools that reach across these sectors and enable them to coordinate and work toward a common purpose.

III. 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. How much is available is another story.

There are numerous studies, assessments and projections outlining the woody biomass feedstock picture, such as the fairly well-known USDA Billion Ton Report¹¹ and some recent work by the USFS Research branch¹². But perhaps the best available for the intermountain west is the renewable energy body of work put out by the Western Governors' Association (WGA). Starting with their Clean and Diversified Energy Initiative¹³ and following with their Transportation Fuels for the Future Report¹⁴, a fairly comprehensive picture of woody biomass supply in the twelve intermountain states can be ascertained.

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

¹¹ Billion Ton Study - http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf

¹² www.fs.fed.us/pnw/pubs/pnw_gtr753.pdf

¹³ www.westgov.org/wga/initiatives/cdeac/Biomass-full.pdf

¹⁴ www.westgov.org/wga/initiatives/transfuels/Task%201.pdf

WGA runs 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. 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 purposes¹⁵. 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, WGA's projections translate into 2400 megawatt hours of useable power using generally accepted conversion factors.¹⁶ 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 potentially equates to enough electricity to support approximately 2.4 million average households per year and there are an estimated 111.1 million households in the U.S. (2005 Residential Energy Consumption Survey). This is also enough to produce 1.6 billion gallons of ethanol. And put into a heating context, 20.4 million bone dry tons is equivalent to 69.600 septillion Btu / year¹⁷, or enough to heat 683,000 households,¹⁸ more than enough to heat the cities of Denver, Salt Lake City, Las Vegas and Boise combined.¹⁹

Clearly, 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. One 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 organizations, institutions and 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

¹⁵ Billion Ton Study - http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf

¹⁶ 8,500 bone dry tons = 1 MWyear : 1 bone dry ton = 80 gallons of ethanol
www.forestbioproducts.umaine.edu/documents/conference_stokes1.pdf - p.19

¹⁷ One megawatt is equivalent to 3.413 million Btu/h (British thermal units) -
www.fpl.fs.fed.us/tmu/wood_for_energy/primer_on_wood_biomass_for_energy.html

¹⁸ One household uses 101 million Btu / year -
www.eia.doe.gov/emeu/recs/recs97_additions/recs_changes.html

¹⁹ <http://quickfacts.census.gov/qfd/states/> - Denver – 240K household, Salt Lake City – 71K households, Las Vegas – 177K households, Boise – 74K households.

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 account for the financial 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 capture. There is rarely an easy, nor definitive, way to write down the social contract under which our forests are governed. And 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. Although not a purely collaborative exercise, the 143 million acre Interior Columbia Basin Ecosystem Management Project²⁰ is a tangible example where the large scale was a hurdle in reaching social agreement on management direction. To point, while the industrial forestry community might espouse larger sizes to tap financial economies of scale, there is a general feeling in the environmental community that a business model where increasing scale drives increasing supply is not sustainable. It is important to note that the type of woody bioenergy application to be pursued, as described in TABLE 1 (p. 5), tends to be a significant driver of the "appropriate scale."

The intermountain region has pursued the concept of social contract, or 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

²⁰ www.icbemp.gov

these are occurring in many intermountain west states and they are becoming key ingredients for broadly outlining agreement on sustainability. More of such forums are needed to coordinate the multi-faceted variables interlaced in woody bioenergy development. 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 can flow more readily from agreed upon projects, be they hazardous fuel reductions, stewardship contracts or timber sales, because most parties agree on outcomes.

Moreover, 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 allows the individual community to refine a woody bioenergy project, locking down agreement on sustainability and thus providing greater certainty and comfort for all parties. A good example is an Arizona collaborative based out of Northern Arizona University which calculated that 4 million bone dry tons of woody biomass is available 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. Further study and cataloguing of best practices and successful examples are needed to understand their success and disseminate the concept.

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 on average between \$400-\$1600/acre for mechanical removal²¹. And it is the road transportation costs which often 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 a relatively low valued end product like bioenergy, as compared to dimensional lumber. This limits the radius from which a processor might source its woody biomass.

Another factor influencing these sourcing radii is the type of woody bioenergy solution being pursued. Again, as described in TABLE 1 (p.5), 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, radii will be large or small depending on which woody bioenergy application being pursued. Therefore, when choosing which woody bioenergy solution to

²¹ Synthesis of Knowledge from Woody Biomass Removal Case Studies - www.forestguild.org/publications/research/2008/Biomass_Case_Studies_Report.pdf
http://www.fs.fed.us/rm/pubs/rmrs_gtr149.pdf

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 larger sized communities, towns and cities pulling from longer distances. But in general, sourcing circles tend to be limited and is another factor which influences the fact that woody bioenergy solutions tend to be distributed and localized across the landscape. This distributed characteristic is one of the key reasons why woody bioenergy needs to be looked at on a community scale.

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

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 to local/community scales.

IV. FEDERAL FOREST LAND OWNERSHIP INFLUENCE

Although there is a significant amount of woody biomass across the region, a big question comes is 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 acres²². Of those public lands, the federal government is the largest forest landowner by far (see *TABLE 2 – p.11*), 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. Growth is more than double removals of woody biomass in the west.²³

²² www.treesearch.fs.fed.us/pubs/5596

²³ www.fia.fs.fed.us/library/briefings-summaries-overviews/docs/ForestFactsMetric.pdf

TABLE 2: Intermountain forest resources²⁴

State	Total Forestland (million acres)	Federal Ownership (million acres)	Percentage
Arizona	19.427	10.192	52.5%
California ²⁵	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 ²⁵	29.651	17.741	59.8%
South Dakota ²⁵	1.619	1.004	62.0%
Utah	15.676	11.913	76.0%
Washington ²⁵	21.790	9.422	43.2%
Wyoming	10.995	8.832	80.3%

The recent 2007 Energy Independence and Security Act is a great demonstration of how public land policies and regulations can cloud the intermountain west landscape. 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 creates a competitive disadvantage for bioenergy development in the region. Although just one example, it is reflective of the complexity and multi-decadal 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 to over-reach. One-size fit all solutions do not work in a forestry context where management prescriptions are better driven by local forest considerations, such as forest type and geography, as well as by the interested community in question. It is from within this forestry, and local community, 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

²⁴ Taken from latest USFS Resource Planning Act assessment - http://nrs.fs.fed.us/pubs/gtr/gtr_nc241.pdf

²⁵ 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.

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.

V. 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. 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. This is something that we can ill afford in this day and age as the collective existing industry nationwide directly employs more than 1 million people and ranks among the top 10 manufacturing employers in 48 states.

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 availability of woody biomass, 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 nonexistent, the dialogue around woody bioenergy and sustainability is much different than it is 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. Looking toward the concepts of agricultural cooperatives and the clustering of industrial infrastructure may offer significant opportunities for the industry.

VI. POLICY TOOLS: PUBLIC, PRIVATE AND CIVIC

Development of sustainable woody bioenergy has many facets and numerous challenges to overcome for it to become the new organizing concept for forestry in the region. Policy intervention is needed. Such multi-faceted goals often require the application of a system of policy tools to address the hurdles. In such cases, the socio-political context, land tenure system, effectiveness of the market and robustness of government funding/authorities in the area in question are significant determining factors (Cubbage, 2007)²⁶. For woody bioenergy, a number of different policy tools will need to be applied to ensure its sustainability and success.

The policy tools discussed below stem largely from federal level options, 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.

A. Public Sector Tools

These types of tools often are decided in the public policy arena and take form as rules, government programs and incentives.

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. Arizona is the only state to count the thermal

²⁶ F. Cubbage, et al.; *Forest Policy and Economics*, Vol. 9 (2007) 833-851

properties of woody bioenergy in its RPS calculation. The earlier example of the national RFS definition for renewable biomass is more glaring testimony. Given that this popular standards tool²⁷ will continue to be used and likely be expanded, changes will need to be made to ensure that all renewables, and all applications of 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 Contracting²⁸ authority (Section 323 Public Law 108-7). A successful example is the 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.

A key to its success has been the Community Wildfire Protection Plans developed by nearby communities which enable agreement around need and sustainability. A 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

²⁷ Currently, Idaho and Wyoming are the only two intermountain west states that do not have some form of RPS or state goal (www.dsireusa.org/documents/SummaryMaps/RPS_Map.ppt). Unfortunately, most do not provide for woody biomass.

²⁸ www.fs.fed.us/forestmanagement/projects/stewardship/index.shtml

federal wildfire suppression expenditures, have limited the development of similarly scaled projects in other parts of the west, even though the same needs exist. A stewardship contracting legislative fix is needed for longer contracts and to address the cancellation ceiling.

Stewardship contracting is a relatively new tool and can be complicated. Time must be spent raising federal land manager awareness and comfort to encourage its use. Having been applied mostly in pilot capacity over the past five years, a number of lessons have been learned²⁹ and need to be adapted to current implementation.

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, many view such a credit as a payment for a public good (reduced wildfire threat). The 2005 Energy Bill authorized such a program³⁰ (Sec. 210) at \$20 million per year, but has never been funded. Further, the 2008 Farm Bill has over a dozen different programs that support woody bioenergy development and should be viewed as another source for financial incentive.

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. There are a number of woody biomass utilization directives within this collaborative wildfire context that would further promotion of sustainable woody bioenergy in the intermountain west.

The 10-year Wildfire Strategy also provides an important ingredient necessary for sustainable woody bioenergy success, particularly if it is to become a new organizing foundation for forestry. It provides both a long-term agreed upon vision and lays out a collaborative framework for coordination of forest and wildfire policies at the national, state/regional and local levels. Continued pursuit and funding of the 10-year Strategy is vital.

Tax Credits: Production Tax Credit (PTC)

The PTC is a ten year corporate tax credit for electricity production currently set at 1cent/kWh for open-loop³¹ biomass (closed loop is set at 2cents/kWh). The

²⁹ www.pinchot.org/files/Pinchot_Institute_Lessons_Learned.pdf

³⁰ Commercial Biomass Grants Utilization Program – provides a \$20/green ton subsidy for biomass delivered to a wood utilization facility

³¹ Open-loop biomass is biomass sourced from an open system, meaning biomass sourced from any feedstock available. Closed-loop biomass grows its own biomass.

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. Further, consideration should also be given to expanding the credit to capture the thermal efficiencies of woody bioenergy. The U.S. Forest Service Fuels for Schools program³² is a successful and ready example where the region is primed for evolution to thermal woody bioenergy solutions.

Another important piece of the equation are the various state and federal consumer tax credits, including the 2009 American Recovery and Reinvestment Act, which reward installation of woody bioenergy devices. For example, Oregon recently amended 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 tools that produce woody biomass. Grounded in adequately funded active, sustainable forest management, woody biomass will flow as by-products from management activities.

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 \$20 million 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. Lastly, a related necessity is to fix wildfire suppression budgeting. A new federal agency wildfire budgeting model is needed to address out of control wildfire expenditures (FLAME Act – H.R. 1404 – 111th Congress) which are limiting available forest management dollars for stewardship contracting and other programs.

B. Private Sector Tools

These tools are characterized by solutions where private capital and markets play the dominant role. Considering the context of the intermountain west

³² The FFS program matches educational institutions, or any public building, with woody bioenergy solutions with technical and financial assistance - www.fuelsforschools.info

presented in this paper, the need for the existing and new industry to work together for their mutual benefit has never been greater.

Clustering

A concept introduced earlier in the paper 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 clearly identified investment zone. These companies, with their different niches, might 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 (RFP Numbers 2008-003 and -007).³³

Cultivating public-private partnerships here will be key and having each individual industry member find their niche, will 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.

C. Civic Sector Tools

These tools are grouped primarily around the notion of the community, be it a community of place or a community of interest, banding together to solve a common problem. Wildfire provides a poignant example.

Within the intermountain west a sense of urgency is building, driven in large part by the growing wildfire threat. This threat is drawing many to recognize that the overarching forest health problems we face are on a scale beyond what any one single 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.

A nexus is forming 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. Moreover, such community expressions also tend to be the most sustainable and durable because the community has invested itself in the solution and wants to see it implemented.

³³ www.usendowment.org/currentprograms.html

Numerous examples exist within 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. Community Wildfire Protection Plans (CWPPs) and Resource Advisory Councils (RACs) are prime examples, both of which have statutory grounding and influence over federal land management.

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 aforementioned 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.³⁴ 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.³⁵ It is clear that the acreages can be substantive.

Barriers and constraints around community-scaled, collaborative solutions do exist. Northern Arizona University has a small library of publications on the subject³⁶ and has found that community collaborative efforts can create unrealistic outcomes, leaving unfulfilled expectations amongst participants. Further, inconsistent commitment, participation, and support of collaborative efforts within government agencies can make it difficult for collaborative efforts to succeed. And finally, collaborative group participants often lack the capacity or experience to deliver outcomes. Despite these concerns, which can easily be overcome when acknowledged early in the process, community-scaled, collaborative solutions such as CWPPs and RACs do work.

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

VII. CONCLUSION

The challenges before the intermountain west forests are great. Forest health, wildfire, climate change and an expanding population living in and using the forests create a recipe for conflict because of all the competing demands and threats. A new model is needed to address and find solutions. Sustainable

³⁴ www.fs.fed.us/r3/spf/cfrp/monitoring/pdf/mp-execsum-122005.pdf

³⁵ www.forestsandrangelands.gov/Woody_Biomass/supply/CROP/documents/roms/cropsummary.pdf

³⁶ <http://www.eri.nau.edu/joomla/content/view/26/51/>

woody bioenergy is a (re)emerging forest management option that has the potential to be a major part of the solution. Woody bioenergy represents a chance to re-imagine the organizational foundation for forestry in the region, providing management options for communities and forest landowners as they strive to adapt to changing economic, climatic, energy and forest health conditions.

It also represents an opportunity to rethink our nation's energy system. Our current system is very centralized, highly dependent on regionalized 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, p.5), is an ideal component to diversify and fill the gaps in the nation's energy system.

This paper has explored the status, conditions and factors governing sustainable woody bioenergy development in the intermountain west. As discussed, four key variables rise which influence the sustainability of such prospects; federal land management, processing/operating costs, existing forest products industry supply competition, and the social contract granted by the public to utilize the forests in such a manner. All these point to distributed, community-scaled development, or redevelopment, of woody bioenergy applications across the landscape as having the best chances for success. To get there, and to derive the "appropriate scale," it begins by starting locally, engaging the existing forest products industry and collaboratively working at the community-scale. With the rich history and continuing proliferation and evolution of the region's community scaled collaborations, such as Community Wildfire Protection Plans, mechanisms are within reach.

New Organizing Foundation for Forests

Through all this we must stay mindful of the intermountain west's landscape scale forest health problems. These problems are complicated and nebulous and thus we need to look at solutions from a systems perspective and on a scale that can make a difference. This means establishing a new governance structure for forestry. Moving from one where government control, timber and a strong private industry are replaced by a mix of private sector and civic sector entities stepping up to meet declining public sector capacities and investments. Single policy tool solutions will not be able to navigate these multi-variable fields. To reach this "sweet spot" will require a system and combination of new and existing tools as discussed in this paper.

In trying to make sense of these tools, it may help to think of both short-term and long-term actions that will be needed. Short-term to send positive signals and boost confidence in woody bioenergy development. Long-term to provide vision and consistency. Furthermore, we need to look at the intermountain west in a regionalized way as the application of tools will look different in different parts of

the region. The challenges facing the Northern Rockies are quite different from those facing the Southern Rockies.

Near-term in the Southern Rockies, where a new forest products industry needs to be established, a combination of functioning federal land management tools such as stewardship contracting with a clustered private sector could spell success. For the Northern Rockies where, relatively speaking, there still remains a functioning forest products industry, a mix of government incentives and tools, such as the Production Tax Credit expanded for thermal heat capture, coupled with grandfathering of the existing industry's renewable energy contributions, would provide an infusion for woody bioenergy development and improve private sector confidence.

Long-term, the focus will need to be on sustaining the policy tools and on finding ways to coordinate these new multi-variable systems. These solutions will require commitment to see things through and thus longer term policy blueprints are needed to muster the political backing of these tools. Pivotal to this commitment is injecting enduring leadership to champion the issue and keep focus. The 10-year Wildfire Strategy provides a prime example. It not only charts a decade long vision for leadership to build upon and motivate from, but within, it describes a collaborative framework at the national, state/regional and local levels to coordinate policies and tools. Such coordination and leadership of these complicated systems is vital.

Through all this, we should be looking to enable the broadest solution possible, and it may be smart to begin with state-wide coordinating of CWPPs, or other social contracts, to address the landscape scale and prioritization of limited resources. 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 solutions up to scale.

As this paper is only a preliminary outline, more detailed investigation is needed to optimize development of and better understand how development of sustainable woody bioenergy can solve many of the region's forestry challenges as a new organizing foundation in the region. McDonnell (1987)³⁷ offers a framework to better illuminate how the policy instruments explored here can best translate the substantive policy goals of sustainable woody bioenergy into concrete action. And Schneider (1990)³⁸ can help elucidate the behavioral theories and assumptions behind the various policy tools to better match them to the geographic and temporal application of woody bioenergy. These policy analytical frameworks are recommended for further research and optimization of

³⁷ McDonnell; *Educational Evaluation and Policy Analysis*, Vol. 9, No. 2 (Summer, 1987), pp.133-152.

³⁸ Schneider; *The Journal of Politics*, Vol. 52, No. 2 (May 1990), pp. 510-529.

sustainable woody bioenergy development and helping to create a finer tuned blueprint for the future.