EXECUTIVE SUMMARY

WOOD WASTE UTILIZATION ASSESSMENT FOR THE GREATER TAOS, NEW MEXICO REGION

Prepared for:
The Nature Conservancy
Taos, New Mexico

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Final Report

INTRODUCTION

The Nature Conservancy (TNC) is coordinating with the Taos Valley Watershed Coalition (TVWC) to support planning and implementation of landscape-scale forest restoration projects across 280,000 acres on the west slope of the Sangre de Cristo mountains. In 2015, the TVWC Landscape Restoration Strategy was created as a guiding document that agencies, communities, tribes, Firewise communities, private landowners and NGO's will implement to protect, improve and restore water quality, quantity and ecological function of forests and streams in the Rio Grande watershed within Taos County. The LRS advocates a blend of treatment activities including controlled burns, natural fire ignitions and thinning activities. Thinning treatments (where appropriate) have the potential to generate forest biomass material as a byproduct. TNC has asked that TSS Consultants (TSS) determine the value-added processes that could utilize forest and woodland restoration byproducts generated as a result of implementing the Landscape Restoration Strategy.

Community Outreach

In the course of this investigation, TSS worked in concert with TNC to conduct two community workshops in Taos. The initial workshop, held June 8, 2016, provided interested community members and stakeholders with an overview of the Rio Grande Water Fund objectives and an overview of the wood waste feedstock utilization assessment. The second workshop, held August 25, 2016, provided an opportunity for TSS and TNC to review initial feedstock supply findings and discuss the range of value-added utilization options. (See full report, including Appendix.)

Target Study Area

A target study area (TSA) extending in a 50-mile radius from Taos and containing approximately 5,026,071 acres was selected. All of the TSA is within transport distances up to 1.5 hours of one-way drive time from Taos. Although tangential to Santa Fe, the TSA contains no major urban areas and is still a relatively intact network of private, federal, and tribal lands. The TSA takes in two USDA Forest Service (USFS) national forests, Bureau of Land Management (BLM) rangelands, Pueblo lands, lands managed by the State of New Mexico, and privately-owned forests and rangeland. It includes all of Taos county and portions of Rio Arriba, Colfax, Mora, Santa Fe and San Miguel counties. (See full report, Figure 4, Land Ownership Map).

The fundamental driver of regional biomass supply is the ownership and management of the key vegetation types, specifically conifer forest and pinyon-juniper woodland.

Conifer ecosystems with the potential to produce woody biomass material long term occur on approximately 51% of the TSA landscape. The TSA contains over 1.85 million acres of conifer forests (36.8% of the TSA) and 730,000 acres of pinyon-juniper woodlands (14.5% of the TSA). The fundamental driver of regional biomass supply is the ownership and management of the key vegetation types, specifically conifer forest and pinyon-juniper woodland. The USFS manages significant tracts of conifer forest within the TSA at over 1.1 million acres, or 37.8% of the area. Private landowners manage approximately

1.3 million acres, or 41.7% of the area. The majority of pinyon-juniper woodlands (approximately 45.4%) are owned by private landowners, although 29.0% are under USFS jurisdiction and 13.9% are under BLM jurisdiction. The ownership of landscapes capable of producing biomass is critical to the long-term sustainable availability of feedstock because ownership and jurisdiction directly impact policy, regulations, and management with regard to vegetation treatment activities.

BIOMASS FEEDSTOCK SUPPLY ANALYSIS

An analysis of biomass feedstock supply was conducted using multiple data sources, models and informational interviews with agency personnel, private landowners and forest product manufacturing operations. Biomass feedstock considered in this analysis includes forest or woodland sourced material, forest products manufacturing residuals, and urban wood waste. For all biomass sources, TSS has estimated a potentially, technically and economically available volume. The potentially available volume is the total amount of biomass currently produced annually. Recoverable biomass is judged to be technically available considering physical constraints (such as terrain and transport) or policy constraints. Economically available biomass is the amount available considering existing competition for wood waste material. At this time, there is no competition within the TSA for woody biomass. The common unit of measure for biomass material is bone dry ton (2,000 pounds of dry wood fiber).

Biomass Supply Availability Findings

SOURCE	POTENTIALLY AVAILABLE (BDT/YEAR)	TECHNICALLY AVAILABLE (BDT/YEAR)	ECONOMICALLY AVAILABLE (BDT/YEAR)
Timber Harvest Residuals	6,085	3,189	3,189
Forest Restoration and Fuel Treatment Residuals	34,095	17,878	17,878
Pinyon Juniper Treatment Residuals	10,905	5,761	5,761
Forest Products Manufacturing Residuals	0	0	0
Electric Transmission/Distribution System Maintenance	0	0	0
TOTAL	**51,085**	**26,827**	**26,827**

Costs to Collect, Process and Transport

There are few commercial-scale contractors equipped to collect, process, and transport forest and pinyon-juniper biomass material operating within the TSA. Round wood (logs) are typically removed for sawlogs, firewood, vigas or latillas. Limbs, tops and small stems are typically piled and burned, lopped and scattered, chipped and scattered or occasionally left on site. TSS relied

on discussions with forest biomass contractors operating in the region, in addition to TSS's past experience, to analyze these costs.

Biomass Feedstock Collection, Processing, and Transportation Costs

SOURCE	LOW RANGE ($/BDT)	HIGH RANGE ($/BDT)	AVERAGE DELIVERED COST ($/BDT)
Timber Harvest Residuals	$56.25	$61.25	$58.75
Forest Restoration and Fuel Treatment Residuals	$46.25	$50.00	$48.13
Pinyon Juniper Treatment Residuals	$47.50	$51.25	$49.38
Urban Wood Waste	$36.25	$41.25	$38.75

VALUE-ADDED OPPORTUNITIES ANALYSIS AND CRITICAL ATTRIBUTES

Using findings from the biomass feedstock supply availability analysis, field visits in the Taos area, community stakeholder meetings, interviews with staff at existing wood products and waste facilities and new wood product developers, TSS conducted a value-added opportunity review to assess the range of commercial utilization options available. The biomass feedstock considered in the value-added opportunities analysis is biomass waste material that would be derived from forest hazardous fuels reduction, timber harvest operations, forest restoration and landfill wood waste recovery activities.

Based on TSS experience with value-added utilization of woody biomass, and in consultation with TNC, six categories of value-added products were selected for analysis for potential utilization within the Taos region. These are: Biomass Power and Thermal Energy; Densified Fuelwoods; Co-location with Existing Sawmill Facility; Agriculture, Landscaping and Furniture; Advanced Wood-based Materials; and Biofuels. The report presents a matrix of each of the six value-added categories describing individual products for each category with feedstock specifications, type of equipment, market potential, and comments. (See full report, Table 23, Value-Added Biomass Utilization Opportunities in Northern New Mexico.)

To assist in determining which value-added opportunities identified for the Taos TSA might be the most appropriate path forward, each of the six value-added utilization categories was analyzed for the following critical attributes: Minimum economic scale; Types of feedstock utilized; Existing and potential markets; Transportation to markets; Synergies for co-location in existing sawmill or product yard; Ease of facility siting; Workforce requirements; Environmental permitting and compliance; and Potential project partners. (See full report, Table 24, Critical Attributes for Value-Added Utilization by Categories.)

Identification of Potential Biomass Utilization Projects

A focal point of the value-added analysis was to identify potential projects that could be established in the Taos region using locally generated biomass material that does not impact the feedstock supply of existing wood products businesses. TSS identified the following projects, or project types, for the Taos region.

Wood-Plastic Composites

Wood-plastic composites (WPC) are products made of a combination of wood fiber and thermoplastics such as polyethylene and polypropylene (as virgin or recycled material). WPCs are still relatively new materials in the wood products industry. WPCs are primarily used as wood decking but are also used for railings, fences, landscaping timbers, siding, park outdoor and indoor furniture, molding and trim, and window and doorframes. As a potential eco-friendly substitute for traditional forest products, both existing and potential markets exist locally, regionally and beyond into the southwestern and western markets. Transportation to the markets from Taos can be accomplished by truck, with transfer to rail in Albuquerque if the market demands.

A WPC product manufacturing process meets many of the critical attributes for a potential value-added process in the Taos region. An example is PJ Woodlands, an Albuquerque company currently establishing itself as a manufacturer of WPC. Their Altree product can reportedly utilize waste biomass material from a wide range of tree species and all forms of the waste material – limbs, needles, bark, etc. The Altree process is modular and a facility can be designed to add on production lines as feedstock supply increases or markets for the Altree products ramp up.

A Wood Plastic Composite product manufacturing process meets many of the critical attributes for a potential value-added process in the Taos region.

Biomass Heating Systems

Biomass heating is an effective use of excess forest biomass. Wood waste is combusted in a biomass boiler system to produce hot water or steam in a closed loop configuration which can then be transferred via a simple heat exchange system to either heat water and/or air for space heating. Biomass heating systems are used extensively in Europe and are increasingly common in the northeastern U.S. Most biomass heating systems are used in larger-scale commercial or institutional facilities.

Biomass heating systems typically only require several minutes of attention each day. Compared to most other renewable energy options currently available, biomass has the advantage of dispatchability, meaning it is controllable and available when needed, similar to fossil fuel heating systems. A biomass heating system can generally be coupled with an existing gas or propane fired heating system, whereby the existing system is utilized as backup or to supplement the biomass heat requirements during peak demand. This ensures that a redundant system for heating is available at all times.

Biomass heating in price per British thermal unit ($/Btu) is slightly lower than natural gas, and there are numerous commercial and institutional/governmental buildings in and around the town of Taos that could investigate the use of biomass fuel and heat systems as a potential retrofit (particularly for heating systems that due to age are candidates for replacement) or in new construction. However, biomass-fired heating systems for commercial and institutional/governmental buildings would be especially cost effective in areas of the Taos TSA where propane and electricity are used for space and water heating systems. There are several candidate sites in the Taos region.

Biomass-fired heating systems for commercial and governmental buildings would be especially cost effective in areas of the Taos TSA where propane and electricity are used for space and water heating systems.

Mine Reclamation

Wood chips can be used in the reclamation of abandoned and/or closed mining sites where large concentrations of mine tailings are located. The use of wood chips, combined with biosolids from wastewater treatment facilities, has been used to reclaim tailings at molybdenum mines in central Colorado. The combination of these materials, blended in a composting arrangement, creates a soil-like bedding for vegetation, which significantly aids in the potential cost effective reclamation of large mining sites.

Within the Taos TSA, there is a former molybdenum mine site that requires extensive reclamation and remediation. However, communication with the Chevron Environmental Management Company revealed that although the use of wood chips was considered at one time, they have been removed from future consideration based on initial testing.

Pyrolysis Production of Biochar

Pyrolysis production of biochar is the decomposition of woody biomass by heating in an oxygen-free, or oxygen limited, environment. The yield of biochar from a given unit of woody biomass material ranges from 20% up to 50% depending on the technique and equipment used. Generally, fast pyrolysis is preferred over slow pyrolysis due to better biochar quality and significantly less adverse emissions. There are numerous potential uses for biochar including soil amendment and soil conditioning, compost additive, air filtering and decontamination and treatment of domestic and industrial wastewater.

The biochar marketplace is considered by many in the industry as in an emergent mode and suffering from the "chicken or the egg" syndrome. There have not been sufficiently reliable suppliers of biochar products to date to allow the demonstration of the at-scale value propositions in specific biochar markets. Thus, the issue of how cost effective biochar is in specific markets, such as wastewater filtration and treatment, is still largely unresolved, although credible studies are accumulating in the literature and within individual industrial demonstration-scale projects. Adelanto Consulting (Albuquerque, NM) and TNC are partnering with Sandoval County to develop a biomass utilization facility that is capable of processing up to 80,000 BDT of woody biomass material into biochar.

Fuel Bricks

Wood fuel bricks are highly-compressed sawdust or woody biomass shaped into a one to five pound block. A woody biomass briquetter, such as those offered by RUF Briquetting Systems, converts loose woody waste material into uniform-sized briquettes that are easy to store and transport to market. They are often used in camping, wood stoves, patio stoves and chimineas.

TSS interviewed a small company using a briquetting machine with forest slash in Arizona. The operator uses the portable RUF Briquetting System (RUF-600) directly in the forest to source pinyon-juniper and other wood species waste from timber harvest or forest restoration sites. Briquettes are made from drying residuals along with bark and needles. The unit is mobile and set up on a portable frame to be able to utilize the wood waste coming from forest projects. In discussions with RUF Briquetting Systems, they believe that the briquettes could be manufactured and sold at a wholesale cost of about $165 per ton delivered. Currently, wood briquettes are retailing on a national average range of $250 to $275 per ton, with cord wood in the Taos area currently selling for $200/cord (unstacked) for mixed fir/pine. These price points are significant since the briquettes are densified wood and would cost less than cordwood on a heating value basis ($/Btu).

A briquetter can be portable and used in the forest at a restoration or harvest site. Fuel bricks are competitively priced in the cord wood market.

RECOMMENDED BIOMASS UTILIZATION OPPORTUNITIES

Due to the currently very limited value-added markets for woody biomass material generated as a byproduct of forest fuels treatment activities in the Taos region, most of the treatment operations are simply chipping slash and residual wood, then leaving it on site or piling and burning the material. Discussions with current woody biomass facility owners/operators (sawmills, landfills, transfer stations, etc.), foresters, and potential users of the waste woody biomass indicated that if a ready market for biomass existed, with values high enough to cover most of the processing and transport costs, significant waste biomass volume would be diverted away from current business-as-usual activities (e.g., pile/burn, chip/scatter). Results of these discussions confirm that there are opportunities to add value to forest biomass generated as a byproduct of forest fuels treatment, forest restoration, and landfill wood waste recovery activities in the Taos region.

Discussions with stakeholders indicated that if a ready market for biomass existed, with values high enough to cover most of the processing and transport costs, significant waste biomass volume would be diverted away from current practices of pile and burn or transfer to landfills.

In coordination with TNC, TSS identified three potential value-added options for the Taos region which are recommended as candidates for a Phase Two assessment with detailed economic and technical analysis:

- Wood/plastic composite board
- Biomass heating of a large facility
- Fuel bricks

FURTHER RECOMMENDATIONS AND NEXT STEPS

TSS further recommends the following next steps.

Community Outreach

Continued dialogue with the community is critical to success. Local businesses, residents, land managers and agency staff should have the opportunity to weigh in on the value-added technologies targeted for possible deployment. As this report is finalized, an executive summary document should be posted on the TNC New Mexico website.

Local Partners for Value Added Opportunities

TSS met with the following potential local partners for value-added options in the Taos region. TSS recommends their consideration for a Phase Two analysis: PJ Woodlands and the Altree Product for WPC manufacturing, Southern Methodist University for biomass heating systems, and Pradera Madera for fuel brick manufacture and marketing. (See full report for contact information.)

Fuels Treatment/Restoration Demonstrations

Consider a series of fuels treatment and forest restoration trials that would demonstrate the latest harvest, collection, processing and transport technologies. These demonstrations would allow local land managers and contractors to view conventional and innovative equipment up close. Site conditions both pre and post treatment could be monitored to analyze cost effectiveness and impacts on soils, vegetation, and fire behavior.