



Shoshone County Woody Biomass II

Renewable Energy Enterprise Zone (REEZ) Program

Ed Pommerening

Riverview Timber Service, LLC

Shoshone County Biomass II

Abstract

In the Silver Valley of Northern Idaho, a disastrous event happened in the summer of 1910. Anyone who has lived in Shoshone County, or the vicinity, knows the event simply as ‘The Fire of 1910’. Idaho was a young state with lands not yet subject to mass homesteading. Settlers had not discovered logging as something they could do for profit. At the time, towns through the modern day Silver Valley were mining towns. The mountains contained dense stands of old growth White Pine, Ponderosa Pine, Cedar, Douglas Fir, Grand Fir and Western Larch trees. However, it was the material within the ground early settlers desired and the forest lands, for the most part, were left alone. In the summer of 1910, wildfires consumed the thick stands of trees. The amounts of woody biomass contained within the forests were significant enough to combust settlements into fire many miles away from the original fires.

Over 100 years have passed since the Fire of 1910, but unfortunately, minimal steps have been taken to prevent another similar disaster. The United States Forest Service states that there currently exists 2.5 times the amount of woody biomass fuel within our public lands now, than there was before the 1910 fire. This report show that within the 105,096 acres of private and state owned land in the Woodland Urban Interface (WUI) of northern Shoshone County alone, over 500,000 tons of biomass are created per year; that is 4.9 tons of biomass per acre per year added to Shoshone County’s timber land. The majority of the landowners in the portion of the county would be willing to take actions to help prevent another 1910 fire.

Contained within this report is a description of the research, resulting data and charts, along with pictures and recommendations regarding the woody biomass in Shoshone county.

Shoshone County Biomass II

Shoshone County Woody Biomass (REEZ) II

Shoshone County, on the eastern side of the north Idaho panhandle, stretches over a large area covering 2,636 square miles of mountains and valleys. Eighty-seven percent of its land area (or 1,888,941 acres) is classified as “forest uplands,” while less than one percent (only 6,027 acres) is “urban or developed.” Shoshone County has been seeking to promote industries that utilize woody biomass in an effort to improve the health of the county’s forests, reduce potential hazards from wildland fires, and stimulate sustainable economic growth.

Project Introduction

Background

In 2008, Shoshone County contracted with the McKinstry Company to develop a study in order to determine if a Combined Heat and Power (CHP) plant would be feasible. The study concluded that a CHP plant may indeed be feasible, but a biomass inventory was needed for the area. In July 2011, Shoshone County contracted with Riverview Timber Service, LLC to complete a woody biomass *availability* inventory and feasibility study (REEZ I). In August 2011, Shoshone County contracted with Riverview Timber Service, LLC to complete a woody biomass *regrowth and sustainability* inventory and feasibility study (REEZ II).

Scope and Purpose

The REEZ II project includes:

1. An analysis of sustainable timber re-growth and biomass regeneration in specially selected sampling plots
2. Establishment of sustainable rates of timber re-growth and biomass regeneration in selected plots where such estimates may be made confidently

3. Projected biomass tonnages including
 - a. Uniform stands
 - b. Mixed stands
4. Performance of a preliminary field survey on several forest types as defined in photo-interpretations from REEZ I.

The purpose of the REEZ II project is to develop, initiate, implement, and complete a study and analysis of the *re-growth and sustainability* of biomass.

Executive Summary

Findings

This study has found that there is a significant amount of biomass growth in Shoshone County and determined that 1.76 tons of biomass is produced annually per acre for a total of 184.3 thousand tons of biomass produced every year. In a conservative estimate, there is an additional 140,000 tons/year of biomass in the adjacent eastern side of Kootenai County that could readily supply a Shoshone County biomass facility.

Recommendations

The recommendation is to harvest 300-400 thousand tons of biomass from Shoshone County forests annually.

An additional recommendation is to establish a diversified biomass utilization complex in Shoshone County with sufficient capacity to process the amount of biomass that needs to be harvested annually.

Data Collection and Analysis

Background

Shoshone County has a unique situation in that there are areas surrounding Smeltonville and Kellogg where forest fires and pollution from the zinc and lead smelters in 1918-1981 decimated the natural forests. The barren hillsides were replanted in 1975-1993 with Ponderosa Pine, Douglas Fir, Western Larch, and Blister Rust resistant White Pine. It is rare to have the opportunity to know the exact age of 10,232 acres of trees, but in this case, the replanting records provided the ability to gain an accurate measurement of growth per year. The growth information in these areas is conservative when applied to the rest of the county and to future regeneration in the Kellogg/Smeltonville areas because, for about the first five years, the trees faced reduced growth rates due to the adverse soil conditions.

Mapping – Background

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS allows for viewing, understanding, questioning, interpreting, and visualizing data in ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. GIS helps in answering questions and solving problems by showing data in ways that are easy to understand and share. GIS technology can be integrated into any enterprise information system framework.

The GIS network selected was ArcGIS. It is a well-respected program for accuracy and precision. The system is taught at North Idaho College and at the Coeur d'Alene campus of University of Idaho. Many local (including Shoshone County), state, and federal government agencies depend on ArcGIS for mapping and GIS needs.

Mapping – Data Collection

A base map of the area to be analyzed was developed using a satellite image called *Shoshone_2009_1.sid*. This map can be downloaded from the United States Geological Survey (USGS) website database at <http://seamless.usgs.gov>. A point of reference was established, called a datum, so all coordinates, specific locations, and scale factors would conform to each other. Downloads from the USGS website typically utilize the North American Datum of 1983 (NAD83), thus it was a logical choice to use as the standard datum for this report.

After developing a base map in the ArcGIS program, ‘layers’ were inserted onto the base map. Layers are additional data applied to a map.

The first layer inserted was *plss100k*. This layer depicted imaginary lines that break the State of Idaho into square sections. With the *plss100k* layer having the same NAD83 datum as the base map, it created a working map that shows the location with exact reference points as the federal and state government. This layer was important for this research because it made it possible to break down each section and study that specific location.

The next layer, *RLTY_SMA_PUB_24K_POLY*, established ownership between private land, State of Idaho Endowment Trust land, and federal government land (Bureau of Land Management (BLM) or United States Forest Service (USFS)). This layer is also on the USGS website and the datum used was NAD83 so that all data from this layer would match with the base map and *plss100k* layer.

With ArcGIS, a third layer was created that outlined the timber types. When creating this layer, the NAD83 datum was again used as a reference point, which allowed ArcGIS to calculate the area inside of each outline.

Shoshone County Biomass II

A fourth layer was added for farm and prairie land that has little or no timber on it.

A fifth layer was created showing the locations of 'ground truthing' plots.

Mapping – Analysis

With the base map, *plss100k* layer, and ownership layer, it is possible to see three distinct timber types that incorporate the I-90 corridor through Shoshone County.

When using photos, data within that image is only accurate from the point in time that the photo was taken. By a process of 'ground truthing,' (in the field data collection of sample plots), the data from the photos was confirmed visually and additional statistical data was added.

Shoshone_2009_1.sid was a satellite image taken in the summer of 2009. It was found that most of the data within 2009 image was truthful.

Mapping – Findings

Four distinct timber types were identified throughout the I-90 corridor. ArcGIS calculated the geometry within these different timber types. The breakdown is as follows:

Type	<u>Total Acres</u>	<u>Map Color</u>	<u>Volume</u>
Type A	8,260 acres	Yellow Shade	<20 Tons/acre
Type B	29,303 acres	Green Shade	20-39 Tons/acre
Type C	40,989 acres	Red Shade	40-69 Tons/acre
Type D	26,544 acres	Blue Shade	>70 Tons/acre
<i>Total: 105,096 acres of private and state owned land within the I-90 corridor.</i>			

Table 1 Timber Types

In the attached maps, *Figure 1, Overview Map of Forest Types* shows the locations of timber types in the study area.

Ground Truthing – Background

2010 IDL Cruiser, an Excel spreadsheet program designed by Idaho Department of Lands (IDL), was chosen to process the ground truthing data. 2010 IDL Cruiser was chosen because of its unique ability to calculate tonnages, as opposed to board feet typically used in timber sale calculation. 2010 IDL Cruiser is also utilized by the US Forest Service (USFS) and contains USFS national volume equations to determine the following:

- Saw log tons per acre
- Non-saw log tons per acre
- Slash <3” tons per acre
- Trees per acre
- Ave diameter at breast height (DBH = 4.5 feet from the ground)
- Other equations not necessary for this report

Ground Truthing – Data Collection

Data was collected from the plots in the areas surrounding Kellogg and Smeltonville where trees had a known planting date. The age of the trees in these plots was no greater than 36 years. No logging had occurred in these stands. In the plots where fire mitigation treatment had been done, either the data was collected before the treatment or the plot was moved to an area where no disturbances had occurred in order to gather accurate growth rates. Data was only collected from and applied to private and State owned properties. Data was *not* collected from or applied to federally owned lands (including USFS and BLM), land outside of Shoshone County (i.e. Kootenai County or Montana), or land within Shoshone County that would require an unrealistic

Shoshone County Biomass II

haul distance (i.e. southern Shoshone County). In the attached maps, refer to Figure 1, *Overview Map of Forest Types*.

Data was collected from 100 random 1/50th acre (16.7-foot radius) plots. Trees within each plot were listed on an Exam Tree Data Form. Information on the Exam Tree Data Form included the species, the diameter at breast height (DBH), and the height of the tree. After acquiring the information from each plot, it was entered into the 2010 IDL Cruiser spreadsheet.

Ground Truthing – Data Analysis

Volume calculations from 2010 IDL Cruiser generated the tons per acre stated above in Table 1. This was accomplished by using a statistically sufficient number of random plots within each timber type to generalize the data for the timber type. The IDL Cruiser was then able to calculate the specific tonnages per acre within the known color code.

Ground Truthing - Findings

Total acreage on private and State owned lands: 105,096 acres.

Total present biomass is 5.2 million tons.

The conservative annual growth for total useable biomass equals 4.9 tons per acre. This growth would allow for a total sustainable yield of 500,000 tons of useable biomass per year. This is a grand total of biomass that includes biomass in the form of growth of potential saw logs. After subtracting potential saw log biomass, the annual average growth, conservatively, for biomass alone is 1.76 tons per acre annually for 184.3 thousand tons per year of sustainable growth.

Shoshone County Biomass II

Seventeen years between harvests are needed in order to grow a healthy saw log forest at the same time that biomass is being produced. Table 2, below, shows the amount of production and the acres required for a 17 year rotation at 1.76 tons/year/acre:

CHP Plant Size in Megawatts	Estimated Tonnage Needed	Acres Harvested Annually	Tonnage Harvested Annually @ 30 ton/acre	Total Acres Needed in 17years	Actual tonnage produced in 17years/acres harvested
10	85,000	2,850	85,500	48,450	85,272
15	127,500	4,250	127,500	72,250	127,160
20	170,000	5,670	170,100	96,390	169,646

Table 2 Production and Acreage required with 17 year Rotation

Attached to this report is Table 3, *Tonnage Calculations by Area per Acre*. Table 3 shows the following:

- Area Name - used for tracking/reference purposes, contains multiply sampling plots
- Years - known (marked with *) or estimated age of trees
- Saw Log Tons - calculated tonnage of timber with DBH ≥ 10 "
- Non-saw Log Tons - calculated tonnage of trees with DBH < 10 "
- Slash Tons - calculated tonnage of slash (i.e. tops and limbs) generated from harvest of saw logs
- Total Growth Tons/Year – is the calculation of all growth in a year, (Saw logs + Non Saw Logs + Slash) \div Years
- Total Growth Biomass Tons/Year – is the total biomass produced in a year without including merchantable timber (saw logs), (Non Saw Log + Slash) \div Years
- Total Biomass Tons – tons of biomass, excluding Saw Logs, Non Saw Logs + Slash

Shoshone County Biomass II

- Average DBH – average diameter at breast height of all trees
- Average DBH Biomass – average diameter at breast height of Non Saw Log trees
- Trees/Acre – calculated number of trees per acre, includes both Saw Log and Non Saw Log trees

Conclusions and Recommendations

Conclusions

After sampling 100 plots across 10,000 acres of timber stands with known planting dates, the amount of annual growth was determined to be 1.76 ton per acre. With over 105,000 acres of private and state forest, 184,000 tons of biomass is produced yearly. This is a conservative growth rate because the planted areas had retarded growth in the first five years due to harsh soil conditions.

Additionally, there is estimated to be another 140,000 tons of biomass produced annually in eastern Kootenai County that would be readily available to supply a biomass facility in Shoshone County and easier to obtain than portions of Shoshone County. This equates to a combined total of 340,000 tons per year.

Recommendations

Due to the amount of annual growth (184,000 tons) and the current amount of biomass (5.2 million tons), it is highly recommended that 300-400 thousand tons of biomass be harvested each year in order to restore the health of Shoshone County's forests and reduce the potential for repeating the devastating fires of 1910.

Shoshone County Biomass II

It is further recommended that an appropriately sized facility be established in Shoshone County that could process this amount of biomass. The Combined Heat and Power (CHP) feasibility study conducted by McKinstry demonstrated that a 20MW plant would consume 170,000 tons of biomass annually, leaving 130-230 thousand tons of biomass to be processed. By placing a large CHP plant at the heart of a biomass complex, it would be able to provide electricity and heat for additional enterprises/industries (such as pellet production, gasification, bio-char, briquettes, structural heating, etc.) which could then utilize the remaining 130-230 thousand tons of biomass. Having a diversified biomass complex also helps to minimize the impact of economic fluxes in any one industry, thus providing for a more economically strong and stable complex overall.