WOOD FUEL AVAILABILITY ANALYSIS FOR THE ROARING FORK VALLEY, COLORADO

March 31, 2011

Prepared for:

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INTRODUCTION

The Roaring Fork Biomass Consortium retained TSS Consultants to conduct a biomass fuel availability analysis for the greater Roaring Fork Valley. The results of this analysis will help to guide the Consortium to better understand regional opportunities to utilize woody biomass material for bioenergy (e.g., thermal, power) installations in the Roaring Fork Valley.

The primary objective of this analysis is to confirm existing biomass fuel availability and forecast what type and volumes of material could be sustainably available long term. This analysis is meant to help guide the Consortium as it considers ways to best utilize excess woody biomass material; it was not conducted as an investment grade fuel availability assessment.

The primary impetus for this analysis is the need to address alternatives to current wood waste disposal methods.

- Tree trimmings, construction/demolition wood and miscellaneous wood waste are typically deposited in local landfills. Recovering wood waste will extend the service life of landfills.

- Forest operations (public and private lands) generate wood waste that is currently left on site, piled and burned in the open, deposited in local landfills or chipped and scattered. Diverting wood waste away from pile and burn activities into a controlled combustion facility (e.g., bioenergy facility) will improve local airshed quality. Reduction of pile burning will also mitigate greenhouse gas emissions.

- Utility line maintenance crews remove hazards through tree trimming or hazard tree removal from distribution and transmission lines on a regular basis. Markets for value-added use of this material are limited.

SCOPE OF WORK

The scope of work tasks utilized to provide guidance in the implementation of this analysis are listed below.

Task 1. Pre-Work Conference

Convene a meeting with the Roaring Fork Biomass Consortium steering committee. Review project need, approach and implementation schedule for the analysis. Confirm primary Consortium contacts. Review availability of existing studies and data (if any). Confirm target study area for sourcing of woody biomass material. Review scope of work and implementation schedule.

Task 2. Biomass Feedstock Availability

Conduct a review of potential woody biomass feedstocks available from local landfills, forest management activities and line clearing operations by local utility crews. Analysis will focus on biomass volumes currently available that meet fuel specifications consistent with thermal energy technologies. Biomass potentially available from forest management activities will be estimated based on compliance with all state and federal forest practice and environmental requirements. Only biomass fuel that might be available as a byproduct of forest management activities (e.g., fuels reduction, forest restoration) will be considered.

TSS will analyze availability of woody biomass material including:

- Raw material/woody biomass from forest management activities:
    - Timber harvest operations;
    - Fuels treatment/forest restoration projects;
    - Timber stand improvement projects;
- Raw material/woody biomass from urban wood waste (construction/demolition wood, pallets, tree trimmings).
- Utility line tree trimming and hazard tree removal activities.

Task 3. Costs to Collect, Process and Transport Biomass Fuel

The costs associated with collection, processing and transport of fuel analyzed in Task 2 will be assessed. Findings from this analysis will be used to provide a cost estimate forecast for all of the biomass feedstock types considered in Task 2.

Task 4. Generate Biomass Fuel Availability Report

Based upon information, analysis and findings from Tasks 1, 2 and 3, a final report document will be generated. The final report will be written with the target audience (The Roaring Forks Biomass Consortium and interested stakeholders) in mind.

KEY FINDINGS

The Roaring Fork Valley region includes heavily forested landscapes that are predominantly managed by public land management agencies. This region also supports a number of small communities economically dependant upon seasonal recreation activities. Woody biomass material from forest operations, local landfills, and utility line maintenance activities are sustainably available in volumes that could support several small bioenergy facilities located within the Roaring Fork Valley. Table 1 provides an overview of currently available wood waste volumes by biomass fuel type.

Table 1. Biomass Fuel Availability – 2011

BIOMASS FUEL TYPE	BDT PER YEAR
Timber Harvest Residuals - USFS	1,600
Fuel Reduction - USFS	750
Wildlife Habitat Improvement - USFS	535
Timber Harvest Residuals/Salvage/Wildlife Habitat Improvement - Private	200
Urban Wood Waste	2,600
Utility Line Maintenance	175
TOTAL	**5,860**

Table 2 summarizes the results of the biomass recovery opportunity analysis adjusted for biomass availability five years from now (2016).

Table 2. Biomass Fuel Availability – 2016

BIOMASS FUEL TYPE	BDT PER YEAR
Timber Harvest Residuals - USFS	1,200
Fuel Reduction - USFS	750
Wildlife Habitat Improvement - USFS	600
Timber Harvest Residuals/Salvage/Wildlife Habitat Improvement - Private	400
Urban Wood Waste	3,500
Utility Line Maintenance	175
TOTAL	**6,625**

TARGET STUDY AREA

Consistent with the objectives of this analysis, the forested landscapes and watersheds that make up the greater Roaring Fork region were included in the Target Study Area (TSA). Figure 1 highlights the TSA.[1]

Woody biomass availability for any given region is heavily dependant on vegetation cover, land management objectives and ownership. Vegetation cover within the TSA is predominantly forest (52%), shrub/brush (19%), and juniper (8%). Figure 2 shows vegetation cover types within the TSA.

[1] As defined by the Consortium during March 2, 2011 meeting at Aspen, Colorado.

Figure 1. Target Study Area

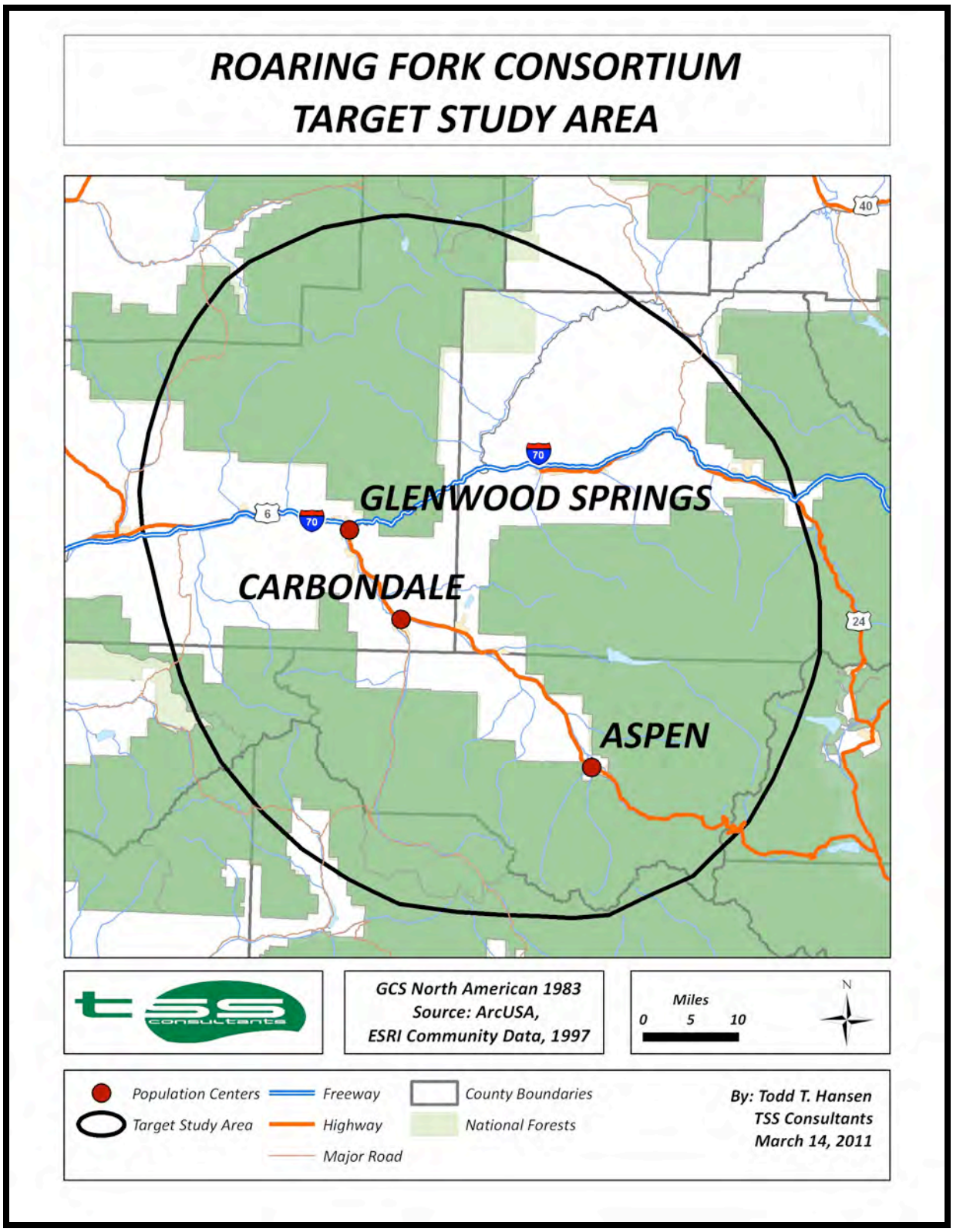
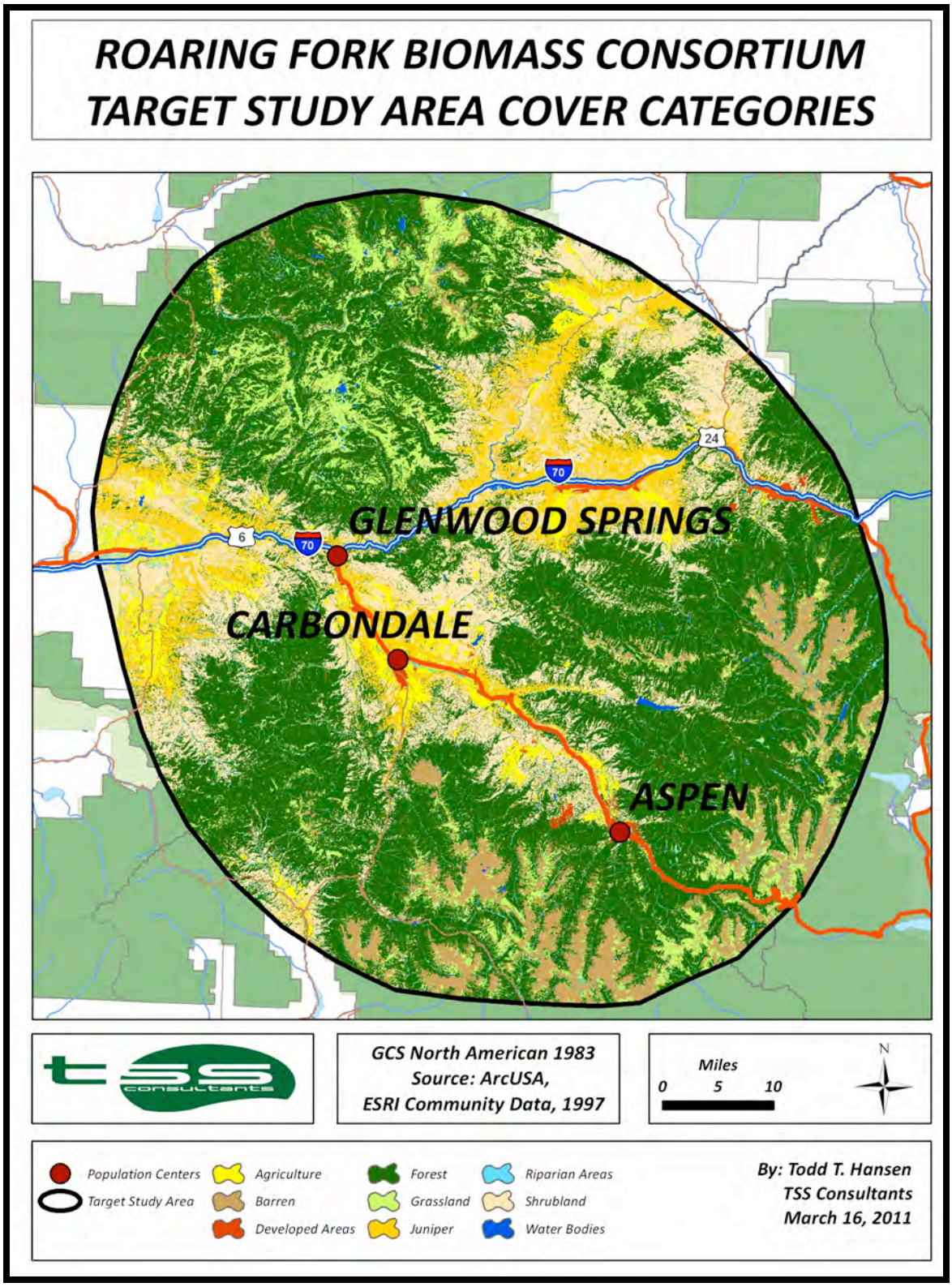


Figure 2. Vegetation Cover Within the Target Study Area



Vegetation cover dictates what vegetation types are predominant within a region and therefore influences woody biomass availability. Depending on management objectives, certain cover types could generate sustainable volumes of woody biomass material for use as fuel. Table 3 summarizes vegetation cover by category within the TSA.

Table 3. Vegetation Cover Within the TSA

COVER CATEGORIES	ACRES	PERCENT OF TOTAL
Agriculture	91,293	3.6%
Barren	161,264	6.3%
Developed Areas	28,938	1.1%
Forest	1,336,427	52.0%
Grassland	184,935	7.2%
Juniper	204,540	8.0%
Riparian Areas	71,943	2.8%
Shrub/Brush	477,250	18.6%
Water Bodies	11,886	0.5%
TOTALS	**2,568,475**	**100.0%**

Land ownership drives vegetation management objectives and within the TSA the USDA Forest Service (USFS) is the most significant land manager with responsibility for over 60% of the landscape within the TSA. Private land makes up about 23% and the Bureau of Land Management (BLM) makes up 15%. Federal land management agencies (USFS and BLM) manage approximately 76% of the land and almost all of the forest cover within the TSA. Table 4 summarizes land ownership and jurisdiction within the TSA.

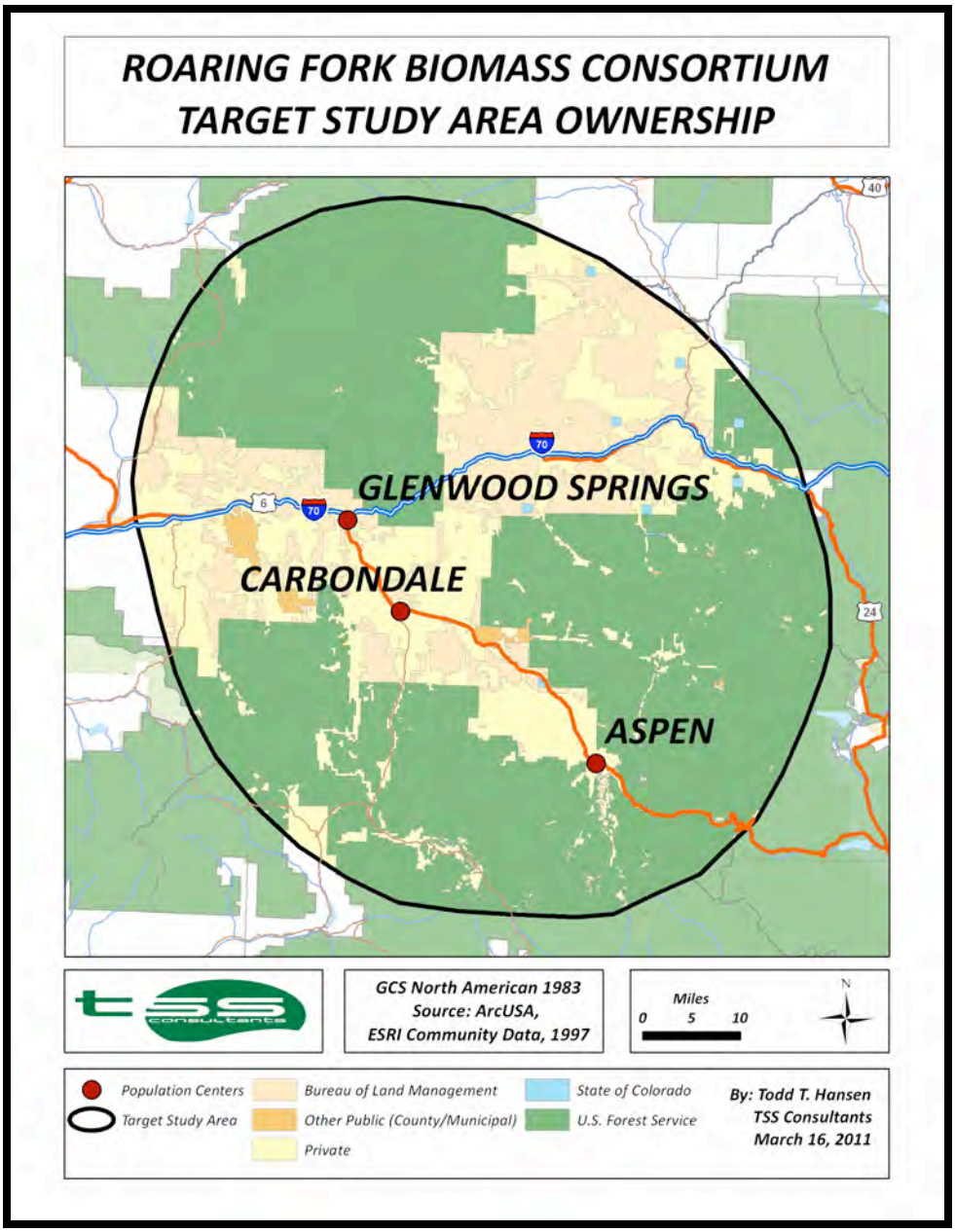
Table 4. Land Ownership/Jurisdiction Within the TSA

LAND OWNER/MANAGER	ACRES	PERCENT OF TOTAL
U.S. Forest Service	1,603,716	61.6%
Bureau of Land Management	387,772	14.9%
Private	586,778	22.5%
State of Colorado	6,871	0.3%
Other Public (Municipal/County)	19,033	0.7%
TOTALS	**2,604,171**	**100.00%**

Discussions with USFS staff[2] confirmed that between 50% and 60% of USFS managed lands within the TSA include wilderness or roadless areas which will not provide opportunities for recovery of woody biomass material.

Figure 3 highlights the locations of the various ownerships and jurisdictions.

Figure 3. Land Ownership/Jurisdiction Within the TSA



[2]Chris McDonald, Forester, White River National Forest.

BIOMASS FUEL AVAILABILITY AND COST

Woody biomass fuel types considered in this study includes a range of material.

- Raw material/woody biomass from forest management activities:
  - Timber harvest operations;
  - Fuels treatment/forest restoration projects;
  - Timber stand improvement projects;
- Raw material/woody biomass from urban wood waste (construction/demolition wood, pallets, tree trimmings).
- Utility line tree trimming and hazard tree removal activities.

Forest-Sourced Biomass

Timber harvest residuals can provide significant volumes of woody biomass material. Typically available as limbs, tops and un-merchantable logs, these residuals are byproducts of commercial timber harvesting operations. As such, these residuals can be a relatively economic raw material fuel supply. Once collected and processed using portable chippers or grinders, this material is an excellent biomass fuel source.

As noted in Table 4, the USFS manages most of the forested landscape within the TSA. Interviews with USFS representatives[3] indicated that the east side (Eagle-Holy Cross and Dillon Ranger Districts) of the WRNF is where most of the forest management activities are currently focused. This is due primarily to the fact that the mountain pine beetle infestation is concentrated on the east side of the forest. The west side of the forest (Sopris-Aspen, Rifle and Blanco Ranger Districts) is comprised of predominately spruce/fir mixed conifer stands with some pockets of lodgepole pine and is not severely impacted by the mountain pine beetle infestation. Spruce budworm is causing some mortality in selected stands on the west side but is not impacting forest ecosystems on a landscape scale like the mountain pine beetle. The Sopris-Aspen and Blanco Ranger Districts make up most of the USFS managed lands within the TSA. Recent aerial surveys indicate that only select pockets on the Sopris-Aspen Ranger District have been impacted (see Appendix A – February 3, 2011 Aspen Times article). The 2010 aerial survey map shows some pine beetle activity within the Roaring Fork Valley that is limited to pockets of lodgepole pine stands (see Appendix B – 2010 Aerial Survey Map).

In 2010, over 90% of the timber harvest activity on the WRNF (WRNF) was concentrated on the east side. This is likely to continue for the next four to five years as the pine beetle infestation salvage/restoration continues. Approximately 21,200 MBF[4] of

[3]Chris McDonald, Forester, Jeff Hogenson, USFS Representative and Cary Green, Forester, White River National Forest.
[4]1,000 board feet = MBF. One board foot is the equivalent of a 12 inch by 12 inch board, one inch thick. USFS harvest estimates are based on 100 cubic feet measure (CCF). Typical conversion is two CCF = one MBF.

sawlogs were sold on the forest in 2010, with 19,600 MBF concentrated on the east side. For 2011, the WRNF is planning to sell approximately 23,500 MBF on the east side and about 4,500 MBF on the west side.

Discussions with WRNF foresters[5] working on the west side of the forest indicate that for the next four to five years, timber sale activity within the TSA will generate about 2,600 to 4,500 MBF per year. This amounts to an average volume of 3,550 MBF per year. TSS' experience with forest biomass recovery confirms that a recovery factor of 0.9 bone dry ton (BDT)[6] would apply for mixed conifer stands in the TSA. This amounts to a gross potential of 3,195 BDT per year of timber harvest residuals.

Not all topography or road systems will accommodate biomass recovery operations. For the purposes of this forecast, it is assumed that only 50% of the timber harvest operations on USFS projects within the TSA are located on topography and road systems that will support biomass recovery. Approximately 1,600 BDT per year are projected to be available as timber harvest residuals from USFS projects within the next five years. Six to ten years out, this is likely to drop to about 1,400 BDT per year.

Some very limited forest salvage, habitat improvement and commercial timber removals are conducted on private forest lands within the TSA. Local logging contractors[7] indicated that some timber harvests, concentrating on removal of dead and dying trees, are conducted within the TSA. Harvest levels are variable and have been down in recent years due to limited markets for sawlogs. There are no records available regarding timber harvests on private lands (unlike USFS timber harvests). Based on interviews, TSS estimates 1,000 MBF per year on private lands will generate about 900 BDT, of which 50% is available for recovery. Approximately 450 BDT per year are projected to be available as timber harvest residuals in the next five years. This is likely to ramp up to 800 BDT per year in years six through ten as the economy recovers, housing starts increase, and forest products are more valued.

Other vegetation management activities are conducted in support of fuels treatment and wildlife habitat improvement projects on USFS managed lands. Fuels management staff[8] on the WRNF confirmed that approximately 1,000 to 1,500 acres per year within the TSA are targeted for fuels treatment activities. About 66% of these fuels treatment projects are implemented using prescribed fire and do not present biomass material recovery opportunities. The balance of the acreage is treated using mechanical equipment or hand crews to masticate (shred and scatter) vegetation. USFS staff estimated that about 100 acres per year targeted for fuels treatment in the TSA is on topography and road systems that may present an opportunity to recover biomass material. Assuming a recovery factor of 7.5 BDT per acre, about 750 BDT per year could be available from fuels treatment activities within the TSA.

[5]Chris McDonald, Forester, Jeff Hogenson, USFS Representative, White River National Forest.
[6]One bone dry ton equals 2,000 dry pounds of wood fiber.
[7]Ken Tacker's Tree Removal, Carbondale, Colorado.
[8]Toni Toelle, West Zone Fuels Specialist, White River National Forest.

Habitat restoration activities may present an opportunity to recover additional forest biomass. The Sopris-Aspen Ranger District is currently seeking public comment on the 49,900 acre Aspen-Sopris Wildlife Habitat Improvement Project. Planned for implementation over a 10-year period, this project will use prescribed fire (26,200 acres), mastication (19,400 acres) and mechanical treatment (4,300 acres) as the primary vegetation management tools. The mechanical treatments are targeting conifer and aspen stands for restoration[9] and may generate recoverable biomass material. Assuming 430 acres of mechanical treatment per year and potential biomass recovery of 5 BDT/acre, about 2,150 BDT are potentially available. Due to limited road access and steep topography, TSS estimates that around 25% of this material is recoverable. Approximately 535 BDT per year is available from wildlife habitat improvement activities within the TSA. This should increase slightly over time as the project ramps up, resulting in about 600 BDT recovered per year by 2016.

Urban-Sourced Biomass

Wood waste generated by tree service companies, residents and businesses is regularly processed for use as biomass fuel in many parts of North America. Tree trimmings, construction/demolition wood and miscellaneous wood waste, if sorted and processed, has relatively high heating value (7,800 to 8,000 BTU/dry pound) and low moisture content (30% to 40%).

Two waste recovery operations located within the TSA are currently receiving urban wood waste: South Canyon Landfill at Glenwood Springs and Pitkin Resource Recovery near Aspen. Interviews were conducted with site managers[10] at both operations. The site managers indicated that almost all wood waste is segregated and processed into soil amendment products (compost) and biomass fuel (septic water evaporation system at Glenwood Springs). Some wood waste is processed and used as alternative daily cover.[11] Recovering wood waste extends the service life of these landfills.

Both South County Landfill and Pitkin Resource Recovery offer discounted tip fees for clean wood waste and no tip fees if the delivered wood is processed (chipped). Both maintain detailed records documenting wood waste that is delivered to each site.

Table 5 summarizes brush, tree trimmings, and other wood waste received annually from 2006 through 2010 at both the Pitkin Resource Recovery and South County Landfill operations.

[9]Per discussions with Phil Nyland, Wildlife Biologist, Sopris/Aspen Ranger District.
[10]Christopher Hoofnagle, Solid Waste Manager, Pitkin County; Doug Oliver, Superintendant, South Canyon Landfill.
[11]Alternative daily cover is used to minimize issues related to smell and vermin.

Table 5. Urban Wood Received at Pitkin Resource Recovery and South County Landfill 2006 through 2010

YEAR	PITKIN RESOURCE RECOVERY		SOUTH COUNTY LANDFILL	
	Cubic Yards Per Year	BDT Per Year	Cubic Yards Per Year	BDT Per Year
2006	14,590	1,313	16,340	1,471
2007	15,742	1,417	13,260	1,193
2008	14,939	1,345	15,386	1,385
2009	12,179	1,096	15,367	1,383
2010	14,831	1,335	11,069	996
Average Per Year	**14,456**	**1,301**	**14,284**	**1,286**

Discussions with South County Landfill staff indicated that each yard of unprocessed brush, tree trimmings and wood waste averages about 300 pounds. TSS' experience is that urban wood with a heavy green component (brush, tree trimmings) will average about 40% moisture content. Using these metrics (300 lbs/cubic yard and 40% moisture), the cubic yard figures were converted to BDT.

Utility Line Tree Trimming/Hazard Tree Removal

Power utility companies regularly maintain transmission and distribution line corridors by trimming or removing hazard trees. These operations are conducted on a consistent basis in order to minimize power line damage and power supply interruptions from falling limbs or trees.

Holy Cross Energy services the Roaring Fork Valley and operates two crews using a treatment plan that visits transmission (120 miles total) and distribution lines (1,150 miles total) on a five-year rotation. Interviews with Holy Cross Energy staff[12] confirmed that each line crew utilizes a chipper to reduce the limbs/trees removed to manageable size (3" minus chip) for removal to local landfills (30%) and area nurseries or consumers (60%). Occasionally material is chipped and scattered on site (10%). Typical tree species removed include aspen, cottonwood, box elder and elm. Holy Cross crews are removing very little lodgepole pine.

Holy Cross crews remove hazard trees and limbs year round, with peak season (May through October) chip production amounting to about 2.5 BDT per day (20 cubic yards/day, 476 pounds per yard with 50% moisture content). During off-peak months (November through February), about 0.5 BDT per day of tree material is removed. Total production for the year is approximately 440 BDT. For this analysis, TSS assumed that

[12]Todd Jacobs, Service/Maintenance Supervisor, Holy Cross Energy.

40% of this volume (175 BDT per year) is recoverable from line maintenance activities tributary to the Pitkin Resource Recovery facility.

Biomass Fuel Availability – Current Forecast

Summarized in Table 6 are the results of biomass recovery opportunity analysis from forest activities, urban wood management and utility line maintenance within the TSA.

Table 6. Biomass Fuel Availability – 2011

BIOMASS FUEL TYPE	BDT PER YEAR
Timber Harvest Residuals – USFS	1,600
Fuel Reduction - USFS	750
Wildlife Habitat Improvement - USFS	535
Timber Harvest Residuals/Salvage/Wildlife Habitat Improvement - Private	200
Urban Wood Waste	2,600
Utility Line Maintenance	175
TOTAL	**5,860**

Biomass Fuel Availability – Future Forecast

Summarized in Table 7 are the results of biomass recovery opportunity analysis adjusted for biomass availability five years from now (2016).

Table 7. Biomass Fuel Availability – 2016

BIOMASS FUEL TYPE	BDT PER YEAR
Timber Harvest Residuals - USFS	1,200
Fuel Reduction - USFS	750
Wildlife Habitat Improvement - USFS	600
Timber Harvest Residuals/Salvage/Wildlife Habitat Improvement - Private	400
Urban Wood Waste	3,500
Utility Line Maintenance	175
TOTAL	**6,625**

Assumptions used for this forecast include:

- General improvement in the local and regional economy (more urban wood waste generated).
- Improved saw timber markets (slight increase in timber harvest on private lands).
- White River National Forest timber sales level off by 2016.

Costs to Collect, Process and Transport Biomass Fuel

Very little commercial-scale infrastructure to collect, process and transport currently exists in the Roaring Fork Valley. TSS relied on past experience to analyze these costs. Table 8 provides results of the cost analysis.

Table 8. Cost to Collect, Process and Transport Woody Biomass Materials

BIOMASS FUEL TYPE	$/BDT – LOW RANGE	$/BDT – HIGH RANGE
Timber Harvest Residuals - USFS	$59.50	$73.00
Fuel Reduction - USFS	$65.50	$81.00
Wildlife Habitat Improvement - USFS	$65.50	$81.00
Timber Harvest Residuals/Salvage/Wildlife Habitat Improvement - Private	$59.50	$73.00
Urban Wood Waste	$15.00	$20.00
Utility Line Maintenance	$10.00	$20.00

Assumptions used to generate this cost forecast include:

- Pitkin Resource Recovery is target destination.
- Transport costs average $120/hour (cost of self unloading commercial truck/trailer).
- Average haul distance is 80 miles round trip for forest-sourced biomass with transport time of three (low-cost estimate) to four hours (high-cost estimate).
- Urban wood waste costs include processing and screening (no transport).
- Utility line maintenance biomass fuel cost assumes reimbursement for excess haul costs (over and above normal haul).

CONCLUSIONS

As noted in the Findings, there is more than ample woody biomass fuel available within the Roaring Fork Valley region to sustain several small-scale bioenergy installations. Outlined below are conclusions and observations generated during the course of this analysis.

Competing Value-Added Uses for Biomass Material

In the course of this analysis, TSS found several alternative uses for biomass material in the Roaring Fork Valley. While a competition assessment is outside the scope of this analysis, these markets are worth noting and include the following.

- Biomass fuel for septic water evaporation technology. Operated by Heartland Environmental, this facility is located in Glenwood Springs and utilizes about six BDT per day of woody biomass fuel. Peak demand for biomass fuel is in the winter months.

- Compost and soil amendment markets. Both the Pitkin County Resource Recovery facility and the Glenwood Springs landfill have compost operations that utilize biomass material (mostly green waste in the form of tree trimmings, grass clippings) as feedstock. Compost and soil amendment markets are variable with peak season in the summer months.

Local Forest Products Market Sector

The forest industry in the region has been heavily impacted by the downturn in the U.S. housing markets. The last remaining commercial-scale sawmill operating in the region is Intermountain Resources LLC located in Montrose, Colorado. In May, 2010, Intermountain announced plans to restructure due to ongoing financial challenges and is currently in receivership. This reduced demand for saw timber due to reductions in local forest products manufacturing infrastructure presents serious challenges to forest managers and owners. A recent article in the Spokane Spokesman Review (see Appendix D) addresses this issue and discusses impacts to regions in the West, including Colorado.

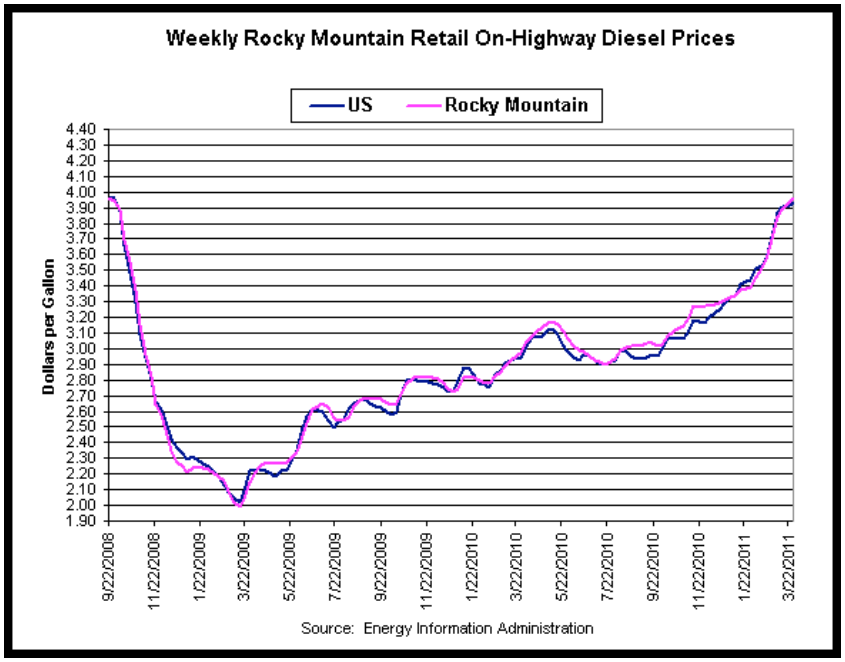
As the demand for sawtimber has declined, so too has active forest management in the Roaring Forks Valley. Primary markets for sawlogs and small logs are now the few remaining small, family-owned sawmills in the region. In addition, there is a local market for small logs that can be manufactured into firewood. If the demand for sawtimber continues to decline, the availability of forest residuals from timber harvest will also be reduced.

Diesel Fuel Pricing

The cost of transporting biomass fuel represents the single most significant expense when procuring biomass as a fuel source. Variables such as diesel fuel cost (currently at $3.90+/gallon), workers compensation expense, and maintaining a workforce (locating qualified drivers) are all factors that significantly impact the cost to transport commodities such as biomass fuel. Interviews with commercial transport companies indicate the current cost to transport a bulk commodity such as biomass fuel is approximately $75 to $85 per hour for a 100 cubic yard chip truck/trailer. A self-unloading 120 cubic yard truck/trailer costs about $120 per hour.

At this time, diesel fuel costs are the most significant variable impacting transport costs. Diesel fuel price escalation has had a major impact on biomass fuel prices throughout the U.S. in recent years. Based on TSS' experience, the average forest-sourced biomass fuel requires approximately 3.5 to 4 gallons of diesel to collect, process and transport one BDT (assuming average roundtrip haul distance of 60 to 90 miles). Therefore, a $1.00/gallon increase in diesel fuel equates to a $3.50 to $4.00 per BDT increase in the cost to produce and transport forest-sourced biomass fuel. Any significant increase in the price of diesel fuel presents a risk to the overall economics of producing forest-sourced biomass. Diesel fuel pricing volatility is primarily driven by the cost of crude oil. Figure 4 outlines the change in diesel prices from September 2008 to March 2011.[13]

Figure 4. Rocky Mountain Region Diesel Prices – September 2008 to March 2011



[13]Energy Information Administration, http://tonto.eia.doe.gov/

Seasonal Availability

Discussions with USFS foresters indicate that the typical season for operations is July 1 through October 31. A variety of factors impact this including snow depth and wildlife habitat concerns (e.g., elk calving season).

Seasonal availability of forest-sourced fuels (including utility line maintenance biomass material) will severely impact biomass availability in the peak demand months for thermal energy production (November through April). Storage of biomass fuel will be very important to sustain bioenergy facilities through the winter months. Discussions with Pitkin County staff[14] indicated a possible interest in setting aside room at the Pitkin Resource Recovery operation to stockpile biomass material for use as fuel during winter months. The Consortium should consider contacting Pitkin County to pursue this potential opportunity.

Collection, Processing and Transport Infrastructure

There is currently very little biomass collection, processing and transport infrastructure within the TSA. If small-scale bioenergy projects are implemented within the Roaring Fork Valley, considerable effort will need to be focused on fuel supply chain development.

[14]Chris Hoofnagle, Solid Waste Manager, Pitkin County Resource Recovery.

RECOMMENDATIONS AND NEXT STEPS TO CONSIDER

This analysis provides an overview of biomass fuel availability and costs, confirming that there is enough biomass material to sustain several small bioenergy installations in the Roaring Fork Valley. TSS recommends that the Consortium pursue the potential for development of small-scale bioenergy installations.

Next steps to consider (in order of implementation):

- Perform community outreach to present findings of this analysis and roll out plans for next steps.
- Conduct small bioenergy technology review with emphasis on thermal energy production.
- Seek out potential installation sites/partnerships.
- Conduct site review to confirm optimized locations for potential installations.
- Prepare environmental permitting plan for selected sites.
- Conduct preliminary discussions with electrical utilities regarding potential for a power sales arrangement if a combined heat and power installation is considered.
- Prepare a fuel procurement plan.
- Finalize short list of preferred installation sites and partnerships.
- Conduct technology assessment/selection and preliminary design.
- Issue Request for Quotes from select technology vendors.
- Issue Request for Quotes from select engineering and construction firms.
- Prepare detailed financial analysis.
- Secure state/federal grant support to offset a portion of capital cost.
- Select and contract with technology/engineering and construction firm.
- Engineer, construct and start up.

GRANT FUNDING RESOURCES

TSS conducted a literature search for grant and loan support targeting small-scale bioenergy projects. Posted below are the results summarized between federal and state administered programs.

Federal

Rural Energy for America Program. Administered by the USDA Rural Business-Cooperative Service, this program replaced the Renewable Energy Systems and Energy Efficiency Improvements program in the 2002 farm bill. The program provides grants and loans for a variety of rural energy projects, including efficiency improvements and renewable energy projects. Assistance is limited to small businesses, farmers and ranchers with projects located in a rural community. REAP grants and guarantees can be used individually or in combination. Together the grants and loan guarantees can finance up to 75% of a project's cost. Grants alone can finance up to 25% of the project cost not to exceed $500,000 for renewables and $250,000 for efficiency.

Woody Biomass Utilization Grants. Administered by the USDA Forest Service, the Woody Biomass Utilization Grant program (WBU) is a nationally competitive grant program that supports wood energy projects that require engineering services. The projects use woody biomass material removed from forest restoration activities, such as wildfire hazardous fuel treatments, insect and disease mitigation, forest management due to catastrophic weather events, and/or thinning overstocked stands. The woody biomass must be used in a bioenergy facility that uses commercially proven technologies to produce thermal, electrical or liquid/gaseous bioenergy.

State of Colorado

Funding for Alternative Fuel Feedstock Production (HB 1203). The Colorado General Assembly encourages the Governor's Office of Energy Management and Conservation to set a high priority on funding projects that assess the potential for carbon sequestration and agricultural bioenergy production in the state. Agricultural bioenergy production means the agricultural production of grain or biomass that is used to generate electricity or heat for agricultural, municipal, or industrial use, or that is converted into diesel, ethanol, hydrogen gas, or other fuels for energy production or transportation.

Clean Energy Development Authority (House Bill 1150/Colorado Revised Statutes 40-9.7). The Colorado Clean Energy Development Authority is created and may issue bonds to finance projects that involve the production, transportation, and storage of clean energy. Clean energy includes fuels that are manufactured by, and energy derived from, the following: biodiesel; biomass research such as biogas, agricultural or animal waste and landfill gas; ethanol; and fuel cells that do not use fossil fuels.

Community Biomass for Thermal Usage Program (Governor's Energy Office). $100,000 has been allocated for this program from the Colorado Clean Energy Fund. The purpose of this partnership program is to provide financial support for biomass-heating projects that utilize community-based biomass sources. Funding for feasibility studies or economic analyses may be considered in rare cases. Financial support from multiple stakeholders must be committed before a project can receive additional funding through the program. Priority given to projects that use community produced wood chips or Colorado manufactured pellets. High-priority is given to projects that "include supply from fuel reduction, restoration activities, local collection sites, and/or projects that demonstrate long-term availability of biomass supply." Residential and large industrial projects are not eligible for funding.

Colorado Biomass Market Transformation (U.S. Department of Energy's State Energy Program). The Colorado Governor's Office of Energy Management and Conservation (OEMC) funded studies, demonstrated technologies, shared results, and developed internal expertise. Through Rebuild Colorado, OEMC helped state and local governments implement $100 million worth of facility upgrade projects with performance contracts. The bio-based fuel of choice in Colorado is wood chips from forest thinning projects for use in heating buildings. State and local governments, particularly in forested areas, are motivated to thin forests to reduce the danger of forest fires so the ability to use forest thinnings for energy is viewed as a win-win prospect. This activity implemented eight projects that will save $1.6 million and use 20,000 tons of wood chips per year.

APPENDIX A
FEBURARY 3, 2011 ASPEN TIMES


- *Fortheforest.org*

Beetle infestation hits pockets of forest around Pitkin County

Aerial survey shows hot spots, but experts say area will avoid large-scale devastation

FEBRUARY, 3 2011
SCOTT CONDON
THE ASPEN TIMES
ASPEN, CO COLORADO

ASPEN — Small pockets of the national forest around Aspen were hit hard by bark beetles in 2010 but Pitkin County will avoid the infestation that's ravaged other parts of Colorado, according to experts with the U.S. Forest Service.

The beetle infestation affected another 400,000 acres in Colorado and southern Wyoming last summer, an aerial survey by the Forest Service and Colorado State Forest Service showed. The infestation has spread to about 4 million acres covered in lodgepole pine, five-needle pine and ponderosa pine trees since the outbreak began in 1996, the agencies say.

Jan Burke, a silviculturist with the White River National Forest supervisor's office, said the forest surrounding the Roaring Fork Valley has natural defenses.

"[The valley] doesn't have large contiguous areas of the lodgepole pine," Burke said. "Where you do have [lodgepole], it's getting hammered."

The pockets where the infestation is most noticeable include Buttermilk ski area, the south edge of Snowmass ski area, upper Smuggler Mountain and portions of the Fryingpan Valley, particularly around Ruedi Reservoir, said Burke and Roy Mask, a Forest Service entomologist based in Gunnison.

"It's something that will catch the eye of skiers," Mask said.

The needles of trees that were infested and died have turned a rust color. Maps from the aerial survey show significant areas of new beetle activity in 2010 to the southwest and south of Aspen. However, Mask said he learned after checking with the aerial survey team that the infestation in the Aspen area affects fewer trees per acre and is spread over a broader area then in places like Summit and Eagle County along Interstate 70 and around Winter Park. In those areas, thousands of contiguous acres of lodgepole pines have been killed. The number of acres infested in Pitkin County wasn't available.

Former Aspen mayor John Bennett is executive director of a nonprofit organization called For the Forest, which is working to educate people about beetle infestation and what can be done to combat it.

"The place in the valley where I saw dramatic growth [in beetle kill] is Mount Sopris," Bennett said. The change between summer 2009 and 2010 was visible in the Thomas Lakes area because of the number of trees that died, he said.

Despite those pockets where the beetles have made a buffet of tree stands, the damage is isolated.

"I'm just not anticipating that red landscape," Burke said, referring to the Roaring Fork Valley.

Mask concurred. "One of the factors that works in favor there is the species diversity," he said.

The Aspen area has a good mix of lodgepole, subalpine fir and Engelmann spruce at higher elevations, Burke said. Douglas fir and ponderosa pine can be found lower, generally below 9,000 feet.

Burke said all types of trees are vulnerable to various types of bark beetles. Pockets of different types of trees are likely be killed by beetles at different times. The Forest Service has established 5,000 points throughout the 2.3 million-acre White River National Forest where it takes inventory of species diversity and other conditions every so often.

Research indicates that climate change — with later falls and earlier springs — allows beetles to spread over a longer period, Burke said. But it also provides a longer growing season for the next generation of trees that will replace those now dead and dying.

The Forest Service has teamed with the Skico to successfully battle the Douglas fir beetle at Aspen Highlands. Little packets of a pheromone have been tacked onto the mature fir trees in the ski area. Those packets send a chemical scent to beetles with a message that says, "Go away, the inn is full," Burke said.

For the Forest also teamed with Pitkin County and the city of Aspen to treat lodgepole pines on about 130 acres of 250 acres of open space on lower Smuggler Mountain. Brood trees were cut down and removed before beetles could spread. Pheromone packets were placed on surviving lodgepoles.

"I would call it a dramatic success," Bennett said of the work.

For result of the state and national forest survey, go to www.fs.usda.gov/r2.

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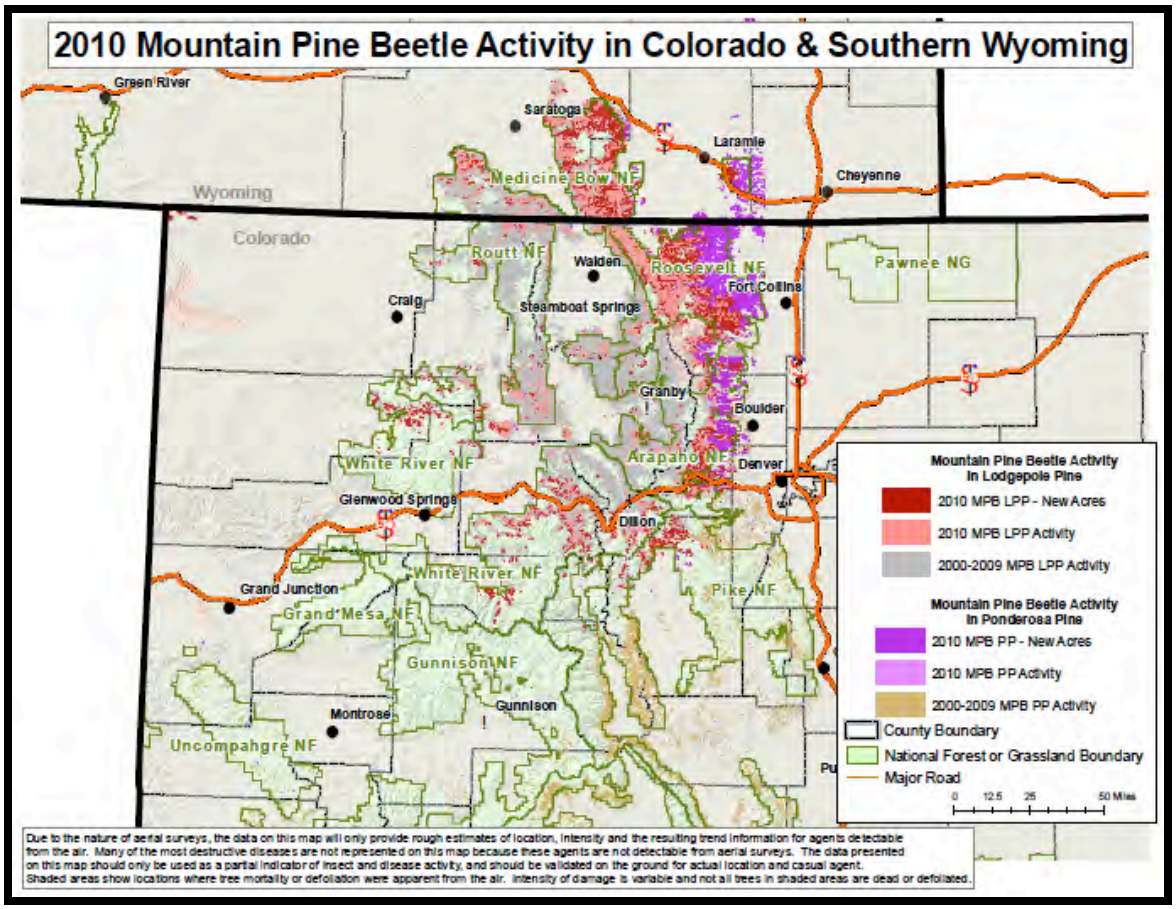
APPENDIX B
2010 MOUNTAIN PINE BEETLE ACTIVITY IN COLORADO AND SOUTHERN WYOMING
(Provided by the USFS Region 2 and the Colorado State Forest Service)



APPENDIX C
March 25, 2011 SPOKANE SPOKESMAN-REVIEW

THE SPOKESMAN-REVIEW
March 25, 2011

Lack of sawmills an issue for forests

It means fewer bids for timber sales, USDA official says

Becky Kramer
The Spokesman-Review

Bark beetles have ravaged hundreds of thousands of acres of Colorado's forests, yet that state has only one large sawmill left to bid on federal timber sales.

That's a problem for the Forest Service, which is depending on the timber industry to thin stands of unhealthy, crowded trees across the Rocky Mountain West, a top U.S. Department of Agriculture official said Thursday.

"The Forest Service is going to have to pay someone to do it, if they can't sell that timber," said Robert Bonnie, a senior advisor to U.S. Agriculture Secretary Tom Vilsack.

Last year, the Forest Service pledged $54 million to fight bark beetle outbreaks, which have affected more than 3.3 million acres of forest in Idaho, Colorado, Wyoming and South Dakota. In Idaho, the beetles have denuded trees from Lolo Pass to Lookout Pass along the Idaho-Montana border. The money is slated for thinning trees, restoring watershed health and reducing wildfire danger near rural communities.
Bonnie said costs for those kinds of projects escalate if there's not a viable timber industry to bid on the work.

Bonnie spoke to a receptive audience Thursday at a small-diameter log conference at the Coeur d'Alene Resort. Many rural communities have lost sawmills. And with no quick turnaround in sight for the U.S. housing market, the economics of producing lumber remain challenging.

John Konzen said all the mills have closed in Lincoln County, Mont., where he's a county commissioner. Trees cut on the Kootenai National Forest are trucked out of the state for processing.
"The closest mill is at Moyie Springs in Idaho," Konzen said.

Bonnie said that conservation groups – traditional adversaries of the timber industry – are starting to understand the role the industry can play in keeping forests healthy.

That's happening at the Colville National Forest in Northeast Washington, which has become a national model for collaboration among industry groups, environmentalists and outdoor recreation interests. The groups look for common ground on forest management issues.

Collaboration benefits the timber industry, Bonnie said, because fewer timber sales are delayed through appeals or lawsuits. Mills can rely on a steadier stream of timber from federal lands. That allows the industry to invest in upgrades and strengthens local communities.

"We need forest management for the health of the landscape and the economic stability of rural communities," Bonnie said.

APPENDIX D
ASPEN-SOPRIS WILDLIFE HABITAT IMPROVEMENT PROJECT
TREATMENT UNIT MAP