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Phone: (906) 226-7487 Fax: (906) 226-7040

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## **Biomass Utilization and Restoration Network in the Upper Peninsula of Michigan: **BURN-UP****

*Final Report for Grant Award #MI 07-DG-11420004-307*

**Date:** December 15, 2009

**Grant Recipient:** Upper Peninsula Resource Conservation &  
Development Council

**Grant Project Period:** October 1, 2007 - September 30, 2009

**Recipient Contact Person:** Darcy Rutkowski

**Principal Investigator/Project Director:** Chris Burnett

<b>Grant Budget:</b> Federal -	\$99,450
Recipient Match -	<u>\$42,652</u>
Total	\$142,102



The Upper Peninsula Resource Conservation & Development (UPRCD) Council recently completed a multi-faceted woody biomass utilization project with the help of a diverse coalition of partners. The project was funded by a grant from the Northeastern Area State and Private Forestry Division of the U.S. Forest Service. Forested areas make up the majority of land cover in Michigan's Upper Peninsula (UP), representing approximately 8.5 million acres, or 79% of the total land base. Forest products industries are an important component of the UP economy and key to maintaining healthy forests in the region. Almost half of the manufacturing jobs in the UP are associated with forest products industries, and the related forestry, logging and support service jobs also provide significant employment. Interest in the utilization of woody biomass is very high in the region.

There are potentially great economic benefits available from the increased utilization of low quality wood for fuel. Diversifying energy sources using biomass feedstock and reducing infrastructure costs will improve rural community resilience and sustainability. The potential exists for woody biomass to become an important, low-cost fuel for public institutions, such as schools, hospitals and others while at the same time improving forest health and condition by reducing fuels and invasive species, and allowing for forest treatments that in the past were not profitable. It is important to ensure the long term health and sustainability of the UP forest resource through proper management. There are ecological risks that must be avoided. Over-harvesting can lead to depletion of soil nutrients or erosion on certain soil types and to degradation of wildlife habitat. The BURN-UP project contained several components which focused on the sustainable development of the woody biomass industry in the Upper Peninsula.

The BURN-UP project addressed four major program components:

- Assemble a technical team of experts who will work with other groups, notably the Michigan Department of Natural Resources (MDNR) Forest Management Advisory Committee, to refine and promote sustainable forest management for harvesting woody biomass
- Identify and provide technical assistance to schools, hospitals, and other institutions that are interested in converting their heating system to utilize woody biomass as a fuel source
- Set up demonstration sites on different forest types to provide education on sustainable woody biomass harvesting methods
- Create an on-line woody biomass information clearinghouse linked to the UP RC&D Council website

By working with a diverse coalition of public and private partners, the UP RC&D Council has been able to capitalize on current and previous efforts to promote economic stability and healthy forests in the Upper Peninsula. Through Project BURN-UP, the Council has increased the knowledge of UP stakeholders regarding the sustainable utilization of woody biomass.

## SUMMARY OF PROJECT GOALS AND ACCOMPLISHMENTS

### *Goal 1: Assemble a Team of Technical Experts to Advise the Project*

A diverse group of individuals was assembled to provide expertise and technical support to the UP RC&D Council on this project. These steering committee members were drawn from the UP RC&D Council Forest Resources Committee, the US Forest Service, universities, conservation districts, the Michigan Department of Natural Resources (MDNR), industry, and environmental organizations. These individuals have been extremely dedicated to this project and willing to participate in quarterly steering committee meetings and also to serve on sub-committees related to various other project objectives like vetting engineering firms, sponsoring biomass harvesting demonstrations, and participating in workshops to help educate the public. Several steering committee members have been assisting the Michigan DNR Forest Management Advisory Committee to create guidelines for sustainable forest management for harvesting woody biomass. This effort is being led by DNR state forester (and BURN-UP steering committee member), Cara Boucher, and the draft guidelines can be found in Appendix A of this report. Virtually all members agreed to continue to serve on the steering committee to provide expertise for a second grant funded project (BURN-UP-Phase II).

The success of this diverse partnership was recognized in December of 2008 when the BURN-UP Project received the Two Chiefs' Partnership Award. Recipients for this award are chosen annually by the Chief of the USDA Forest Service and the USDA Natural Resources Conservation Service (NRCS), and the award recognizes outstanding partnerships in forest conservation work among Conservation Districts, State Foresters, the Forest Service, and NRCS.



*BURN-UP Project partners receive the Two Chief's Partnership Award. Presenting the awards were Garry Lee, NRCS State Conservationist (left) and Don Howlett, Partnership Coordinator for the Hiawatha National Forest (back row, fourth from left).*

#### ***BURN-UP Project Partners***

***Natural Resources Conservation Service  
U.S. Forest Service - Hiawatha National Forest  
Marquette County Conservation District  
Michigan Department of Natural Resources  
Michigan State University Extension  
The Forestland Group, LLC  
Big Creek Forestry  
Marvin Nelson Forest Products, Inc.  
North Dickinson County School District  
Public Schools of Calumet-Laurium-Keweenaw  
Michigan Technological University -  
School of Forest Resources & Environmental Sciences  
The Nature Conservancy  
Suchovsky Logging, LLC  
D & S Forestry  
Marquette County  
Smurfit-Stone Container Enterprises, Inc.  
USFWS - Seney National Wildlife Refuge  
UP Resource Conservation & Development Council***

***Goal 2: Identify and provide technical assistance to schools, hospitals, and other institutions that are interested in converting their heating system to utilize woody biomass as a fuel source***

In December 2007, the UP RC&D Council contacted all school districts in the Upper Peninsula to let them know about Project BURN-UP (Biomass Utilization and Restoration Network for the Upper Peninsula). One of the primary goals of the project was to assist schools and other institutions in determining if converting their existing fossil fuel heating systems to a system that utilizes woody biomass is feasible. Interested schools were invited to apply for a no-cost engineering pre-feasibility study of their facility and were also offered the opportunity to attend a tour of one of the schools in the UP that is currently heating their facility with woody biomass. An informational brochure (Appendix B) was developed which provided information about the benefits of heating with woody biomass and also highlighted success stories from schools that were already utilizing woody biomass heating systems. The project director made a presentation on the BURN-UP Project at a meeting of all the school superintendents (62 districts) from the Upper Peninsula and distributed the brochure as well as an Energy System Survey (Appendix C) to be completed by the superintendent or facilities manager for each school district. All districts received the information at the meeting or by mail. Follow-up letters were sent to all school board presidents to inform them about the project and about the materials their superintendent had received. The brochure was also made available on the project website.



***Tour participants view the biomass storage garage at the C-L-K School.***



***Augers move the woody biomass material which is being utilized at the North Dickinson School.***



***Ash is removed daily from the woody biomass boiler.***

Three tours were conducted at Upper Peninsula schools that had already adopted wood as a heating fuel to provide information on the feasibility and process of converting to wood energy. Administrators, facility managers, and school board members from other UP schools that were interested in exploring the feasibility of installing a woody biomass heating system attended the tours. The tours took place at Calumet/Laurium/Keweenaw School District (western UP), North Dickinson Schools (central UP), and Whitefish Township School District in Paradise (eastern UP). Eight different districts were represented at the tours. The North Dickinson County School District and the Public Schools of Calumet-Laurium-Keweenaw were two of the eighteen partners to receive the Two Chiefs' Partnership Award. Both districts were among the original partners that provided letters of support for the grant application to the U.S. Forest Service. North Dickinson Schools have been heating with wood since 1991. The C-L-K Schools installed a wood-fueled boiler in 1990 to heat the middle school and high school in Calumet. The same boiler now also heats an attached elementary school as well. The Whitefish Township School has been heating with wood since 1992. All three schools are saving money by heating their facilities with wood. The money saved is being utilized for student instruction. Additional school tour photos are available in Appendix D.

The Energy System Survey was used to collect information about the current energy system (heat, domestic hot water) of each school, the fuel and electricity usage for the previous two years, the existing physical plant and biomass storage capacity, neighboring facilities that might share an energy system, interest in attending a tour of a school that currently utilizes woody biomass, and the school's interest in converting to a woody biomass heating system. Steering committee members made personal contact with school district personnel they had a connection with, offering information about the project and urging them to return surveys. All schools that were identified in the study "Exploring Woody Biomass Retrofit Opportunities in Michigan Boiler Operations" ([www.michiganwoodenergy.org](http://www.michiganwoodenergy.org)) as being top prospects in the UP to convert to woody biomass were also personally contacted by the BURN-UP Project Director as a follow-up to the survey distribution.

A dozen schools responded, with 9 ultimately returning the surveys. Six of the school districts were highly interested in continuing to explore whether or not conversion to a woody biomass heating system was feasible for them at this time.

The UP RC&D Council secured the services of Integrated Designs, Inc. to provide the six school districts with engineering pre-feasibility assessments to help them determine if conversion to, or supplementing with a wood fuel-based boiler system would be a preferable alternative to their existing non-renewable fuel system. Each assessment was valued at \$6,000 with one-half paid with BURN-UP Project grant funds and the other half generously donated by Integrated Designs, Inc. as in-kind match for the project. Each pre-feasibility assessment evaluated the existing building construction and insulation values, current heating system operation and current fuel costs, impact to the existing site, truck maneuverability, and biomass fuel handling and equipment options. The estimated fuel savings were calculated by taking the actual fossil fuel costs and subtracting the cost of the amount of wood chips that would be needed to provide the same amount of thermal energy. The estimated construction costs were divided by the estimated fuel savings to arrive at the simple payback. The escalation in fuel costs, both fossil fuel and biomass is uncertain. The studies assumed that escalation in biomass fuel costs will remain even, or possibly lag behind fossil fuel costs over the 20-year amortized life of the system. Availability of any fuel source, including biomass, is difficult to predict with any certainty. It can be said with some certainty that fossil fuels through the next 20 years are projected to decline while renewable biomass fuels, when managed properly, can be a stable source of fuel for many years within the Upper Peninsula. The studies found that all facilities would see fuel savings by utilizing woody biomass. When these fuel savings were compared to the cost of installing the new system, the studies showed that some of the schools could pay back their investment in a relatively short time period. The results of the pre-feasibility assessments are summarized below for each of the six districts (8 facilities) that were evaluated.

<b>School</b>	<b>Estimated Installation Costs</b>	<b>Estimated Annual Fuel Savings</b>	<b>Estimated Payback (years)</b>
Manistique	\$430,000	\$56,593	7.60
Munising Mather	290,000	26,337	11.01
Munising High	428,000	30,432	14.06
Stanton Township	322,000	19,123	16.84
St. Ignace	580,000	73,502	7.89
Tahquamenon	475,000	37,359	12.71
Marquette High	854,000	54,277	15.70
Marquette Bothwell	954,000	24,540	38.90

These studies were intended to be a resource for the districts to help them determine if they should further explore the conversion to a woody biomass system. If a district is in the position of having to replace a heating system, that can make the conversion even more attractive. The BURN-UP project director and a representative from the engineering firm met with personnel from each of the six districts to share the results of the pre-feasibility assessments and discuss further options. Each of these districts were offered the chance to apply for additional funds to help pay for a second, more-detailed engineering assessment under a second USFS grant-funded project, BURN-UP Phase II.

The BURN-UP Project Director and the engineering firm also had discussions with some hospitals and other non-profit and governmental institutions regarding their interest and the feasibility of converting their heating systems to utilize woody biomass as a fuel source. Some of these institutions are exploring the feasibility of participating with other nearby institutions and schools to utilize a combined heating plant. These institutions are being assisted under BURN-UP Phase II.

***Goal 3: Set up demonstration sites on different forest types to provide education on sustainable woody biomass harvesting methods***

One of the primary goals of the BURN-UP Project was to increase the knowledge of foresters, loggers, land users, and others regarding sustainable methods of harvesting woody biomass that would enhance conventional and

restoration-oriented timber harvests. Two woody biomass harvesting demonstration workshops were held in September, 2008. The demonstrations which were targeted to an audience of loggers, land managers, and foresters were highly successful with more than 40 participants attending each workshop.



*The slash-bundler, manufactured by John Deere, is widely used in Scandinavia.*



*Close-up of bundles which will be dried, transported, and then chipped or ground for hog fuel.*

The day ended with a Logger Roundtable/Panel Discussion (topics included equipment options, handling/transport, supply chain, markets, etc.). The workshops were approved for SAF and SFI continuing education credits. Following the workshops, several requests were received to have information added to the Biomass Exchange portion of the BURN-UP website. More pictures of the harvesting demonstrations are included in Appendix E.



*This seed tree plot was mechanically harvested with 80% of woody debris removed and utilized as biofuel.*

The first demonstration was conducted on land being managed by Plum Creek Timber Company which was being logged by Nelson Forest Products. The 40 acre parcel consisted of mixed species which included northern hardwoods, aspen and some lowland conifers. The parcel was clear-cut with management primarily for pulpwood production. Several pieces of equipment were being used on the site during the demonstration. A Ponsse chipper was operational and the John Deere slash bundler owned by Nelson Logging was working on the site.

The second demonstration was sponsored by the Forestland Group, LLC on their land which is being managed by Cold Springs Forestry. They have established several 5 acre trial plots to compare regeneration and harvest methods in northern hardwoods which are being managed for beech bark disease removal. Logging was being conducted by Zellar Forest Products and equipment manufactured by Bandit Industries was being demonstrated including a whole-tree grinder and a processor.

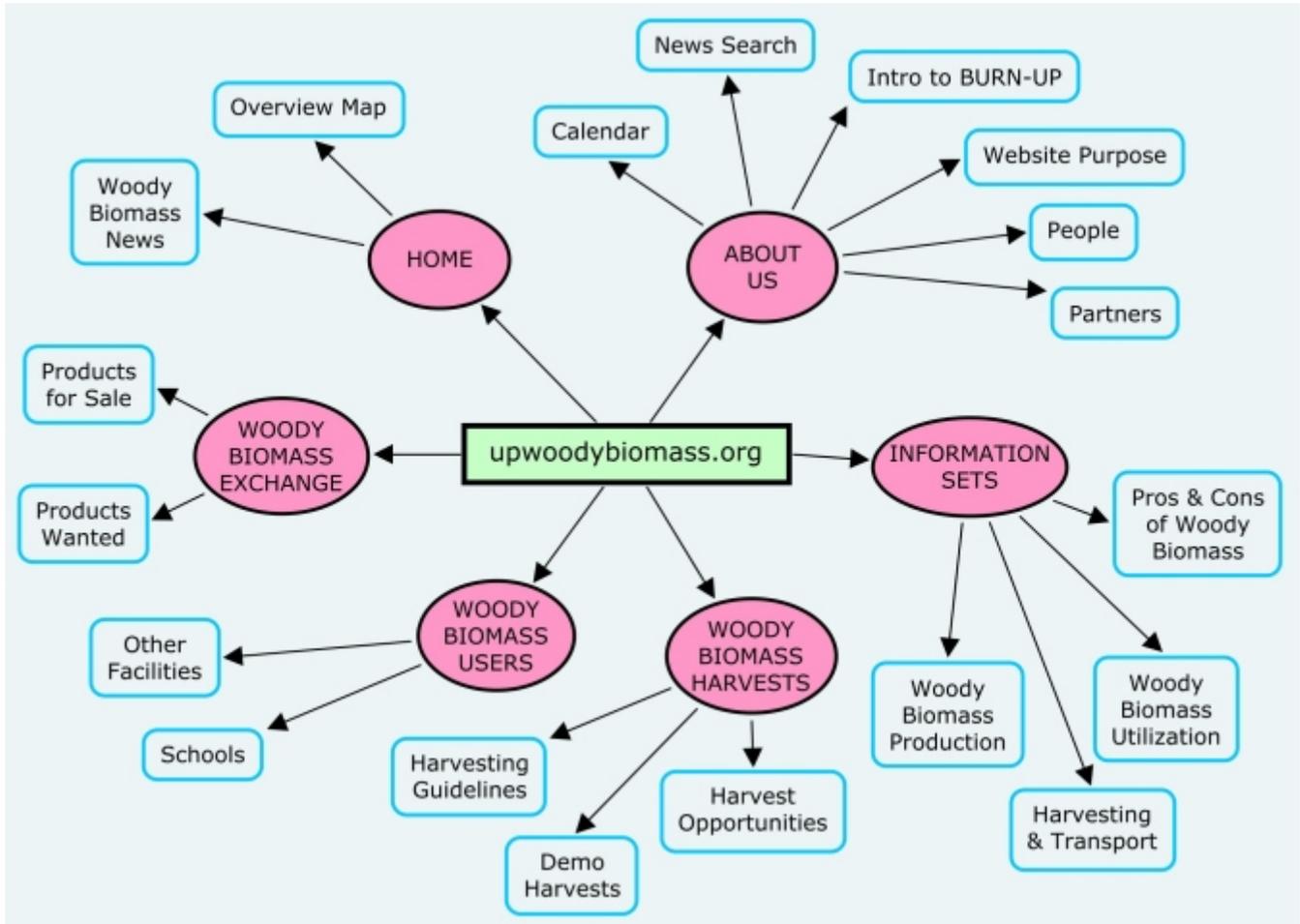
The morning of each demonstration featured an onsite demonstration and the afternoon featured several speakers addressing: Benefits of Using the Soil Survey (Dwight Jerome, NRCS Soil Scientist), Biomass Harvesting Based on Soil Map Units (Chris Burnett), Michigan's Biomass Harvesting Guidelines (Cara Boucher, State Forester, MDNR), USFS Woody Biomass Harvesting (Bill Gimler, USFS), and Using the BURN-UP Website (Chris Burnett).



*"The Beast", a grinder manufactured by Bandit Industries was featured at the second woody biomass harvest demonstration.*

**Goal 4: Create an on-line woody biomass information clearinghouse linked to the UP RC&D Council website**

There are plenty of loggers who would like to harvest more woody biomass, and there is plenty of interest in switching to cheaper, lower-impact, wood fuel. But, loggers aren't going to invest \$100,000's in specialized equipment unless they are confident of a market. Conversely, schools and other facilities are not going to install wood boilers unless a reliable supply of fuel wood is available. Thus, the need to simultaneously develop both sides of the equation is obvious. In response to this need the BURN-UP project has developed an informational website (www.upwoodybiomass.org). A good deal of effort has gone into designing a website that will provide education and information well beyond the completion of this grant.



As can be seen in the website template above, there is a Woody Biomass Exchange on the website where producers with biomass products to sell and users who are in need of woody biomass can find each other. This user friendly site provides a map of the Upper Peninsula indicating the location of biomass products available or desired.

In addition to the Biomass Exchange, there is a section for Woody Biomass Users (schools and other facilities), and Woody Biomass Harvesters (includes harvesting guidelines, soil suitability map tool, information about our harvest demonstrations, and other harvest opportunities), and Information Sets. This section has a search tool allowing the user to find information regarding the pros and cons of woody biomass, woody biomass production, utilization, harvesting and transport. Project BURN-UP screens information regarding woody biomass from such sources as Smallwood News, and the Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Network News and makes information which is pertinent to the Great Lakes region available on our website.

### ***A Little More about the Soil Suitability Map Tool:***

The BURN-UP Project has developed GIS maps of soil ratings for biomass harvesting. The literature on the impacts of woody biomass harvesting overwhelmingly indicates that soils have a wide range of sensitivities to biomass removal, and that these sensitivities are very site specific (not to mention seasonally specific). Fortunately, as of fall 2007, soil mapping at a resolution of 3-4 acres is available in digital format for the entire UP. Many chemical and physical properties have been determined for each soil type. These properties have been combined in various ways to provide suitability ratings for many types of uses. However, no ratings for woody biomass harvesting have been produced, until now. Using six of the most relevant soil properties and existing ratings, BURN-UP Project Director, Dr. Christopher Burnett, developed the "UP Woody Biomass Harvest Soil Suitability Rating (Version 1)." The rating consists of 15 electronic maps in ESRI shapefile format, one for each county in the UP. A wide variety of factors were considered for the rating. Many of the candidate factors were eliminated due to insufficient coverage of the region. Version 1 of the rating is based on six factors, three representing soil quality in terms of plant productivity (Calcium Carbonate, Organic Matter, and Available Water Supply), one representing soil quantity (Depth to Any Restriction), one representing risk of erosion (Representative Slope), and one representing runoff/infiltration rate (Hydrological Group). These six factors were combined into a composite score for each soil survey mapunit. The rating is a map-based tool that provides site-specific guidance about the suitability of a soil mapunit for biomass harvesting from a soil sustainability perspective. The rating does not provide quantitative guidance about how much biomass should be retained on site. It only provides a relative scale of suitability/sensitivity, but one that is based on good scientific data. Other considerations, such as wildlife habitat and aesthetics, although important, are not included in the rating. To be able to use the rating, one must have a GIS system capable of displaying ESRI shapefiles and a working knowledge of the system. By varying the symbology used to display the data, the ratings can be used for site-specific guidance and for county-wide or regional analysis. This tool is available on the BURN-UP website at [www.upwoodybiomass.org](http://www.upwoodybiomass.org).

### ***The Future of Project BURN-UP:***

Project BURN-UP has shown that a great potential exists in the Upper Peninsula of Michigan for woody biomass to become an important, sustainable, less expensive fuel for public institutions, such as schools, hospitals and others, while at the same time improving forest health and condition by reducing hazardous fuels and invasive species, and allowing for forest treatments that in the past were not profitable. The UP RC&D Council has been awarded additional grant funding by the Wood Education and Resource Center (WERC) of the U.S. Forest Service to continue to build on the accomplishments and partnerships which were developed during this project. The goals of BURN-UP Phase II are:

- Continue to assist schools, hospitals and other institutions in their efforts to convert to using woody biomass as a heating fuel
- Bring information and technology to existing and emerging businesses that focus on the use of low value woody biomass
- Increase the sustainable use of woody biomass by further developing local markets and forest industry infrastructure

BURN-UP Phase II will continue under the guidance of the steering committee, most of whom have volunteered their time and expertise until this new project is completed. During Phase II of the project (utilizing the new grant funds) we intend to help one or more UP schools complete the steps toward converting to a woody biomass heating system by assisting them in obtaining a more detailed engineering assessment and helping them in their efforts to locate woody biomass materials to supply their new system. The project will also sponsor additional sustainable harvest demonstrations, and conduct educational workshops for a variety of audiences (such as conservation districts, schools, loggers, landowners, land managers, etc.) as part of a larger outreach program. Grant funds will be used to identify potential locations for clustering small-scale wood energy facilities in order to allow the use of larger and more efficient utilization technologies that would help wood suppliers make harvesting equipment investments more feasible by increasing and concentrating markets.