A Report on:
West Central Minnesota's
Red Cedar Resource
2004 thru 2006
Grant No: 03-DG-11244225-284

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Prairie Country Resource Conservation & Development

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Introduction

This report presents an analysis of the Red Cedar (Juniperus virginiana) resource in west central Minnesota. It covers a five (5) county area in which red cedar has become well established since the enactment of the 1985 Farm Bill, which created the Conservation Reserve Program (CRP). Since the inception of CRP, large acreages of farmland in western Minnesota have been idled. As a result of idling the former agricultural land, red cedar has invaded many sites.

In west central Minnesota, particularly in the counties of Kandiyohi, Redwood, Renville, Swift and Yellow Medicine, red cedar has become somewhat of a weed tree. Red cedar now occupies over 4,500 acres of land, which had previously been in row crops, hay or pasture. With these trees now forming dense stands of trees, local landowners are looking at ways to utilize this resource, rather than using the old method of cutting and burning the trees.

This project was undertaken to determine if there is an adequate resource base to entice a small business or two to take advantage of potential products that can be derived from these trees. The primary interest of Prairie Country RC&D was to look at the opportunity to tap into the essential or aromatic oils markets. As the project evolved, other marketing opportunities have come up that are also addressed in this report. It is hoped that by promoting multiple uses (products) of this tree we can develop some small business ventures to turn this “weed” into a cash crop. Since red cedar is a highly prized tree in other parts of the US, there is no reason why it can’t gain similar status in Minnesota.

Red Cedar Inventory Report

USDA Forest Service Grant No: 03-DG-11244225-284

Focus: The focus of this project was to survey the red cedar (*Juniperus virginiana)* resources of west central Minnesota. The Prairie Country Resource Conservation & Development Council (RC&D) has an interest in developing marketing opportunities for essential oils and other products from this species. If the survey results showed a favorable amount of potential, this would spur the promotion of a value added business opportunity for this "weed" tree. Multiple products, if feasible, would also be promoted in order to better utilize this potentially abundant resource. The inventory was focused on a five (5) county area in west central Minnesota.

Methodology

Over the past 2 years, Soil and Water Conservation District (SWCD), RC&D, and Minnesota Department of Natural Resources (DNR) Forestry staff inventoried the red cedar resource in West Central MN. A total of 27 tenth-acre plots were taken on private land owned by 17 different private individuals in: Swift, Kandiyohi, Renville, Yellow Medicine, and Redwood Counties.

The MN DNR Resource Assessment section performed analysis of satellite imagery that suggested that there are approximately 4,500 acres of red cedar cover type in the study area. This acreage reflects only the red cedar stands that have red cedar as the dominant canopy cover. Stands of hardwoods with red cedar in the under-story were not included in this study. Also not included were the acres of young, seedling sized red cedar that is invading many idle fields in the study area, which does not show up on satellite images, which is estimated to be another 600+/- acres.

On the 1/10th acre circular plots, all red cedar trees were measured. All trees that were at least 4" diameter at breast height (dbh – which is measured 4.5' above the ground) were measured to determine total tree height and stem diameter at dbh. For trees less than 4" dbh, average height and diameter were recorded for each plot. Once the plots were measured, total tree volume per acre was calculated. This calculation was based on Tree Volume and Biomass Equations for the Lake States, as published by the USDA Forest Service (NC-250).

Data Results

Average Volumes: Data collection results, for trees 4" dbh and larger, indicate that there is an average of 28.25 green tons/acre (GT/A) of red cedar in the study area. The lowest volume per acre average was found in Swift County, where the average was 14.84GT/A. The highest yields were found in Redwood County, where the average was 46.13GT/A. On a stand by stand basis, volumes ranges from 0.36GT/A to 70.67GT/A (both in Redwood County).

The data suggests that the Minnesota River valley has the highest volumes per acre, as well as ¾ (3,400 acres) of the red cedar cover type acreage in the study area.

Kandiyohi and Swift Counties contain about ¼ (1,100 acres) of the total acreage, and lower volumes per acre. The lower volumes can be attributed to the fact that the stands of cedar are considerably younger than those in the Minnesota River valley.

Average Diameters: The average dbh for the entire survey area came out to be 6.5", with an average dbh range of 5.9" (Swift Co.) to 7.4" (Redwood Co.) by county. The range of dbh among plots was 4" in Swift County to 10.1" in Redwood County.

Small Diameter Tree Volumes: Data indicate that there is an average of 5.77 GT/A over the study area in trees less than 4" dbh. Volume in this size class ranged from 0.29 GT/A to 18.13 GT/A. Volume per acre comprised of trees less than 4" dbh were fairly consistent between the northern area and the MN River valley.

Potential for Aromatic Oil Production: Essential oils are concentrated aromatic oils of plant leaves, flowers, seeds, bark, wood, roots and the bark of some fruits. They have different strengths but are generally very potent and have to be diluted to be used. These aromatics have to go through a distillation process before they are ready to be used and purchasers of the product scour the country for just the right properties.

Essential oils are the core of the $10 billion U.S. fragrance, food flavorings and cosmetic industries. They are highly dependent on certain oils because of certain irreplaceable formulas that are the basis for their sales. Examples of raw materials used for distillation are Texas and Virginia cedar-wood oils, tea tree oils, lemongrass oils, balsam fir, hemlock, spruce and, sweet birch oils. Currently, China is a major competitor in this market. Most of the U.S. market for cedar oils is based in the southern Great Plains, east to the southern Appalachian region.

Potential for Other Products: Red cedar lumber can be used for closet lining, storage chests, and other specialty products. Fence posts, rails, and stiles are also good uses for cedar wood. Bent wood and rustic furniture and yard structures (arbors, trellises, etc) are other market options for red cedar (particularly the branches), as are landscape mulch, pet bedding, and potpourri. Finally, we can't overlook the potential for fuel, either direct combustion or gasification as market opportunities.

With the abundance of small diameter trees at the present, the potential for sawn products would be several years off. One of the best opportunities for solid wood utilization is in the bentwood and rustic furniture, and decorative markets. The wood fuel market is also seeing an increased interest in this portion of Minnesota, as well as regionally. These markets could be developed to only indirectly compete with an essential oils market, as small diameter material (branches & tops) could be utilized, and larger pieces with more heartwood could be dedicated to essential oil production. Another option is to have the essential oils extracted, and then send the remaining wood to an energy facility for use as a fuel source.

Recommended Priorities for Utilization: Since higher yields are reported to come from older trees (those with a higher % of heartwood), it would make sense to explore

utilization of red cedar trees from the Minnesota River valley first, and then look north to the moraine country of Kandiyohi & Swift Counties. The oldest and largest trees are located in the river valley southeast of Granite Falls. The area south of Granite Falls has younger trees than some areas in the moraine country. Kandiyohi County has a diverse age structure, and should be explored after the Renville/Redwood County area. Swift County, as a whole, has the youngest trees and should be considered last.

Summary of Relevant Data

	DBH inches	**Board Feet/A**	**Total Wt GT/A**	**GT/A <4"DBH**	**GT/A >4" DBH**	**Bole Wt GT/A**	**Top Wt GT/A**	**Cubic Feet / Acre**	**Stems/ Acre**	**Estimated Acres**
Kandiyohi Co. (7 plots)	6.6"	10,228	31.83	4.94	26.89	19.1	7.8	1046	739	700
Redwood Co. (7 plots)	7.4"	16,342	51.54	3.94	47.60	33.5	14.1	1785	879	2,000
*Renville Co. (1 plot)	6.1"	10,813	44.69	18.13	26.56	18.7	8.6	1015	1220	1,000
Swift Co. (8 plots)	5.9"	5,669	21.19	6.35	14.84	10.1	4.4	562	756	400
Yellow Medicine Co. (4 plots)	6.3"	9,729	30.23	6.19	24.04	17.0	9.6	926	798	400
Average (27 plots)	**6.5"**	**10,410**	**34.02**	**5.77**	**28.25**	**19.92**	**8.33**	**1075**	**807**	**Total 4,500 Ac**

* Only one plot taken in Renville County

Economic Analysis

Available Red Cedar Volume: Based on the average of 34.02GT/A, there is 153,090 GT on hand in the study area. Not all of this is harvestable, as some is locked up in parks and inaccessible site conditions. Thus a conservative reduction of 15% still leaves approximately 130,126 GT as potentially available for utilization. As noted in the Methodology section of this report, there is additional volume in the understory of many of our hardwood stands. These understory stands will have in the neighborhood of 2,000 board feet per acre. Some of these stands have trees averaging up to 9" dbh, which could provide another 6.6 GT/A of usable material.

Yield of Cedar Oil: For most Cedarwood Virginiana oil, 55gal weighs 400 lbs. The typical yield is 30 to 64 lbs of oil / dry ton yield. Since cedarwood oil weighs c. 7.5 lbs/gal., we could expect a yield of 4 to 8.5 gal/DT yield. With average moisture content of 40% we should see yields of 2.4 to 5.1 (average of 3.75) gallons of oil per green ton. Based on 34.02 GT/A, we could see oil yields of 81.6 to 173.5 (average of 127.6) gallons per acre. Grown on a 30 year rotation, 150 acres per year could be sustainably harvested from the study area. This would result in annual yields of 12,240 to 26,025 (average of 19,140) gallons of oil per year. Assuming 15% unavailable acreage, we would have 127.5 acres available per year, yielding 10,404 to 22,121 (average of 16,269) gallons of oil per year.

Estimated Cedar Oil Value in Study Area: Based on a retail price of $50 per gallon, there is a potential for $520,200 to $ 1,106,062.50 (average of $813,450) of value per year in oils. If understory trees are used to make up the 15% unavailable from the assessed stands, the value would increase to an average of $957,000.00, with a range of $612,000 to $1,301,250. The more likely scenario is that we could develop a small-scale production network that would provide wholesalers with essential oils valued at roughly 30% to 50% of the retail value. This wholesale market could provide between $156,060 and $650,625 in base economic activity.

Estimated Cedar Biomass Value in Study Area: Based on an estimated market value of $20 per ton of processed chips, there is a potential for market a value of $102,060 in the biomass markets (this includes: fuel; mulch/landscaping; and bedding sectors). This is based on 34.02 GT/ac. from 150 acres per year. If we reduce the harvestable acreage by 15% we get a potential value of $ 86,751. If we include the additional 600+/- acres of non-surveyed sites, we could increase the annual harvest by another 20 acres, worth an additional $ 13,608 in biomass value. The market value of craft-wood is hard to determine, as most crafters try to get their material for little or no cost. A conservative price of $20 per ton for the craft market is not out of line, thus it could result in similar values to that of biomass.

The lumber value as base stumpage is valued at $24 /thousand board feet. Based on an average of 10,410 board feet per acre and a harvest of 150 acres per year we get a potential value of $37,476.00. The stumpage price for biomass/pulp quality red cedar is $6/cord, which calculates out to $12/thousand board feet. Based on an average of 10,410 bd. ft. / ac. harvested from 150 ac. per year, there is a minimal value of $18,738

Conclusions: Based on the data, it is recommended that Prairie Country RC&D continue to look into markets for essential oils from the red cedar resource in their area. If the market can be entered, it is believed that there is enough resource to fill gaps in existing demand, or develop/expand local markets for these oils and their byproducts. There is potential to establish a business venture with an investment of $100,000 to $200,000 that could tap into this or another lucrative niche market. Some further testing of essential oils – quality, quantity, and chemical make up – should be conducted prior to pursuing the development of an enterprise. A system of utilizing various portions of the tree for different uses needs to be further examined as well. This could provide for the start up of new business or the expansion of existing cottage industries in the area.

The opportunity for developing markets and developing small scale businesses to deal with products other than essential oils is also something that should be pursued by the RC&D. A combination of several products and markets could easily keep 1 or 2 small businesses viable in the west central portion of Minnesota.

The utilization of Small Business grants would be a good stimulus to get some small enterprise started to utilize the red cedar resource in the study area. If this occurs, it could spur development in other parts of the state, such as the bluff lands of southeast Minnesota. It is unlikely that Minnesota could compete with the southern regions of the

US in the red cedar markets. However, Minnesota is definitely in a position to be a positive contributor to the red cedar industries.