

**2014. Project Abstract
For the period ending June 30, 2016.**

PROJECT TITLE: Cattail management for wetland wildlife and bioenergy potential.

Project Manager: Dan Svedarsky, Research Biologist
Affiliation: Northwest Research and Outreach Center, U of Minnesota
Mailing Address: 2900 University Avenue
City/State/Zip: Crookston, MN 56716
Phone: (218) 281-8129
E-mail: dsvedars@crk.umn.edu
Website: http://www3.crk.umn.edu/faculty/S/WDaniel_Svedarsky.htm

Funding Source: Environment and Natural Resources Trust Fund

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 06i

Appropriation Amount: \$ 74,000

Overall Project Outcome and Results

Cattails are a major problem in Minnesota wetlands because their growth is commonly in excess of the 50:50 ratio of cattail/bulrush vegetation to open water desired for optimum wetland wildlife habitat. How to control them is the most frequently asked question by wetland managers. This project evaluated traditional management techniques (mowing, burning, grazing, and chemical) and explored the logistics of partial harvest for biofuel. Since 2005, the International Institute for Sustainable Development in Winnipeg, Manitoba has been evaluating cattails to remove nutrients from runoff water to reduce eutrophication of Lake Winnipeg, and develop an economically viable system of harvesting cattails for biofuel. This project used the Canadian model to evaluate possible applications in Minnesota. Management effects on vegetation, birds, and amphibians were measured. The energy content of cattail pellets is similar to wood (~ 8,500 Btu/lb.) and, at least for northwest Minnesota, are an ideal sustainable bioenergy source; available in large quantities, no planting required, and no competition with agricultural lands. Challenges include guaranteeing a reliable fuel supply in spite of varying wetland and weather conditions, and refine logistics so the energy content of the product is in favorable relationship to the total amount of energy required to harvest, transport, and process. Cattails produce 8-10 tons of biomass per acre so the resource is large since about half could be harvested in a checkerboard pattern for wildlife management. Over 95,500 acres of cattails are in the 10 northwestern Minnesota counties. What is needed is an integrated management system of dependable harvest, processing into an acceptable fuel (usually pellets), storage systems, and identify users all within reasonable proximity to reduce transportation costs. Such would help offset the expensive cost of cattail control, and generate a renewable and Minnesota-grown fuel that would help mitigate greenhouse gases. The potential economic and environmental values are significant.

Project Results Use and Dissemination

Findings from this project and other case studies are being disseminated through presentations to a broad spectrum of interest groups (natural resource agencies, landowners, researchers, students, private industry, and entrepreneurs), through the electronic media, and by an illustrated booklet. The booklet by 13 authors contains a review of a broad range of management techniques along with a discussion of the ingredients of a niche industry, called the “bioeconomy” in Manitoba. Presentations were made to the following: Cattail Summit in Crookston campus involving collaborators from the International Institute for Sustainable Development in Winnipeg, University of North Dakota, Red River Basin Commission, Agricultural Utilization Research Institute, and the Hudson Valley Grass Energy Cooperative of Kingston, NY; annual meeting of the North Dakota Chapter of The Wildlife Society; Wetland Biomass Workshop at Loyola University in Chicago; Heating the Midwest with Biomass Conference in Rochester, MN sponsored by Agriculture Utilization Research Institute; International Wildlife Management Congress in Sapporo, Japan; symposium on Renewable Energy and Wildlife at the national meeting of The Wildlife Society in Winnipeg, Manitoba; Cattail Management and the Bioeconomy Workshop, U of Winnipeg, Manitoba; workshop on using cattails for bioremediation and energy sponsored by Red River Basin Commission. More recently, Ray Norrgard, one of the booklet co-authors and Wetlands Program Leader for MN DNR spoke on cattail management at a statewide wetland management workshop for 150 wetland wildlife managers sponsored by the MN Chapter of The Wildlife Society. Booklets were distributed and discussed.

Cattail and other resources on biofuels and sustainability are posted on the U of MN Crookston Center for Sustainability web page under “Reports and Resources.” <https://www.crk.umn.edu/units/center-sustainability>. Also at the U of MN’s Northwest Research and Outreach Center web site under <http://www.nwroc.umn.edu/research/wildlife-management-biofuels> with the booklet at: http://files.knightprinting.com/502492_Cover_kp3.pdf) A list serv of wetland and sustainability researchers and managers has been established and sets the stage for follow-up collaboration.



Environment and Natural Resources Trust Fund (ENRTF)

M.L. 2014 Work Plan. Final Report.

Date of Report: August 9, 2016

Final Report

Date of Work Plan Approval: June 4, 2014

Project Completion Date: June 30, 2016

PROJECT TITLE: Cattail management for wetland wildlife and bioenergy potential.

Project Manager: Dan Svedarsky, Research Biologist

Organization: Northwest Research and Outreach Center, U of Minnesota

Mailing Address: 2900 University Avenue

City/State/Zip Code: Crookston, MN 56716

Telephone Number: (218) 281-8129

Email Address: dsvedars@crk.umn.edu

Web Address: http://www3.crk.umn.edu/faculty/S/WDaniel_Svedarsky.htm

Location: Counties of Polk, Red Lake, Pennington, and Marshall.

Total ENRTF Project Budget: ENRTF Appropriation:\$ 74,000

Amount Spent: \$62,961

Balance: \$ 11,039

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 06i

Appropriation Language:

\$74,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Northwest Research and Outreach Center in Crookston to evaluate different management techniques for cattail control and related wildlife impacts in northwest Minnesota and to assess the use of cattails as a biofuel feedstock.

I. PROJECT TITLE: Cattail management for wetland wildlife and bioenergy potential.

II. PROJECT STATEMENT: On many public lands (National Wildlife Refuges, Wildlife Management Areas, Waterfowl Production Areas, flood control impoundments) in northwest Minnesota, cattail growth has far exceeded the 50:50 distribution recommended for optimum wetland wildlife habitat (Weller and Spatcher, 1965; Murkin, et. al., 1981). The need for cattail control is supported by David Rave and Ray Norrgard, wetland scientists with the Minnesota Department of Natural Resources: *“There have been some studies examining the management of exotic cattails using flooding, herbicide treatments, and mechanical means such as roto-tilling. However, these methods are expensive and labor intensive. If a market could be established to utilize exotic cattails, management would become much more affordable. We are excited by the possibilities that this innovative research project may lead to in the management of exotic cattails in Minnesota wetlands, and fully endorse this project.* Also, David Bennett, manager of the Glacial Ridge National Wildlife near Crookston, and where extensive acreages of hybrid cattails are developing, commented: *“As a manager of a National Wildlife Refuge, cattail management has been a concern for nearly my entire 37 years with the U.S. Fish and Wildlife Service. Hybrid cattail encroachment of our nation's wetlands is having a negative effect on many water-nesting birds. I believe your project will provide the essential first steps to making the biomass harvest of cattails a viable wetland management tool.”* Cattails have also been recently demonstrated to have bioenergy potentials in Manitoba. Grosshans, et. al. (2011), noted that pelletized cattails have energy comparable to wood pellets at 17 MJ/Kg. (http://www.iisd.org/pdf/2011/netleylibau_marsh.pdf) Thus, cattails could be simultaneously managed for wetland wildlife and harvested for bioenergy. The U.S. is heavily dependent on fossil fuel energy. Using cattails as a partial substitute for fossil fuels could help mitigate climate change by reducing Greenhouse Gas emissions. Additionally, local rural economies could be boosted by harvesting an in-state, renewable resource since Minnesota has no fossil fuels. In 2012, an inventory of cattails in northwest Minnesota determined cattails can be effectively managed/harvested with conventional equipment in dry falls like 2012, but methods must be developed that can be employed in average to wet years and assure more dependable bioenergy harvest and fuel source. Along with management/harvest demonstrations, data on the response of wetland wildlife to these management applications will be collected to measure these effects.

Goals include the following:

- 1: Evaluate cattail management/harvesting techniques in representative habitats of northwest Minnesota.
- 2: Monitor wetland wildlife effects of cattail management/harvest.
- 3: Develop a publication that extends the findings to citizens, land managers, and policy makers.

This project will achieve the above goals by working with agencies and private contractors to do field tests using conventional and modified harvesting equipment to operate in a range of wet habitats. An agreement has been made with the Mattracks Company in Karlstad, Minnesota to rent a bi-directional tractor that is equipped with their custom designed tracks. It would also have a front-mounted swather (to cut and wind-row cattails) and a rear-mounted round baler that would also be equipped with tracks. Hopefully this arrangement would allow the baling of biomass with a single pass through a wetland and thereby save energy.

To augment field demonstrations, an extensive literature review of findings in North America and Europe will describe the range of equipment used for harvesting and processing in similar settings, different examples of using biomass in various applications, and wildlife effects of biofuel harvest in wetlands. This project will continue and intensify wildlife and cattail studies initiated on a pilot basis in 2013 at the Glacial Ridge National Wildlife Refuge near Crookston.

III. PROJECT STATUS UPDATES:

Project Status as of December 30, 2014:

Vegetation and bird survey data were collected and summarized for all 3 study sites in the pre-treatment condition in 2014. Additional funds from the Red Lake Watershed District allowed the timely collection of bird data in May and June of 2014 before LCCMR funds became available. Baling of cattail biomass did not occur as planned in 2014 due to the unavailability of equipment and the transition of personnel at a national wildlife refuge. However, a track-mounted CATERPILLAR machine with a mower was rented and a checkerboard mowed pattern was created in a 50-acre plot at the Parnell Flood Control Impoundment to present a study area for biological evaluation in 2015. Cattail control treatments of mowing, disking, fire, and herbicides were completed at the Glacial Ridge National Wildlife Refuge but not baling. Seven, large round bales of cattails are available from a prior year at Glacial Ridge and will be used for demonstration pelleting in 2015. Herbicide spraying was completed at the Agassiz National Wildlife Refuge. Biological data will be collected from treatment plots at all three study sites in 2015. Funds from other sources supported travel to evaluate harvesting and processing equipment for related biomass in Manitoba and New York in the fall of 2014. Internet searches and correspondence with other collaborators continue. This background information (publications, progress reports) along with field data will be posted on the project web site and used as resources for the outreach publication.

Summary reports of vegetation, birds, and amphibians were distributed to agency cooperators and will be posted on the web site of the Northwest Research and Outreach Center and the Center for Sustainability of the University of Minnesota, Crookston. A Cattail Summit was hosted on the Crookston campus on 2 December 2014 involving collaborators from the International Institute for Sustainable Development in Winnipeg, University of North Dakota, Red River Basin Commission, Agricultural Utilization Research Institute, and the Hudson Valley Grass Energy Cooperative in Kingston, NY. A progress report will be presented at the annual meeting of the North Dakota Chapter of The Wildlife Society on 11 February 2015. A proposal for a progress report paper will be submitted for the International Wildlife Management Congress in Sapporo, Japan scheduled for July of 2015 (Travel funds to be identified from other sources)

Project Status as of June 30, 2015: Bird, amphibian, and vegetation data continue to be collected at the 3 study sites to assess the biological impact of cattail management activities in different settings. A "Cattail Collaborative" has been established to include the International Institute for Sustainable Development in Winnipeg, Red Lake Watershed District, Red River Basin Commission, North Dakota State University, Loyola University, Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, and Northwest Manufacturing in Red Lake Falls. This collaborative allows the sharing of findings and brain-storming to find solutions to problems of harvesting and utilizing cattails as they arise. Conversations are on-going with private entrepreneurs and implement dealerships as to the modification of harvest and processing equipment. Findings are shared at professional conferences and informal meetings.

Project Status as of December 30, 2015: The cattail project to date has been a learning journey in which we now know much more about the nature of the plant, its potentials as a biofuel energy resource, challenges in harvesting and control methodologies, biological effects of harvesting methods, and the range of attitudes which resource managers have about the situation. A number of inquiries have been received from the general public and managers indicating a high level of interest in this resource management challenge. It has been extremely helpful to collaborate with others, especially researchers at the International Institute for Sustainable Development in Manitoba. They have been working on the problem for a longer period of time, have a broader base of funding, and are under a mandate in Manitoba to discontinue the use of coal in the near future. We

have encountered some setbacks such as changes in personnel at study sites, challenges in locating private collaborators willing to do custom harvest and fabrication work, logistical challenges in equipment suitability to work in our study settings, and managing the timing of equipment availability with that of operators and within a suitability range of weather conditions. The project will produce a range of useful information about the management of invasive cattails under different circumstances for wetland management and for realizing biofuel potentials. The project will, as most studies, be a progress report of our present understanding and point the way for more detailed studies of the situation.

Overall Project Outcome and Results

Cattails are a major problem in Minnesota wetlands because their growth is commonly in excess of the 50:50 ratio of cattail/bulrush vegetation to open water desired for optimum wetland wildlife habitat. How to control them is the most frequently asked question by wetland managers. This project evaluated traditional management techniques (mowing, burning, grazing, and chemical) and explored the logistics of partial harvest for biofuel. Since 2005, the International Institute for Sustainable Development in Winnipeg, Manitoba has been evaluating cattails to remove nutrients from runoff water to reduce eutrophication of Lake Winnipeg, and develop an economically viable system of harvesting cattails for biofuel. This project used the Canadian model to evaluate possible applications in Minnesota. Management effects on vegetation, birds, and amphibians were measured. The energy content of cattail pellets is similar to wood (~ 8,500 Btu/lb.) and, at least for northwest Minnesota, are an ideal sustainable bioenergy source; available in large quantities, no planting required, and no competition with agricultural lands. Challenges include guaranteeing a reliable fuel supply in spite of varying wetland and weather conditions, and refine logistics so the energy content of the product is in favorable relationship to the total amount of energy required to harvest, transport, and process. Cattails produce 8-10 tons of biomass per acre so the resource is large since about half could be harvested in a checkerboard pattern for wildlife management. Over 95,500 acres of cattails are in the 10 northwestern Minnesota counties. What is needed is an integrated management system of dependable harvest, processing into an acceptable fuel (usually pellets), storage systems, and identify users all within reasonable proximity to reduce transportation costs. Such would help offset the expensive cost of cattail control, and generate a renewable and Minnesota-grown fuel that would help mitigate greenhouse gases. The potential economic and environmental values are significant.

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IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1:

Description:

Cattail Management and Harvest

We will demonstrate and evaluate methods of cattail management in 3 northwest Minnesota settings; restored shallow wetlands landscape (Glacial Ridge National Wildlife Refuge), a representative flood control impoundment with water level control capability (Agassiz Valley Project or Parnell Impoundment), and a representative wetland wildlife management area with limited water level control capacity (Agassiz National Wildlife Refuge). Agassiz NWR received Lessard-Sams Outdoor Heritage Council (LSOHC) funding for chemical control of 600 acres of cattails in 2014 which will be followed by fall burning. Cattails will not be harvested at Agassiz NWR since they will be fall burned; only vegetation and bird effects will be monitored. Glacial Ridge NWR received Lessard-Sams Outdoor Heritage Council funding for mechanical management of cattails in shallow wetlands where conventional farm equipment will be used for 50% cattail harvest from study wetlands. Modified, track-mounted equipment will be used to harvest cattails in a flood-control impoundment removing about 50% of the biomass in a patch-work fashion. .

Summary Budget Information for Activity 1: ENRTF Budget: \$ 22,600

Amount Spent: \$ 12,800

Balance: \$ 9,800

Activity Completion Date: November 30, 2014

Outcome	Completion Date	Budget
1. After harvest of cattails in a flood-control impoundment, an approximate 50-acre wetland will be present where 50% of the cattails have been removed in a patch-work fashion. The outcome will be a demonstration area where “before and after” vegetation and bird survey data will be collected to measure effects of harvest. A bi-directional tractor will be equipped to do this harvest and produce a number (to be determined) of large round bales of cattails. The outcome will be performance data and observations of this operation.	November 30, 2014	\$ 22,000
2. Harvest of cattails in shallow wetlands at Glacial Ridge NWR to provide the second demonstration and study area. Spraying of cattails at Agassiz National Wildlife Refuge to provide the 3rd area.	November 30, 2014	\$ 600

Activity Status as of December 30, 2014: Because of the unavailability of the bi-directional tractor from the Mattracks Company in Karlstad, the option of baling material was not possible in the Parnell Flood Control Impoundment in 2014. However, a track-mounted CATERPILLAR machine with a mower was rented and a checkerboard pattern was created in a 50-acre plot at the Parnell Impoundment to present a study area for biological evaluation in 2015. Harvesting and baling of cattails was not completed at the Glacial Ridge National Wildlife Refuge due to the transition of managers but other control treatments were completed. Seven, large round bales are available however from a prior year at Glacial Ridge and will be used for demonstration pelleting. Herbicide spraying was completed at the Agassiz National Wildlife Refuge. Funds from other sources supported travel to evaluate harvesting and processing equipment for related biomass in Manitoba and New York in the fall of 2014.

Activity Status as of June 30, 2015:

No cattail harvest or management activities have occurred since the December 30, 2014 progress report but numerous discussions are occurring with members of the “collaborative” to identify more fruitful means of management under varying Minnesota conditions. An amendment request is being planned to reflect a slightly modified approach for management which involves harvest and utilization.

Activity Status as of December 30, 2015:

Numerous discussions were had over the summer of 2015 regarding the retrofitting of equipment to operate within the wet areas where cattails grow. At this point, a Bombardier trail-groomer seems the most promising as a power source since it has plenty of power (350 hp Cat diesel engine) and is mounted on tracks which can be up to 3 feet wide. It has hydraulic power at the front and back to run implements, however most conventional implements are run by PTO (power take off). The machine has clearance of only 12” which would be problematic in passing over swaths of mowed cattails since it would tend to mash them down and impede baling. What is needed is a modified disk-cutter or swather that can be adapted to run off hydraulics, deliver cut cattails to the side, so they are not flattened, and be able to operate with some snow cover. Also needed is a round baler mounted on tracks which can operate by hydraulics and not be impeded by some snow. Ideally, it would be advantageous to equip a “harvester” that could cut and bale in one pass for energy efficiency. I’m currently working with a local operator of a Bombardier reconditioning business who has expressed an interest in doing some customer retrofitting of machines to harvest cattails. During a dry fall, it is possible to harvest cattails in many situations with conventional farm equipment but it can be very difficult to locate a cooperater willing to take their machinery into wetland settings. Evaluation of equipment options is on-going in discussions with collaborators at the International Institute for Sustainable Development in Winnipeg, at Loyola University in Chicago, Illinois, and a private contractor in Utah.

I was able to find a local farmer willing to harvest cattails this fall in 2 wetland settings at the Glacial Ridge National Wildlife Refuge but they harvested in October before the wetlands had frozen and were limited by standing water limiting them to harvesting around edges rather than a checkerboard pattern over the entire marsh. Also, they had to work this harvesting in with their farming schedule. They had previously harvested cattails on Glacial Ridge in 2012 but did so in December when the substrate was more firm but snow caused belts to slip on their round baler. Sixty round bales of cattail were harvested and are in upland storage as I’m attempting to have a farmer cooperater pelletize them with a recently purchased machine. A local pellet stove manufacturer is willing to test burn cattail pellets when we get a sufficient supply. A student from the University of Minnesota, Crookston is conducting a Life Cycle Analysis of the use of cattails as a biofuel which is necessary to do a full cost accounting in evaluating the material as a viable energy source.

Final Report Summary:

It has been an interesting journey to develop a reliable system to harvest cattails in multiple settings and at different times of the year. Hopes were high to modify a Bombardier trail groomer to operate in soft conditions and equip it to power a baler by converting a hydraulic system on the Bombardier to a PTO system on a baler. However the owner decided that it could take too much of a commitment on his part and, due to a recent heart attack, he backed out. Areas where cattails grow can be challenging to work in and many would-be cooperators are cautious. In the course of the project, I've conducted numerous internet searches and talked to many agency and private entrepreneurs and have amassed considerable knowledge that is summarized in the resulting project booklet. I've collaborated extensively with Richard Grosshans the International Institute for Sustainable Development in Manitoba where they have developed cattail harvest at the commercial scale for biofuel use and nutrient recovery. I'm also working closely with Jeff Lewis and Aaron Ostlund of the Red River Basin Commission (RRBC) who are in year 2 of a 3-year LCCMR companion project looking at using cattails for water quality bioremediation and biofuel harvest. They can apply the findings of this project and the Canadian work. I've delivered 2 of the 60 cattail bales to a local farmer who has developed a pelletizing plant that he is presently using to process alfalfa hay into high quality, organic dairy cow feed. He has not been able to work in processing cattail bales to date since he is busy with farm work and trying to recover his investment of over \$ 300,000. Cattails need to be densified into pellets or cubes in order for test burning or co-firing in commercial or residential stoves. I've recently discussed the prospect of burning whole, large round bales with personnel at the University of Minnesota Morris. They have a large scale biomass burning heat plant that was designed to burn larger fuel packages, including bales. Some aspects of the follow-up work may be supported by Jeff Lewis of RRBC since the objectives are compatible. I've also been recently contacted by a private entrepreneur who is investigating starting a cattail harvesting business as a private contractor. I look forward to sharing my successes and short-comings with he and others.

There was a remaining balance of \$ 9,800 as a result of not being able to identify a cooperator willing to allow the modification of their machinery with power conversion (hydraulics to PTO) equipment and the attachment of tracks to a baler and/or a tractor. These funds will need to be returned to the LCCMR.

ACTIVITY 2:

Description: Biological monitoring (includes both vegetation and birds).

Monitor vegetation structure and wildlife, especially breeding wetland birds, in the 3 study settings during the 2014 season (before cattail manipulation) and the 2015 and 2016 field seasons (after management). Travel, meals and some lodging is included in the budget for this monitoring activity. The Minnesota Department of Natural Resources will provide bird monitoring assistance

Summary Budget Information for Activity 2: **ENRTF Budget:** \$ 46,400

Amount Spent: \$ 46,400

Balance: \$ 0

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
1. Vegetation and bird survey data will be collected before and after cattail harvest or control to measure effects of cattail manipulation by baling and by chemical application. Vegetation structure (height and density) along transects and breeding birds in sample plots will be recorded. The data and associated observations will be the outcome.	June 30, 2016	\$46,400 (Includes \$ 8,000 for associated travel.)

Activity Status as of December 30, 2014: Vegetation and bird survey data were collected and summarized for all 3 study sites in the pre-treatment condition. Bird data collected by the MN DNR at the Glacial Ridge National Wildlife Refuge in 2013 were made available to this study but they did not assist in 2014; data were collected solely by project personnel.

Activity Status as of June 30, 2015: Biological data continue to be collected at this reporting date. Preliminary effects data are inconclusive at this time but progress reports were presented at the North Dakota Chapter of The Wildlife Society annual conference in February, informal reporting meeting of the North Ottawa Project in Breckenridge, MN in March, Heating the Midwest with Biomass Conference in Rochester, MN, and Loyola University biomass working group meeting in Chicago in June. Results will be posted on U of MN web sites. Josh Bruggman, principal researcher on the project will use the data as part of a Master's degree program at the University of North Dakota under the co-advisorship of Dr. Dan Svedarsky and Dr. Susan Felege.

Activity Status as of December 30, 2015:

A second field season of biological monitoring was completed by Josh Bruggman and his field assistant in 2016. Field data are currently being more thoroughly evaluated by Bruggman as part of his graduate studies at the University of North Dakota. A 3rd field season will be conducted in 2016 and additional funding will be sought to extend beyond the 30 June 2016 completion date of LCCMR funding in order to support a more complete analysis of findings.

Final Report Summary:

A third field season of biological data have been collected at this writing (August 8, 2016). Supplemental grant funds were obtained to support field personnel in the month of July and the first week of August in 2016. These findings have been shared with other land and water managers and biologists at many technical conferences and workshops as well as summarized in the resulting project booklet. The data will provide the basis for a Master's thesis for the principal researcher, Josh Bruggeman, at the University of North Dakota.

ACTIVITY 3:

Description: Outreach publication

Conduct extensive literature review, interview land managers and equipment operators, take photos, and work with publication and media personnel. Develop an illustrated informational booklet and a CD version that describes wetland wildlife values of cattail management/harvest and as a concurrent source of bioenergy. This will inform user groups, students, and policy makers. Electronic copies of the publication and a video clip summary will also be developed for distribution on the web sites of the University of Minnesota's Northwest

Research and Outreach Center and the U of MN – Crookston Center for Sustainability. Electronic copies will allow updating of content as new information is gathered.

Summary Budget Information for Activity 3: ENRTF Budget: \$ 5,000

Amount Spent: \$ 5,000

Balance: \$ 0

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
1. Produce 300 copies of the publication and 100 CD's for free distribution at informational meeting, industry groups, and college classes. Publications and other information will be available on web sites.	August 10, 2016	5,000

Activity Status as of December 30, 2014: Internet searches and correspondence with other collaborators continue. This background information (publications, progress reports) will be posted on the project web site and used as resources for the outreach publication.

Activity Status as of June 30, 2015:

Literature review and various informational resources continue to be assembled and will be presented as an electronic resource library on the web site of the U of MN Northwest Research and Outreach Center.

Activity Status as of December 30, 2015:

A part-time research assistant was hired to complete a draft copy of a 19-page illustrated booklet entitled, *Cattail management and uses*. After editing, this will be posted on the web site of the Northwest Research and Outreach Center in January 2016 and will serve as an illustrated progress report to be added to as more data are collected.

Final Report Summary:

An attractive, 52-page booklet (http://files.knightprinting.com/502492_Cover_kp3.pdf) is at the printers and will be widely distributed to land and water managers. Due to cost, the number of copies was revised from 300 to 200. Also, the proposal to product 100 CD's was dropped in favor of making an electronic copy available on the Northwest Research and Outreach Center and the U of MN's Center for Sustainability websites. Many practitioners prefer downloading a pdf copy of research bulletins and papers.

V. DISSEMINATION:

Description: Progress reports will be dissemination through the project website hosted by the Center for Sustainability and the Northwest Research and Outreach Center of the U of MN, oral presentations at wildlife and biomass conference, technical papers within wildlife and biomass journals/publications, U of MN's Clean Energy Resource Teams (CERTS) meetings, and the resulting informational booklet that will be available in hard copy as well as electronically.

Activity Status as of December 30, 2014: Summary reports of vegetation, birds, and amphibians were distributed to agency cooperators and will be posted on the web site of the Northwest Research and Outreach Center and the Center for Sustainability of the University of Minnesota, Crookston. A Cattail Summit was hosted on the Crookston campus on 2 December 2014 involving collaborators from the International Institute for Sustainable Development in Winnipeg, University of North Dakota, Red River Basin Commission, Agricultural Utilization Research Institute, and the Hudson Valley Grass Energy Cooperative in Kingston, NY. A progress report will be presented at the annual meeting of the North Dakota Chapter of The Wildlife Society on 11 February 2015. A proposal for a progress report paper will be submitted for the International Wildlife Management Congress in Sapporo, Japan scheduled for July of 2015 (Travel funds to be identified from other sources)

Activity Status as of June 30, 2015:

The activities summarized on December 30, 2014 are on-going and a group head-quartered at Loyola University has been added which includes collaborators from the Great Lakes region. The proposed progress report for Japan was accepted and Svedarsky will be presenting and moderating a session.

Activity Status as of December 30, 2015:

Travel funding, other than LCCMR, was obtained to present preliminary results at the International Wildlife Management Congress in Sapporo, Japan in July and also at a symposium on Renewable Energy and Wildlife at the national meeting of The Wildlife Society in Winnipeg. Abstracts of the preceding conferences are available electronically. An upcoming international conference in February is slated for Winnipeg and will focus on the broad spectrum of cattail management and uses. Svedarsky has been invited to speak at this conference which will feature European researchers as well as from the U. S. and Canada. Funding other than LCCMR will support this travel.

Final Report Summary:

Cattail and other resources on biofuels and sustainability are posted on the U of MN Crookston Center for Sustainability web page under "Reports and Resources." <https://www.crk.umn.edu/units/center-sustainability>. Cattail resources are similarly posted under the U of MN's Northwest Research and Outreach Center web site under <http://www.nwroc.umn.edu/research/wildlife-management-biofuels>. A list serv of wetland and sustainability researchers and managers has been established as part of a planning meeting at Loyola University in the summer of 2015. This allows the sharing of information and possible project collaboration. By engaging 12 co-authors in the informational booklet, this not only ensured a broad representation of information but instilled a broad sense of ownership in the information that will be shared with other constituencies. Technical papers will be published based on the biological data collected. A number of technical presentations have been given to a wide range of groups.

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	\$ Amount	Explanation
Personnel:	\$ 38,000	These funds were fully expended along with supplemental funds procured from other

		sources to complete the collection of 3 field seasons of data. These data were summarized in the project booklet and will provide the basis of a Master's thesis at the University of North Dakota.
Professional/Technical/Service Contracts:	\$ 22,600	Due to the difficulty in obtaining commitments from equipment cooperators, no modifications were made to machines. Instead, study areas were mowed with rented track-mounted equipment and custom harvesting of cattails bales was carried out. An unspent balance of \$ 9,800 remained.
Equipment/Tools/Supplies:	\$ 400	Flagging, field markers, notebooks, miscellaneous tools, waders.
Printing:	\$ 5,000	The production of a booklet was modified to produce only 200 hard copies instead of 300 and no CD's since the latter are not in vogue these days. An electronic pdf copy will be widely circulated.
Travel Expenses in MN:	\$ 8,000	For data collection to and from study areas; travel to in-state conferences and seminars to present finding to other land managers; and coordinating meetings with agencies and contractors. An unspent balance of \$ 1,239 remained from the travel budget.
TOTAL ENRTF BUDGET:	\$ 74,000	Not all of these funds were expended due to unforeseen circumstances leaving a balance of \$ 11,039 (\$ 9,800 + \$ 1,239)

Explanation of Use of Classified Staff: NA

Explanation of Capital Expenditures Greater Than \$5,000: NA

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 1.5 FTEs

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: NA

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
State			
NW Research and Outreach Center, U of MN; MN DNR		\$ 20,000	Project manager salary, use of vehicle and ATV. In-kind. MN DNR assisting with biological monitoring. In-kind.
Red Lake Watershed District		\$ 9,250*	Out of state travel and field work in May and June of 2014 and 2015.
Grant funds to NW Research and Outreach Center for field researcher support		\$ 4,000*	Out of state travel and field work in July and August of 2016.
TOTAL OTHER FUNDS:		\$ 33,250	

* These funds were used to support field work prior to or after the LCCMR funds became available on 1 July 2014 until 30 June 2016 and out of state travel not covered by LCCMR.

VII. PROJECT STRATEGY:**A. Project Partners:**

*Dr. Vanessa Lane (and one student assistant/ year), Ornithologist, U of MN, Crookston. Vegetation and bird monitoring. 2014 Season.

Josh Bruggeman, Graduate Student, U of North Dakota, Grand Forks.

*Northwest Research and Outreach Center and U of MN-Crookston, U of MN. Project coordination office space, equipment maintenance, and vehicle loans.

Knight Printing, Fargo, ND

Trina Brennan and Jessica Dowler, Glacial Ridge NWR. Study site coordination and bird monitoring. In-kind.

Emily Hutchins and Dave Rave, MN DNR. Study site coordination and bird monitoring. In-kind.

Gregg Knutsen, Biologist, Agassiz NWR and later, Manager, Glacial Ridge NWR. Study site coordination. In-kind.

* *Received money from this request.*

B. Project Impact and Long-term Strategy:

BACKGROUND. The U of MN's Northwest Research and Outreach Center (NWROC) sought to assess the extent of larger expanses of cattail cover in northwest Minnesota and evaluate their potential for concurrent bioenergy harvest and wetland management. Cattails are a major problem because of their growth in many areas in excess of the 50:50 ratio of emergent vegetation (cattails and bulrushes) to open water desired for optimum wetland wildlife habitat. If effective methods of cattail harvest and fuelstock preparation can be developed in concert with appropriate combustion facilities, this initiative could result in win-win projects; cattails could be removed

for wildlife benefits while generating a fuel product. In recent years, Richard Grosshans and colleagues at the International Institute for Sustainable Development (IISD) in Winnipeg, Manitoba have harvested cattails in the Netley-Libeau Marsh at the south end of Lake Winnipeg. Their interests are to use cattails to capture nitrogen and phosphorus and reduce the eutrophication of Lake Winnipeg but also use it as an energy source followed by land application of the phosphorus-containing ash. The Canadian work was a major stimulus for this study and collaboration continues. In earlier studies we estimated the cattail coverage in the 10 counties of northwest Minnesota and found 95,498 acres of cattails in patches of at least 20 acres. These wetlands commonly produce over 8 tons of biomass per acre so the biomass potential is significant. The prevalent opinion of land managers was that cattails are too abundant for good wildlife habitat, are difficult and expensive to control, and information is needed for their integrated management. Most were encouraged by the prospect of developing cattail biofuel harvests and markets. In a pilot study, we ground cattails with a hammer mill borrowed from Northwest Manufacturing in Red Lake Falls. Pellets were made and tested at the Natural Resource Research Institute, in Duluth. The energy content of pellets was similar to wood, they produced slightly more ash when burned, and did not produce clinkers (a detrimental property sometimes associated with using certain biofuels). At least for northwest Minnesota, cattails do have many characteristics of an “ideal” sustainable energy source (Seth Fore, personal communication); 1. Available in large quantities, 2. Minimal production inputs, 3. Efficient conversion of raw inputs to energy outputs, 4. Distributed geographically, 5. Limited displacement of other goods and services (food vs. fuel), and 5. Small pollution footprint (greenhouse gases, etc...). Questions remain on items 3 and 5. This project will complement other biomass studies in northwest Minnesota and help fill an informational void. An inventory of biofuels from agricultural lands, prairie (native and restored), brushlands, and woodlands is relatively complete for northwest Minnesota that was co-funded by the Northwest Minnesota Foundation, but cattails were not evaluated in that study.

APPLICATIONS AND NEXT STEPS: We know the extent of cattails in northwest Minnesota and that pelletized cattails are an acceptable biofuel. Although cattails can be harvested with conventional farm equipment in a dry fall and in some wetlands, methods must be refined to permit harvesting and processing across a spectrum of conditions (topography, precipitation) to produce a predictable supply of biofuel product to satisfy a new market. Also, the energy content of the final product must be in favorable relationship to the total amount of energy used in harvesting, transporting, and processing (Life Cycle Analysis). Effects of partial cutting of cattails on wildlife in the Delta Marsh at the south end of Lake Manitoba had positive effects on waterfowl but no bird data have been collected in northwest Minnesota. Preliminary data to measure the response of vegetation and wetland wildlife to cattail management were collected in 2014 and set the stage for this project. If the results of this project show positive co-benefits to wildlife and biofuel, it could encourage the development of a niche biofuel industry by demonstrating supply potential. There are no biofuel processing facilities in northwest Minnesota due to an inadequate demand for pellets; you have to demonstrate dependable supply as a part of creating demand. Most pellets are currently coming from Wisconsin plants, which are running at around 50% capacity (Mark Lindquist, MN DNR. Personal communication, April 2013). Such a plant could possibly be located in Red Lake Falls at Northwest Manufacturing. They currently produce wood stoves and buy pellets from Wisconsin at \$ 150-200 per ton delivered. Depending on the characteristics, pellets could be sold to Northwest Manufacturing’s current stove customers. If pellets could be made at a reasonable price, it would save Northwest Manufacturing and their customers’ money, especially in rural setting where there is a reliance on propane. There is also an initiative to develop a biomass torrefaction plant in northwest Minnesota led by American Agri-Energy and the Agricultural Utilization Research Institute (AURI). Such a plant might use a variety of feedstocks; cattails, willow, aspen, and ag residues, but methods of harvest must be demonstrated. These proposed plants could be centrally located between Crookston and Thief River Falls and could process biomass from the Glacial Ridge and Agassiz National Wildlife Refuges, as well as state wildlife management areas and flood control impoundments. Also, a substantial acreage of cattail wetlands are within 30 miles of the University

of Minnesota-Crookston campus which currently burns coal in its heating plant that was retrofitted to receive coal by semi-trucks. A feasibility study indicated that existing boilers could accommodate biofuel to supplement coal. The Glacial Ridge NWR is only 10 miles from campus and contains 3,068 acres of shallow, restored wetlands, which are rapidly being overtaken by cattails. The demonstration value of a land grant university partnering with agencies in a biofuel project as described here could have regional and national significance for practical applications.

Major project impacts include:

1. By evaluating the efficiency of cattail harvest methods in a variety of settings, we will be able to helpfully provide co-benefits; enhance wetland wildlife habitat at a reasonable rate, produce and use a novel biofuel resource, and help control an invasive plant.
2. By monitoring the response of vegetation and birds to cattail harvest methods, we will be able to develop and recommend best practices to apply these techniques.
3. By disseminating the results of this project, public land managers, students, industry representatives, and rural communities can be informed of findings; this will enhance Minnesota’s wetland wildlife resources, use a renewable biofuel, and possibly stimulate economic development.

C. Spending History:

Funding Source	M.L. 2008 or FY09	M.L. 2009 or FY10	M.L. 2010 or FY11
U of MN CERTS		4,000	
NW Minnesota Foundation			21,570
U of MN, IREE			6,934
Lessard-Sams Outdoor Heritage Council funds for cattail management using equipment and herbicides at Glacial Ridge NWR and Agassiz NWR; ~ 100K.			100,000
TOTAL		4,000	128,504

VIII. ACQUISITION/RESTORATION LIST: NA

IX. VISUAL ELEMENT or MAP(S):

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: NA

XI. RESEARCH ADDENDUM:

XII. REPORTING REQUIREMENTS:



SVEDARSKY VISUAL FOR CATTAIL MANAGEMENT FOR WETLAND WILDLIFE AND BIOENERGY # 163-F

FINAL. ATTACHMENT A.: Budget Detail for M.L. 2014 Environment and Natural Resources Trust Fund Projects.

**FINAL ATTACHMENT A : BUDGET DETAIL FOR
Environment and Natural Resources Trust Fund**



M.L. 2014 Project Budget

Project Title: Cattail management for wetland wildlife and bioenergy potential.

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 06i

Project Manager: Dan Svedarsky

Organization: Northwest Research and Outreach Center, U of MN

M.L. 2014 ENRTF Appropriation: \$ 74,000

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Act 1 Budget	Amount Spent	Act 1 Balance	Act 2 Budget	Amount Spent	Act 2 Balance	Act 3 Budget	Amount Spent	Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	<i>Cattail Management and</i>			<i>Biological Monitoring</i>			<i>Outreach Publication</i>				
Personnel (Wages and Benefits)				\$38,000	\$38,000	\$0				\$38,000	\$0
<i>Josh Bruggman, Research coordinator: \$ 23,000 (66.4% Field technician. 20% FTE for 2 1/2 years. \$ 15,000 (63.2</i>											
Professional/Technical/Service Contracts											
Matracks Inc. Contract to harvest 50 acres of a wetland with track equipped bi-directional tractor. Rent set of tracks to equip baler of large round bales.	\$7,600	\$7,600	\$0							\$7,600	\$0
Rental of swather, front end loader, and round baler from undetermined implement dealer	\$5,000	\$5,000	\$0							\$5,000	\$0
Equipment fabrication and modification. A swather will be adapted to be attached to the rented tractor and may require some welding and modification. Tracks will be attached to a rented round baler.	\$6,000	\$0	\$6,000							\$6,000	\$6,000
Equipment moving costs. Move Matracks equipment from Karlstad to flood control impoundment harvest sites. Removal of bales from wetland. Move rented baler and swather to project site and to a machine shop where modifications can be completed.	\$4,000	\$200	\$3,800							\$4,000	\$3,800
Equipment/Tools/Supplies Field supplies; notebooks, flagging, stakes, waders, miscellaneous tools.				\$400	\$400	\$0				\$400	\$0
Printing (Production setup and formatting, printing of 300 hard copies)							\$5,000	\$5,000	\$0	\$5,000	\$0
Travel expenses in Minnesota Mileage, lodging, meals to and from study sites, conferences, and coordinating visits with equipment providers.				\$8,000	\$6,761	\$1,239				\$8,000	\$1,239
COLUMN TOTAL	\$22,600	\$12,800	\$9,800	\$46,400	\$45,161	\$1,239	\$5,000	\$5,000	\$3,000	\$74,000	\$11,039