From: "Chris Holm" <cholm@rangenet.com>
To: "Susan Thornton" <susan.thornton@daneel.commission...
Date: Fri, Oct 6, 2000 6:28 PM
Subject: Re: 1997 LCMR Project Control of Noxious Weeds in Native Wild RiceLakes

20(c)

10/6/00
Susan:

Actually, we did and are continuing to proceed with the project, but we are not requesting reimbursement for any of the expenditures.

We carried out field collection portions of the project, constructed the laboratory facility and rearing chambers for the experiments, developed the water supply from Nett Lake to the lab for experiment purposes, raised rice in the lab under controlled conditions in preparation for the experiments, did the weed survey portion of the workplan, and archived the samples for nutrient analysis as called for in the workplan. We did this with our internal funding, and considered it our match contribution. We spent approximately $60,000.00 of our own funds to do this.

CANCELED

Our hitch was that we could not collect enough insects to do the experiment as designed (n = 120 chambers, with replicates, each chamber with at least one insect). After considerable effort, we collected two dozen adult insects, which subsequently ate down our reserved stocks of feed plants over winter and then died. In three years, and with numerous collection trips, we have not collected anywhere near the number of insects necessary for a statistically valid study. We did not ask for reimbursement for expenses from LCMR because much background (preliminary) work not defined in the workplan needed to be done first, and I knew that if it was not in the workplan it would not be reimbursed.

This sums up the events of that project. We are continuing to develop the project at our own pace, as time and resources permit.

I will be out of town between October 9-October 16, but will be happy to talk to you more about this when I return if you wish.
Thanks, Susan

Chris Holm

----- Original Message -----
From: Susan Thornton <susan.thornton@commissions.leg.state.mn.us>
To: <cholm@rangenet.com>
Cc: <wendy.Crowell@dnr.state.mn.us>
Sent: Friday, October 06, 2000 4:30 PM
Subject: 1997 LCMR Project Control of Noxious Weeds in Native Wild RiceLakes

> Chris, LCMR and DNR need to close out the 1997 appropriation for ML 97, Chap. 216, Sec. 15, Subd. 20(c) which was available until June 30, 2000. In previous correspondence and conversations it was our understanding that you did not anticipate expending any of these funds and were concentrating on the 1999 appropriation.
>

> Please respond ASAP about the status of the work and any obligations outstanding for the 1997 appropriation. A brief email response is sufficient stating that you did not proceed with the project and expenditures if that is that case.
> Thanks,
> Susan Thornton
>

From: "Chris Holm" <cholm@rangenet.com>
To: "Susan Thornton" <susan.thornton@daneel.commission...
Date: Mon, Jan 31, 2000 4:04 PM

1/31/00
Susan Thornton:
Please find requested Bois Forte Project report for weed control attached.

Chris Holm

Date of Report: January 31, 2000
Date of Next Status Report: June, 2000
Project Completion Date: June 30, 2000
LCMR Work Program 1997

1. PROJECT TITLE: CONTROL OF NUISANCE WEEDS IN NATIVE WILD RICE LAKES (P-5)

Project Manager: Christopher E. Holm
Affiliation: Reservation Biologist, Bois Forte Band of Chippewa
Mailing Address: 5344 Lakeshore Drive, P.O. Box 16, Nett Lake, MN 55772
Telephone Number: (218) 757-3261
FAX: (218) 757-3607
Email: cholm@rangenet.com
Website: www.BoisForte.com

Total biennial project budget:

$LCMR:	100,000.00	$Match:	100,000.00
-$LCMR Spent:	0.00	-$Match Spent:	57,000.00
=LCMR Balance:	100,000.00	=$Match Balance:	43,000.00

A. Legal Citation: ML97, Chap. 216, Sec. 15, Subd. 20(c)

Appropriation Language: This appropriation is from the future resources fund to the commissioner of natural resources for an agreement with the Bois Forte Reservation for a Nett Lake biocontrol study to remove exotic and nuisance weeds from a wild rice lake. Any release of organisms must be in compliance with state and federal permits. This appropriation must be matched by at least $100,000.00 of non-state money. This appropriation is available until June 30, 2000, at which time the project must be completed and final products delivered, unless an earlier date is specified in the work program.

Note regarding revision of appropriation language: Reviewer comments and current funding levels for this project demand substantial revision of this work plan. These revisions have been made and are contained in the work plan. Revision includes removal of field study components related to enclosure construction, placement and weevil introductions in to Nett Lake. Field components of this study related to collection of plants and insects for laboratory evaluations are retained in the plan. Appropriation language has not been changed and reflects the scope of the current work plan.

Status of Match Requirement:
Project match requirement of $100,000.00 was met prior to start of the current grant period. Matching funds were contributed by the Bois Forte Reservation Tribal Council, the U.S. Environmental Protection Agency, and the Department of Interior, Bureau of Indian Affairs. To date, all funds expended on the project have been matching funds. No

draw-down requests for state funds have been made. Approximately $57,000.00 in available match funds have been expended on the project.

Project Summary:
The primary goal of this study is to statistically define the magnitude of impact to wild rice that might reasonably occur if germinating wild rice plants are offered alone or in combination with other aquatic plants to *Euhrychiopsis lecontei*, a species of aquatic weevil. Objectives to be accomplished to achieve the primary goal include the following: **1.** Identify existing plant types and densities in Nett Lake; **2.** Collect test organisms (plants and weevils) under controlled laboratory conditions and promote increased numbers of test specimens to necessary levels for testing purposes; **3.** Develop a dedicated culture room facility to support test specimens and testing equipment; **4.** Conduct feeding and oviposition experiments; conduct statistical evaluation and **5.** Develop technical manuscripts. We have completed preliminary project objectives since January 1999. ~~As indicated in the previous progress report,~~ Unavoidable administrative delays postponed start of two project objectives until April 1998. These objectives (weed surveys and laboratory culture room construction) have ~~since~~ been accomplished. Specific results and accomplishments of the project are provided as follows.

Outline of Project Results:
Result 1: Preliminary estimate of Nett lake plant diversity, density and nutrient composition.
We carried out a comprehensive survey of plant species and plant population distribution in Nett Lake during summer 1998. Plant survey data was confirmed with additional field surveys in summer 1999. We compiled a plant species list that may be viewed on our project internet web site (www.BoisForte.com). Representative plant specimens ~~have been~~ were preserved for future taxonomic reference. We have developed a GIS site map showing plant species distribution ~~collection site locations~~. ~~We preserved representative specimens of each plant collected for future taxonomic verification.~~ Individual plant species samples ~~have been collected~~, were dried, ~~and~~ ground in a Wiley Mill, and are currently being analyzed for total Kjeldahl; nitrogrn (TKN) and total phosphorous.~~for nutrient analyses~~. Split samples of each plant species collected are also presently ~~awaiting for TKN and total phosphorous by our laboratory and~~ being analyzed for these parameters as well as form heavy metals of concern (i.e. lead and arsenic) by an independent, contracting laboratory. Nutrient and metal content of major plant species present in Nett Lake will be complete by May ~~spring~~ 2000.

LCMR Budget:	**$28,000.00**	**Balance:**	**$28,000.00**
Match Budget:	**$25,000.00**	**Balance:**	**$ 3,000.00**

Completion date: June, 2000

Result 2: Collection of Euhrychiopsis lecontei (aquatic weevils).
We collected *Euhrychiopsis lecontei* and northern watermilfoil from Gull Lake, (Brainerd, Minnesota) in summer 1998 and summer 1999. We collected ~~insects~~ adult weevils during each of three separate collection trips in each collection season. Collections were made by wading inspection of plants and through use of SCUBA. We focused collection efforts ~~attention~~ on the south Steamboat Bay area of Gull Lake ~~for~~

~~collection trips made~~ in 1998 and 1999. In 1998 we collected a total of 35 adult weevils. These were subsequently transported to rearing tanks designed for this purpose, located at our Nett Lake lab facility. In 1999, a total of 14 adult weevils were collected. ~~fewer weevils were collected Although milfoil plants were abundant in 1999, few weevils were found and collected~~ During both 1998 and 1999 field seasons, watermilfoil plants with intact root systems were also collected and transported to 118-gallon lab stock tanks. ~~in 1998 and 1999.~~ These were subsequently re-planted in aerated. ~~, 118-gallon stock tanks.~~ In 1999, when low numbers of weevils were detected in established collection zones, we made ancillary collection trips ~~were made~~ to the north Steamboat Bay-section of Gull lake near Squaw Point. ~~We collected approximately three dozen mature weevils at this location in 1998, but only one dozen in 1999. Weevils and watermilfoil plants were re-established in stock tanks maintained at our laboratory and greenhouse. A third trip collection visit to the Squaw Point sample location in September 1999 produced on weevils.~~ Cool~~ing~~ weather conditions prevailing throughout 1999 summer months and at times of collection ~~may have~~ probably prompted lower weevil population numbers and may have induced ~~insects~~ adult weevils to leave the lake and begin over-wintering life stages earlier than typically observed. We will make make two (2) additional collection trips to Gull Lake sample locations in May and June, 2000.

LCMR Budget:	**$18,000.00**	**Balance:**	**$18,000.00**
Match Budget:	**$18,000.00**	**Balance:**	**$ 2,000.00**

Completion date: ~~**September, 1998**~~ **June 2000**

~~**Note:** made additional specimen collections in FY 1999 and will make future collections in summer 2000.~~

Result 3: Colonization culture of aquatic plants, germination of wild rice, and rearing of *E. lecontei* under controlled laboratory conditions.

We colonized laboratory stock-tanks with watermilfoil and weevils. Tanks are 118-gallon galvanized livestock tanks. Tanks are inoculated with autoclaved Nett Lake sediment, aerated, illuminated on a 15:9 light:dark cycle, and maintained at ambient greenhouse air temperature (75.0 degrees F). Tank water is pumped approximately 1000 feet from a well adjacent to the Nett Lake shoreline. Water from the pumped well is charged in a pressure tank and delivered to stock tanks and culture chambers under pressure and at a maximum flow-rate of ~~2~~ 1.0 gallons/minute. Analyzed characteristics of well water (*i.e.*, pH, alkalinity), indicate that it is similar in composition to Nett Lake surface water. Water pumped from the well is colder and less tannin-colored than surface water of Nett Lake. Weevils were introduced to transferred milfoil plants established in laboratory stock tanks. Weevils tended ~~tend~~ to feed heavily on available watermilfoil, and ~~will rapidly~~ depleted available plants faster than the plants can could propagate. All watermilfoil collected in 1998 was consumed by December of that year. Weevils then ~~apparently~~ died or left the confines of the stock tanks to enter ~~entered~~ terrestrial over-wintering phases. This unanticipated result ~~event caused us to~~ consideration of methods to allow faster propagation of milfoil plants. In 1999 We reserved two stock tanks dedicated solely to plant propagation. A third ~~remaining~~ stock tank ~~is presently used~~ was established for use as food reserves for available insects. ~~We are currently attempting to increase insect stock through laboratory propagation.~~ This unanticipated process is necessary since wild stocks of insects and milfoil ~~was~~ were unavailable in 1999 in substantial amounts necessary ~~and~~

~~because current~~ ~~stock levels fall short of that needed~~ to run bioassay testing procedures. In 1999 we ~~are~~ additionally ~~attempting~~ attempted to increase plant stock production through rooting hormone stimulation of watermilfoil plant cuttings, and by differential fertilization of stock tank water. ~~Although the latter~~ Fertilization methods as a means to enhance milfoil production was not included as an objective in the original grant proposal, but we find this preliminary step necessary in order to ensure that adequate biological material is available for future bioassay work.

A total of 90 culture tubes ~~totaling135 in number~~ are presently constructed and plumbed to the lake water inflow line. Pressure and flow-rates are standardized to allow suitable flow-through aeration conditions in the chambers (0.5-0.8 gal/minute). Fluorescent lighting is provided on a 15:9 light:dark cycle. Chamber water temperatures are maintained at ambient culture room temperature (75 degrees F.).

We successfully germinated wild rice seed in plant stock ~~growth~~ tanks, although germination rate is not consistent. We ~~are presently~~ monitor~~ing~~ pH and temperature of seed germination tank water on a daily basis. Average optimum germination pH appears ~~to be~~ is slightly alkaline (8.0-8.5); optimum water temperature is 50.0 degrees F. Individual plant length is measured on a daily basis. Degree-day data is collected for future use in a wild rice germination and production model. Seed tanks are maintained with a 15:9 light: dark cycle, and a constant greenhouse air temperature of 75 degrees F. After germinated rice seedlings have produced at least two sets of true leaves, plants are transferred to culture tubes to encourage growth to the floating-leaf stage. We will continue monitoring programs and germination studies after official end date of the project. ~~Preliminary data on growth, germination and stock replenishment must be defined prior to start of bioassay procedures,~~

LCMR Budget: **$18,500.00** **Balance:** **$ 18,500.00**
Match Budget: **$19,000.00** **Balance:** **$ 0**
Completion date: ~~**March, 1998**~~ **June 2000**
~~**Note:** we will continue monitoring and germination studies after official end date of the project. Preliminary data on growth, germination and stock replenishment must be defined prior to start of bioassay procedures,~~

Result 4: Weevil introduction and feeding experiments.
Additional insect and plant collection and rearing must be accomplished to ensure suitable numbers of test organisms to complete evaluations of feeding and oviposition. We intend to continue bioassay testing after official project end, and after preliminary monitoring and germination studies are completed in FY 2000.

LCMR Budget: **$23,500.00** **Balance:** **$23,500.00**
Match Budget: **$20,000.00** **Balance:** **$ 20,000.00**
Completion date: ~~**November, 1999**~~ **June 2000**
~~**Note:** We intend to continue bioassay testing after official project end, and after preliminary monitoring and germination studies are completed in FY 2000.~~

Result 5: Statistical evaluation of feeding impacts to germinating rice and other aquatic plants.

Statistical evaluations of collected data will occur after culture tube bioassays in summer 2000.

LCMR Budget:	**$12,000.00**	**Balance:**	**$12,000.00**
Match Budget:	**$18,000.00**	**Balance:**	**$ 17,900.00**

Completion date: June 2000

Status of Deliverable Items:

Result 1. A GIS map showing plant collection sites is available to the public through the internet web site. Additional information will be included as this becomes available in 2000. A species list of all plants found in Nett Lake was prepared and is available for view on the internet web site.

Result 2. Detailed documentation of three site collection visits to Gull Lake, Minnesota in summer 1998 and 1999 is available. Additional site details for this lake and other lakes, as well as plant nutrient data, will be available on-line in June 2000. Detailed documentation of collection protocols has been defined. This information will become available on the internet web site in 2000. Insect and plant collections were performed as specified in 1998 and 1999. Additional collections will occur in 2000. Specimens collected will be appropriately preserved for future taxonomic identification.

Result 3. We will continue plant colonization and insect rearing studies in 2000. Such preliminary studies, while not addressed in the original work proposal, are essential in order to successfully manage test specimen numbers suitable for future bio-control studies.

Result 4. We intend to ~~begin~~ complete one full feeding/oviposition study cycle by June 2000, if suitable numbers of adult insects and milfoil plants are available. ~~feeding/oviposition observations in spring 2000 if available plant and insect stock specimens are available~~

Result 5. We ~~anticipate th~~at will complete statistical evaluation of any collected data ~~will be completed~~ in June, 2000.

V. Dissemination:

~~The Bois Forte Reservation will gain internet capability early in 1997. Once accomplished, the Bois Forte Department of Natural Resources will create a web site for public dissemination of this information.~~ A website has been developed and is maintained by the Bois Forte DNR. Related LCMR project information now appears on that website. The website html is: www.BoisForte.com. We will also develop and submit one or more manuscripts describing this research to technical journals for review and publication in June 2000, pending the availability of test specimens to allow completion of biocontrol assays.

VI. Context:

Significance: This project addresses an immediate need to research and define safe, biological alternatives to protect and preserve Minnesota's wild rice resource. It is

believed that over 50% of historical rice lakes yield in Minnesota ~~no longer produce measurable amounts of this product~~ is now lost. (David Biesboer, University of Minnesota, *personal communication*). Reasons for decline vary, but inevitably include inadequate water level management, pollution, ~~and~~ sediment deposition through non-point source discharges, and land-use changes that have indirect effects on water quality through alteration of natural animal and plant communities. Sediment deposition and inadequate water level management directly influence ~~perennial submersed weed colonization and infestation~~ the presence of persistent, perennial submersed weeds. Once established, submersed wed growth substantially alters sunlight penetration and temperature regimes in the lake sediments. This leads to poor rice germination and growth. Our proposal defines methods to safely address preliminary questions regarding this biocontrol agents' ability to effectively and economically reduce competing weed populations in rice lakes without substantial mechanical or chemical intervention. An abundance of indigenous weevils in Minnesota lakes makes this a potential cost-effective management alternative suitable for use in wild rice lakes across the region. This alternative is not invasive, and may be used concurrently with other land-based restoration techniques to successfully ~~restore~~ enhance production in low-yielding ~~damaged~~ wild rice lake ecosystems. Finally, this study is unique in that use of this weevil species has not been proposed in conjunction with wild rice ~~agriculture~~ agronomic studies.

Time: This proposal relates objectives that will be completed between July 1997 and June 2000. Time frames for each component of the project are also identified in the timetable attached to this work plan. Future funding for additional phases of this research will be sought as local and state priorities warrant.

Budget Context: Bois Forte's current project funding level ($200,000.00) includes $100,000.00 in LCMR funding with a requisite non-state match of $100,000.00. Description of the current status of the match is contained in section 1(B) of this work plan. ~~In-kind facility use is anticipated from the University of St. Thomas, St. Paul, MN;~~ In kind labor assistance will be obtained from the Federal AmeriCorps Program; and in-kind technical assistance can be obtained from the Natural Resources Conservation Service, the 1854 Authority and the University of Minnesota. Current and proposed future expenditures for the project are contained in table 1 below. No allocated LCMR funds have been drawn down for use on the project at this time. Bois Forte has invested approximately $ 56,000.00 in matching funds on various aspects of the project. Match fund expenditures are shown by line item in table 3. We anticipate expending an additional $80,000.00 of Bois Forte internal funding in 2000-2002 on project objectives after formal close of the project in June 2000.

Table 1. Past and Anticipated Project Expenditures. 1997-2000

July 1995- June 1997	July 1997- June 2000	July 2000- June 2002
Prior Expenses	**Current Expenses**	**Anticipated Expenses**

1. LCMR	$0.00	$100,000.00	$0.00
2. Other State	$0.00	$0.00	$0.00
3. Non-State-cash	$0.00	$100,000.00	$80,000.00

Table 2. Allocated LCMR Funds by Line Item

Personnel:	$ 27,106.47
Equipment:	$ 52,462.50
Acquisition:	$ -0-
Development:	$ 20,431.03

Table 3. Matching fund expenditures by line item, 1997-present

Personnel:	$29,875.00
Equipment:	$27,125.00
Acquisition:	$ -0-
Development:	$ -0-

Budget Justification

~~A detailed budget describing expenditures with LCMR grant funds is attached as an appendix to this report.~~ No LCMR-appropriations have been expended to date for objectives of this project. Expenditures to date have been from matching fund allocations. We anticipate expending approximately $20,000.00 of LCMR appropriations during the remaining time of the project. Funds will be expended for field personnel salary, fringe and travel associated with field collections, as well as for laboratory assessments and contractual laboratory fees associated with processing of collected plant materials.

"Personnel" line item includes partial costs incurred for salary and fringe for one technical PTE employee during the project period.

"Equipment" line item includes partial costs incurred for purchase of relevant laboratory equipment for this project including: one ashing/combustion oven for analysis of plant carbon content ($2,895.00); one analytic balance for gravimetric analysis of plant dry weight, ash weight, and carbon content ($3,490.00); hardware, pipe and construction material necessary to construct replicate propagation and feeding chamber assemblages and culture room accommodations ($3,400.00); one dissecting microscope with illuminator assembly, camera attachment and camera ($4,500.00); one Pentium model computer with a relevant hard disk data storage capacity, modem, cables, monitor, and printer ($4,300.00); on Kjeldahl nitrogen digestion block unit ($3,500.00); one ventilation fan assembly ($150.00); one thermostatically-controlled heating/cooling assembly unit ($250.00); three (3) dissolved oxygen/temperature probe junction boxes capable of handling a total load of 10 DO/temperature probes ($2,500.00); florescent light tubes apparatus ($180.00); grow-lights($250.00); one pressure pump ($8,700.00); two thermostat timer/controller units ($100.00); one reagent-grade water purification/filtration system ($4,100.00).

INCLUSION OF EQUIPMENT LANGUAGE: Several equipment items necessary for completion of this project will be purchases at a cost of at least $3,500.00. These equipment items will be used specifically for this project. This equipment will be used by the same Bois Forte program throughout its useful life for ongoing water quality analysis procedures and ecological studies to be carried out on the Bois Forte Reservation. If the use changes, Bois Forte will pay back the Fund an amount equal to either the cash value received or a residual value approved by the Director of the LCMR if it is not sold.

"Supplies" line items include software pertinent for this study (e.g., *Lotus* spreadsheet, Axum graphic package; *d-base* processor, *Statistix* or other relevant statistical package ($1,200.00); 2" poly pipe, 110 yards, with associated connection hardware ($247.50); laboratory reagents, laboratory maintenance equipment and aquaria ($3,100.00); PVC pipe, 4" diameter and hardware for culture tube construction ($1,200.00); taxonomic literature ($200.00); culture room construction materials and hardware ($2,200.00)

"Other" category includes anticipated local travel expenditures incurred for field collections ($2,225.00) and research visits to partner facilities and libraries (3,000.00) during the project period; communications costs such as telephone/fax/modem charges and disposal office supplies (i.e. paper, pens, computer diskettes, etc.) ($1,800.00), and vehicle maintenance costs (1,100.00). Also included are contractual costs for quality control analysis performed by ventilation installation in the culture room ($2,500.00); contractual costs associated with purchase or rental of necessary field equipment for plant survey and biological specimen collection (800.00); statistical consultation (2,200.00); web site consultation and development (300.00); and indirect costs at a rate of 28.5% on all line items except equipment and contractual (12,306.03).

Total	100,000

VII: COOPERATION:

The following organizations have agreed to provide in-kind technical assistance in area including project design, implementation, or use of specialized facilities or equipment:

Agency	Estimated time investment (% of total project)
• Federal Americorps Programs	12.0
• ~~University of St. Thomas~~	~~7.0~~
• University of Minnesota	30.0
• Natural Resources Conservation Service (NRCS)	3.0
• 1854 Authority	10.0

We will also confer with the Minnesota Department of Agriculture and the Minnesota Department of Natural Resources throughout the project period. We intend to contact the Natural Resources Research Institute (University of Minnesota-Duluth), and the Iron Range Resources and Rehabilitation Board to discuss the possibility of technical and

financial assistance. **None of the cooperators listed will receive LCMR funds for any aspect of project participation.**

VIII. LOCATION: A map of the Bois Forte Reservation and Nett Lake is attached and indicates the study sites proposed for future evaluation.

IX: Reporting Requirements:

Periodic work programs progress reports will be submitted not later than January 31, 1998; and January 31, 1999. An extension ~~is~~ was requested at the end of the formal project period to allow for data collection through the standard field season. This extension was approved and is defined in the appropriation language for this project. The data for the final work program report and associated products is June 30, 2000.

X. Peer Review Research Project Summary:

I. I. Abstract

Eurasian watermilfoil (*Myriophyllum spicatum L.*) in a nuisance aquatic weed, exotic to North America. Northern watermilfoil (*Myriophyllum sibericum Komarov*) is quite similar in morphology, but is indigenous to North America. The freshwater weevil *Euhrychiopsis lecontei* (Dietz) utilizes norther watermilfoil as its host plant has also feeds on this species. The weevil is currently being considered being considered as a biocontrol agent of the Eurasian watermilfoil.

The objection if this study is to define the magnitude of impact of an indigenous aquatic weevil (*Euhrychiopsis lecontei*) on the growth of wild rice (*Zizania aquatica*) and on competing vegetation present in Nett Lake, a 7369 acre wild rice lake. Past research regarding this insect's value as a biological control agent will be expanded through analysis of the insect's effect on wild rice growth in Minnesota lakes. We will observe and statistically assess *E. lecontei's* propensity to heed and/or oviposit on vegetation maintained under controlled laboratory conditions. Valuation of this weevil as an effective biocontrol agent in rice lakes will be identified through statistical evaluation of its ability to suppress growth of predominant aquatic vegetation while leaving germinating wild rice unaffected.

We will evaluated the feeding potential of *E. lecontei* on three species of submersed weeds found in Nett Lake, the world's largest contiguous wild rice lake (*Zizania aquatica*) lake. We intend to expand knowledge of this insect's feeding and oviposition preferences in relation to test weed species and to wild rice. We will quantify feeding impact these weeds through visual observation of imparted physical damage or presence of oviposited eggs during timed incubation periods. Observations will allow us to refine our understanding of *E. lecontei* behavior and its ability to create more suitable germination environments for wild rice.

We will concurrently assess weevil feeding potential on germinating wild rice. Although in its mature state this plant is emergent and has substantially different morphology from weeds listed, during germination it is a delicate, submersed plant possibly susceptible to predation by weevils. We will modify and use methods previously described in the scientific literature. However, we believe that this research is unique; we have found no similar research preformed in conjunction with wild rice agriculture.

II. Background

Accidental or intentional introduction of exotic plants into aquatic systems often leads to rapid expansion of these species and a reduction of the abundance and species richness of native aquatic plants (Arthington and Mitchell 1986; Aiken *et. al.*, 1979; Carpenter 1980; Room 1990). Such changes in the aquatic macrophyte community may impact thermal structure and dissolved oxygen levels, rates of sedimentation and succession (Carpenter and Lodge 1986), as well as species diversity and growth patterns (Holm, personal observation). In turn, these can substantially alter human uses of the waters. Exotic Eurasian watermilfoil (*Myriophyllum spicatum* L.) and native northern watermilfoil (*Myriophyllum sibericum* Komarov) (=*M. exalbescens*) are submersed freshwater macrophytes. *M. spictum* is native to Asia and Europe and first became established in North America in the 1940's (Smith and Barko, 1990) *M. sibericum* is indigenous to North America. Morphology of these species is quite similar; major taxonomic differences exist in branching pattern and number of fine leaves extending from the main stem. Euhrychiopsis lecontei (Dietz) is a fully aquatic weevil endemic to North America (Colonnelli, 1980) whose presumed host is *M. sibericum* (Creed and Sheldon 1994; Newman and Maher 1995). *E. lecontei* preferentially feeds and oviposits on these weeds species and damages the plants so significantly that is has been considered a potential biocontrol candidate of Eurasian watermilfoil (Sheldon and Creed, 1995.)

A variety of chemical and physical methods have been devised to control growth of watermilfoil. These methods (e.g., herbicides, plants harvesting, lake draw-downs, and placement of bottom barriers that exclude light) provide only temporary reductions in weed biomass. These measures do not eradicate weeds nor provide long term control. In addition, they are not specific to target weed species. Millions of dollars are spent annually on harvesting, herbicide application and other non-specific control methods to manage noxious weeds. (Sheldon and Creed, 1995). Such measures are clearly unsuitable where plant aquaculture occurs; in addition, mechanized management alternatives may violate cultural beliefs of certain civic groups (e.g. Native Americans), who believe in natural stewardship of resources and depend heavily on aquaculture crop production (Holm, *personal observation*). Biological control thus presents an exciting possibility to naturally manage exotic and indigenous species of noxious weeds that threaten economically important, water-based crops such as wild rice.

III. Methods

This study will be carried out over a two year period, beginning July 1, 1997. Prior to and during the first year of this study, Bois Forte DNR staff will execute surveys of aquatic plant communities in Nett Lake. Surveys of weeds beds in Nett Lake have been

in progress since 1995. Watermilfoil beds in Nett Lake generally exist in water 3-5 feet deep, and grow over flocculent organic sediment that reaches depths of 9-12 feet in certain areas. During 1997 we will document predominant weed beds using a global positioning/geographic information system. We will collect statistically relevant of submersed plant samples from surveyed areas f or taxonomic identification and biomass analysis. Statistical design will be reviewed by faculty in the Statistics Application Department at the University of Minnesota. Plant carbon and nutrient content (total phosphorus, total kjeldahl nitrogen) will be analyzed in mature weeds and germinating rice using relevant procedures defined in ASTM Standard Methods.

In 1998, we will collect and propagate aquatic weevils, three species of predominant submersed weeds currently known to exist in Nett Lake, and wild rice seed taken from mature rice plants and aeration systems, and inoculated with autoclaved sediment and water from Nett Lake. Weevils will be obtained from lakes with known infestations of the exotic watermilfoil (Newman and Maher, 1994), as well as lakes bearing only native variety. Only weevils in direct contact with milfoil will be collected for further propagation, and will be propagated in separate in identical chambers. Test vegetation species will also be individually propagated in identical chambers. Wild rice seed will be collected from mature plants in Nett Lake during 1997 harvest season, and will be stored until its use the following Spring.

We will conduct feeding experiments in using PVC growth chambers. Feeding chambers will be prepared from clear PVC, and will be 4 inches in diameter and 18 inches in height. The based of each chamber will be sealed to retain water and sediment collected from Nett Lake. Chambers will be fitted with hinged, nitex mesh (0.357 um) lids to retain test insects. Chamber water will be pumped from Nett Lake via a flow-through system, thus maintaining conditions in chambers similar to those existing in Nett Lake. Chambers will be inoculated with autoclaved sediment collected from Nett Lake. We will identify weevil feeding propensity for weeds and germinating rice through controlled introduction of weevils to growing vegetation transferred to feeding chambers containing pre-determined number of weevils. Weevil stocking number will be determined through observation of average number of insects on milfoil at time of original collection. Weevils will be allowed to feed and/or oviposit for distinct time periods, after which time weevils and plants will be removed. Plant biomass will be visually inspected for the presence of oviposited eggs, physical boring damage, and other evidence of feeding activity. Replicate evaluations will be carried out using weevils taken from both types of milfoil, and with all possible plant combinations.

IV. Results and Products

By June 2000, we will produce a statistical matrix that defines weevil feeding and oviposition preferences for prevalent aquatic found in Nett Lake. Final statistical form of the data bases will be determined through consultation with technical staff at the University of Minnesota Statistical Applications Department. Data bases and research information will be defined for public use through creation of an internet web site containing research results. One or more peer review manuscripts will be developed, and will be submitted to prospective peer-review journals for publications.

V. Timetable

~~A timetable detailing aspects of this project is contained as an attachment~~. All project results will be completed by June 30, 2000.

VI. Budget

Operating cost breakdowns covering the project period 7/97-6/2000 are contained in section VI of the project work plan.