

1991 Research Project Abstract

For the period ending June 30, 1995

This project was supported by the MN Future Resources Fund

Title: Replacement of Eurasian Watermilfoil With Native MN Plants
Program Manager: Edward F. Miller
Organization: White Bear Lake Conservation District
Legal Citation: M.L. 93, Ch. 172, Sec. 14, Subd. ~~1~~(2)(m)
Aprop. Amount: \$40,000

STATEMENT OF OBJECTIVES:

To assess the costs/usefulness of replacing Eurasian Watermilfoil with native Minnesota species of aquatic plants, and to produce a re-planting videotape for use by MNDNR and lake associations.

RESULTS:

In addition to data obtained from literature reviews and personal contacts with recognized professional scientists working with Eurasian watermilfoil (*Myriophyllum spicatum*) field data were obtained from the planting of twenty-four underwater quadrats (7.5Mx7.5M), six per site at four sites in White Bear Lake, MN. These were photographed and underwater videotaped to record transitions throughout the open water seasons of 1993 to June 24, 1995. An edited version of the population densities and species mix are contained within the videotape prepared as the second objective of this project. The plants species selected and used for transplanting were: *Vallisneria americana*, *Potamogeton pectinatus*, *Chara vulgaris*. A cool growing year produced few turions in *Myriophyllum sibiricum*, and *Ceratophyllum demersum* which precluded their inclusion in this time-limited study. The Sago Pondweed, Chara, and Wild Celery were obtained from a licensed commercial supplier, as would be the case for lake managers. The plants grew well and became an integral part of the population mix within the quadrats, and spread beyond them. Where Eurasian watermilfoil had once been the dominant species present prior to chemical treatment with 2,4,D, they were now just another observable species within the mix. This was a short term demonstration project, but the quadrats are permanently affixed to the lake bottom and will remain *in situ* for future comparisons.

PROJECT RESULTS USE AND DISSEMINATION:

The videotape will be available to lake managers at copy costs. It will be shown at the Fall 1995 annual meeting of the Minnesota Lakes Association, a meeting in which most active lake managers participate. Professional papers will make use of the information and will be submitted for publication. A 'general public' version will be written for inclusion in the MINNESOTA VOLUNTEER.

Date of Report: July 1, 1995

LCMR Final Report-Detailed for Peer Review

I. Project Title: REPLACEMENT OF EURASIAN WATERMILFOIL WITH NATIVE MINNESOTA PLANTS

Program Manager: Edward F. Miller
 Agency Affiliation: White Bear Lake Conservation District
 Address: 28745 Belle Creek Way
 Welch, Minnesota 55089-4459
 Phone: 612/258-4023

A. Legal Citation: M.L. 93 Ch 172, Sect. 14, Subd. 19(m)

Total Biennial LCMR Budget: \$40,000

Balance: \$-0-

Appropriation Language as drafted 7/27/92: This appropriation is from the Future Resources Fund to the Commissioner of Natural Resources for a contract with the White Bear Lake Conservation District to research the replanting of areas treated for eurasian watermilfoil with native aquatic plants.

B. LMIC Compatible Data Language: Not applicable

C. State of Match Requirements: Not applicable

II. Project Summary:

The overall goal of the native species replanting research effort to replace eurasian watermilfoil in treated areas, is to aid in the promotion of biological controls over eurasian watermilfoil through the enhanced use of native aquatic plants of Minnesota. The only practical tool now in the hands of the DNR is the use of the chemical 2,4,D. There is a substantive long-term research effort by the DNR to find appropriate biological controls for this invading weed; see Subd. 14(l) of current appropriation requests. This project is complementary, and will be useful by state agencies and lake associations in the near term future in combating eurasian watermilfoil while awaiting the other DNR long-term efforts. There is a rich diversity of native aquatic plants in White Bear Lake, the majority of these plants being found in many Minnesota lakes and ponds. Replacing of weeds is desirable from the viewpoints of using the lake's nutrients, providing food for wildfowl, and sheltering small fish and their prey, all important for recreation and fishery. No attempt will be made to replant weed replacements in public beach areas which may have been treated with 2,4,D. The knowledge gathered will be summarized in the production of a videotape,

copies of which will be made available to help local lake management associations or state agencies in their immediate efforts against eurasian milfoil.

III. Statement of Objectives:

1. Assess the costs/usefulness of replacing eurasian watermilfoil with native Minnesota species of aquatic plants.
2. Produce re-planting videotape for DNR and Lake Associations.

IV. RESEARCH OBJECTIVES:

A. Title of Objective: Assess the costs/usefulness of replacing eurasian watermilfoil with native Minnesota species of aquatic plants.

A.1. Activity: Preparation of Intiation Report.

A.1.a Context within project: Preparation of this report will: delineate replanting efforts by other researchers, select sites to be replanted, select and obtain required field equipment, select species to be used in replanting, layout of permanent quadrat sites to be replanted. All field work is to be carried out in White Bear Lake, a lake which contains typical aquatic plant species for most other Minnesota lakes, making the knowledge gained easily transferable to many other lakes in Minnesota.

A.1.b Methods: Literature search, acquire historical records of areas treated with 2,4,D, interaction with regional scientists from WI, MN, State and Federal agencies (DNR, F&WLS, CofE), field work to select/layout appropriate sites. Permanent quadrats in each site will be planned and selected based upon variations in lake bed sediments and depths, and use by humans. Maps/written report to WBLCD & MN/DNR.

A.1.c Materials: Materials required consist largely of computer time, travel vehicles to meet with researchers/agencies, boat & motor to select sites, photo & Videographic materials, and expendables such as line, gas & oil, marker buoys/floats, telephone and mileage charges

A.1.d Budget: \$11,500

A.1.e Timeline:	7/93	1/94	6/94	1/95	6/95
Literature search	**				
Acquire historic data	**				
Meet with scientists	***				
Select/layout sites	****				
Acquire field gear	*				

A.2 Activity: Conduct complementary field investigations

A.2.a Context within Project: Initial field plantings will help ascertain the usefulness of the methods selected to replant and smooth out or eliminate any problems encountered in techniques or the plants selected. The resultant video will be added to the DNR library of visual aids for use by those lake managers concerned with exotic species.

A.2.b Methods: Paired 7.5M X 7.5M experimental field quadrats will be laid out and an initial planting will be made with *Vallisneria americana*, a species that has: minimal interference with recreational uses of the lake, has wildlife benefits, and which has been replanted successfully in Minnesota waters (1988) by Korschgen & Green of US F&WLS. Plants are obtainable from a local commercial supplier which will help preclude unnecessary disturbance of the White Bear Lake bed flora. We feel that any extraordinary disturbance of the plants in the littoral areas may tend to exacerbate the eurasian watermilfoil problem that this lake now has. The role of our replacement plants is to help preclude rapid re-entry of exotic eurasian watermilfoil onto the bare experimental quadrats. Underwater video for technology transfer and weekly serial still photography will be a part of the report format.

A.2.c Materials: Boat, motor, SCUBA gear, cameras, underwater housing, plants for embedment, cotton bags/gravel to hold plants in position in lake bed quadrats.
Expendables: Batteries, lines, bags, gas/oil, mileage, *Vallisneria* plants, phones, computer time, and raw videotape.

A.2.d Budget: \$8,500

A.2.e Timeline:	7/93	1/94	7/94	1/95
Layout/plant Exp.plots	**			
Skim/cover with Chara	**		**	**
Photo/edit video	**	**	**	**

A.3. Activity: Plant and evaluate multiple permanent quadrats using aquatic macrophytes seen commonly in White Bear Lake.

A.3.a Context within Project: The planting and evaluation of these permanent quadrats is one of the two primary objectives of this project. Success at a reasonable cost will give lake associations and the DNR another optional tool following defoliation of eurasian watermilfoil by 2,4,D applications. The quadrats will be permanent for evaluation in future years.

A.3.b Methods: Underwater quadrats (7.5M X 7.5M) will be located at several 2.4.D treated sites in White Bear Lake with differing depths, substrates, and macrophyte communities. We feel that placing *Vallisneria* in areas that are currently near other *Vallisneria* will help insure success in view of possible microclimate differences which might not be apparent at the time of planting. Similarly, we will try to plant Coontail (*Ceratophyllum demersum*) in deeper areas rich in that species. Divers will collect Turions (winter buds) from mature Coontail for subsequent site plantings into control quadrats.

Planting technique videotapes will be made. Evaluations of 'success/failure' will be made through a series of weekly still photos and another series of videotapes taken in the experimental quadrats. These raw videotapes will be edited and made a part of the Final Report and as the culmination of the second major objective of this research. Cost analyses for replanting per acre will be included in the Final Report.

A.3.c Materials: Boats, motors, still and video underwater cameras, video editing equipment, SCUBA divers/gear, and necessary expendables such as line, cement blocks, blank videotape, blank film, gas/oil, and floats.

A.3.d Budget: \$5,000

A.3.e Timeline:	7/93	1/94	6/94	1/95
Collect Coontail turions	**		**	
Plant Coontail turions		**	**	
Plant <i>Vallisneria</i> buds	**	**		**
Videotape before/after	***	**	***	** * *

A. Status: Completed, on time, within budget.

Problems: The time frame of the LCMR funding programs created a late start for the project and an early finish. We did not have two full growing seasons within which to carry out the work. The first summer was extraordinarily cool which apparently had a severe effect on turion formation throughout Minnesota and Wisconsin. We substituted Sago Pondweed (*Potamogeton pectinatus*) and used greater amounts of the macroalga *Chara vulgaris*, to utilize available plants with reproductive structures. The substituted plants grew rapidly in 1994, and were in the quadrat areas in 1995. The *P.pectinatus* and *V.americana* were affected by the overdose or sabotage with 2,4,D but have since recovered partially as of June 1995. A replanting of *V. americana* and more *Chara* was planted in Spring 1995. The quadrats are permanently attached to the lake substrate and progress of this Spring planting will continue to be followed outside of this funding program. All of the plantings produced major quantities of plants within the quadrats. Eurasian Watermilfoil was NOT displaced, the presence of EWM was visually diminished in that in 1993 the EWM was the major plant in the quadrats, and now are just another scattered constituent of the plant community. The videotape images clearly show this in our videotape produced for the LCMR/MNDNR. No stem-counts were made since this was funded as a demonstration project, not basic research. The concept appears to have use in repopulating desirable species of macrophytes in a chemically denuded substrate. The use of *Chara vulgaris* and *Vallisneria americana* are recommended since they survived a second chemical treatment and possibly a third application of 2,4,D. If the MNDNR offers cooperation, one of the cooperators, Buddy Diving Service, Inc. will try to offer commercial replanting application to lake managers.

B. TITLE OF OBJECTIVE: Produce re-planting videotape for DNR and Lake Associations.

B.1. Activity: A generalized shooting script will be written for use by the investigator and the cooperator (Buddy Diving Service, Inc).

B.1.a Context within project: A shooting script will help assure that essential footage will not be omitted nor forgotten during the investigative field work.

B.1.b Methods: The script will be written by the Project Manager and Principal Scientist Edward Miller, an experienced writer/educator.

B.1.c Materials: A computer and the background material from a good literature search/personal contacts with scientists in this field.

B.1.d Budget: \$2,000

B.1.e Timeline:	7/93	1/94	6/94	1/95	6/95
Background search	**				
Write field script	**				

B.2. Activity: In order to help promote and to document a biological control method for in-lake management of eurasian watermilfoil, expose videotape utilizing underwater video and still cameras, and the video script written in Activity B.1. above.

B.2.a Context within project: Lake Associations and lake managers have few options open to them in their efforts to manage the spread of the eurasian watermilfoil. In general, they are relatively untrained in practical technology. This videotape will be supplied at reasonable cost to those seeking such help. A copy will be placed in the video library of the DNR as well as copies to be sent to USF&WLS and the US ARMY Corps of Engineers for use in environmental management programs. A fully professional videotape will afford those considering such work, to get a better concept of the how, why, when, and costs of such work.

B.2.b Methods: Videotapes will be exposed throughout the project with two ideas and techniques in mind: (1) produce raw footage for the finished videotape, (2) Use underwater as well as above-water video images, and enough of them to fully explain/show what was done. First-cut editing will be done quarterly to reduce the editing time near the end of the project. All of the camera work and editing will be carried out by the cooperators.

B.2.c Materials: Underwater videocamera/housing, surface videocamera and tripod, video-editor and software, raw videotape, batteries, SCUBA gear and divers (cooperator, Buddy Diving Service, Inc), boats, motors, fuel for boats.

B.2.d Budget: \$10,000

B.2.e Timeline:	7/93	1/94	6/94	1/95
Expose videotape	*****			*
Field edit tape	* * * * *	* * * * *		

B.3. Activity: Final editing/production/copying of videotape of the project techniques for use by Lake Associations and outside agencies.

B.3.a Context within project: This work will fulfill the second major objective of the project, the final video product. The videotape is the major tool for technology transfer to other Minnesota lakes.

B.3.b Methods: The final work will be the polishing of the shooting script, final footage edit, sound optimization/edit, and create titles for the final production, and the making of extra distribution copies as indicated above.

B.3.c Materials: Computer for script, Video editor for footage, sound editor for sound optimization, videoeditor/software for titles, and a second video recorder to make copies for Lake associations and outside agencies.

B.3.d Budget: \$3,000

B.3.e Timeline:	7/93	1/94	6/94	1/95
Write Final script			*	
Do Final Image Edit			*	*
Do sound edit		**	*	
Make copies				*

B. Status: Videotape has been produced in Hi8 format, has been converted to VHS format for distribution. Copies have been sent to LCMR, MNDNR, the original Master tape is held at Buddy Diving Service, Inc for duplicating as required. The videotape is expected to be exhibited at the Minnesota Lakes Association Annual Meeting in Fall 1995.

V. EVALUATION: This program can be evaluated by its ability to reach its two primary objectives: (1) the successful planting of native Minnesota macrophytes in areas that have been treated with 2.4.D and a reduction in the establishment of successful eurasian watermilfoil on these areas as compared to control areas not replanted; (2) the production of a 'how-to' videotape which can be useful to Lake Associations trying to manage/preclude eurasian watermilfoil.

VI. CONTEXT WITHIN THE FIELD: To date, no effort has been made by the MN DNR to re-lant native species of aquatic macrophytes in Minnesota lakes that have been treated with 2.4.D. for eurasian watermilfoil. The natural revegetation of denuded areas that have been so treated, has been by those plants most able to quickly re-populate the newly available space/light/nutrients resource. Too often this has been eurasian watermilfoil, which is thereby frequently able to expand its invasion. Replanting of underwater macrophytes has been accomplished by other scientists in the United States. Korschgen & Green(1988) replanted Vallisneria americana in the Mississippi River with view of using them as a replacement organism in restoration. Lawrence and Hollingsworth (1969) evaluated the effects of 2.4.D herbicide on Vallisneria and found no control-effect at dosages of 16-28 kg/ha. This is important for use in managing against eurasian watermilfoil, since it is often necessary to re-treat an infected site with 2.4.D when more eurasian plants are found. Higher concentrations of 100 ppm 2.4.D as seen by Gerking(1948) will manage Vallisneria.

This means that careful 2,4-D dosage calculations by chemical applicators will help the success of our replanting efforts. In Wisconsin, Titus and associates did a series of submerged macrophyte studies that included *Vallisneria* and Eurasian watermilfoil (1977-1982) which indicated that *Vallisneria* should be an excellent candidate organism for this project in White Bear Lake. Titus and Stephens (1983), worked with *Chara vulgaris* and *Potamogeton amplifolius* in New York. Both of these plants are important members of native species seen in White Bear Lake (Miller, Bakken, Miller, 1991).

This project should be supportive of the MN DNR long term biological control program for Eurasian Watermilfoil. Dr John Barko, at U.S. Army Corps of Engineers Environmental Management Technical Center, located at La Crosse, WI has endorsed the concept of this project as being a useful aquatic plant management tool against Eurasian Watermilfoil.

VII BENEFITS: The increasing concern about the costs and extent of the invasion of Eurasian Watermilfoil as voiced by lake associations and the general public is well documented by the media and the mail to Legislators and State Agencies.

This project addresses that concern by researching the practicability and costs of replanting lake-bottom areas that have been treated with the herbicide 2,4-D, one of the only tools that is currently available to the Minnesota DNR. Using commercial suppliers of replacement plants in cooperation with the MN DNR (precluding importation of unwanted species will be a benefit to lake managers so that they can obtain similar plants from such sources without disturbing the lake bottoms of Eurasian watermilfoil infested lakes. The use of SCUBA divers, as well as planting from boats, will give lake area managers several options in their management efforts against Eurasian Watermilfoil. The videotape to be produced as the second objective of this study, will be a teaching tool for those lake managers.

In the long term, other MN DNR biological control initiatives may be able to control the spread of Eurasian Watermilfoil, and the results of this project on White Bear Lake will complement their efforts.

VIII DISSEMINATION: Results from this project will be presented as a videotape for use by lake association managers and state/federal agencies. Further, two articles will be written for inclusion in a scientific journal for technical readers and the magazine MINNESOTA VOLUNTEER for non-technical readers.

IX TIME: As more lakes begin to exhibit the presence of the Eurasian Milfoil invader, there is increasing public pressure placed upon lake managers and public officials. The herbicide 2,4-D is now being used to defoliate Eurasian watermilfoil. The resultant denuded areas will get new growth of underwater plants. Now is the time to research the usefulness and practicality of replanting these treated sites with the more desirable native Minnesota plant species to give them the competitive edge in re-establishing these sites. The environmental health of the fishery and the eutrophic status of the lake are two factors which need to be addressed in the near term future. As this project finishes in 1995, DNR long term biological control efforts should begin to show some successes.

X COOPERATION:

1. Edward Miller
Consulting Ecologist
Welch, Minnesota

An aquatic ecologist with extensive field research, state agency, and college teaching experiences. Mr Miller's role will be to carry out the scientific writing, much filming, major editing, and reporting on this project, and act as Project Manager.

2. Buddy Diving Service, Inc.
Welch, Minnesota

A professional diving service to carry out any and all SCUBA work, help in the planting of macrophytes, underwater videography, some surface photography, cooperate in all editing of the final videotape. This cooperator will supply all of nonexpendable field equipment as well as the video filming/editing equipment.

XI REPORTING REQUIREMENTS: Semiannual status reports will be submitted not later than January 1, 1994, July 1, 1994, January 1, 1995 and a Final Status Report by June 30, 1995.

XII LITERATURE CITED:

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