

AQUATIC WEEDS MANAGEMENT FUND
FINAL REPORT

Epilobium hirsutum Control and Education

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TABLE OF CONTENTS

Project Summary	
o Background	Page 2
o Project Objectives	Page 2
o Project Overview	Page 3
Plant Surveys	Page 3
Control Methods	
Herbicide Trials	Page 4
Non-herbicide Control	Page 5
Biological Control	Page 12
Education/Communication	Page 12
Project Results	Page 13
Proposed Management	Page 13
Appendix	Page 15



Fig. 1, Hairy willow-herb in Island County



Fig. 2, Hairy willow-herb in Klickitat County

Project Summary

Background

Epilobium hirsutum known commonly as hairy willow-herb is a tall, attractive plant capable of escaping cultivation to form monotypic stands in natural wetland areas, where aggressive and dense growth can crowd out native or beneficial species. While often found along ditch-banks and roadsides, this plant is capable of spreading to undisturbed meadows. Records indicate this species is considered established throughout most of the northeastern United States, and the distribution continues to spread westward. Initially the majority of Washington populations were thought to be limited to Whatcom County, where this plant is regularly found as a garden ornamental, and as an escapee to natural wetland areas. Additional survey has verified infestations in at least 11 counties in Washington State. Hairy willow-herb is currently designated as a Class “C” noxious weed by the Washington State Noxious Weed Control Board (WSNWCB).

Hairy willow-herb is aggressive and capable of spreading by wind dispersed seeds, and by a large root system that produces rhizomes which facilitate vegetative spread. This species is an exotic, aquatic species capable of disrupting the ecology of our wetlands by altering food chains, hydrologic cycles and floral composition. These factors all determine the succession or long term management plans of these wetland areas.

In June of 2006, the Washington State Department of Agriculture (WSDA) received a grant from the Washington State Department of Ecology (Ecology) to further develop the knowledge base for hairy willow-herb in Washington State by providing research into control methodology, developing educational materials, looking at the species distribution and range in Washington, updating documentation and suggesting a statewide management strategy.

Project Objectives

- To research control techniques that include mechanical, cultural, biological and chemical treatment methods and strategies. These different methods were assessed for efficacy and suitability for various sites.
- To produce and provide educational materials to nurseries who may be selling this plant and for resource agencies and private individuals to educate them on the threat this plant poses to the natural resources of Washington State.
- To update the “Integrated Pest Management Plan for Freshwater Emergent Noxious and Quarantine Listed Weeds” to include *E. hirsutum* and include prescriptive control recommendations.
- To provide information to the WSNWCB that allows them to update their official written findings on *E. hirsutum*. These written findings were outdated and incomplete.
- To improve our knowledge of the distribution of this species to support the potential upgrading from a state listed Class “C” weed to a Class “B” status that will allow the state to better define its overall management strategy.

- Issuance of a final report to Ecology that summarizes the activities and accomplishments of the project and recommend's a statewide strategy to address this species.

Project Overview

A literature search was completed for control methods for *E. hirsutum* in 2006. After examining the existing data on control it was determined that control of plants using herbicides and by covering plants with tarps would be the most efficacious methods for which to conduct field trials.

Chemical and non-chemical control methods were explored and evaluated by staff from Washington State University, the Island, Whatcom and Klickitat County Noxious Weed Control Boards and the Washington State Departments of Ecology and Agriculture.

An educational postcard was developed by Alison Halpern from the Washington State Noxious Weed Control Board, Jennifer Andreas from the Washington State University Integrated Vegetation Management Program and Bridget Simon, WSDA (See Appendix B).

An updated plant profile for inclusion in the “Integrated Pest Management Plan for Freshwater Emergent Noxious and Quarantine Listed Weeds” as well as an updated Written Findings document have been completed.

Plant Surveys

County distribution data was collected from county weed boards and other sources. Many counties have not been actively surveying for *E. hirsutum*, however as the species becomes more well known as a result of the educational materials developed under this grant, additional sites will be added to the database. The largest single infestation occurs at Crocket Lake on Whidbey Island (Figures 3 & 4). See Appendix A for a map of known distribution.



Fig. 3 & Fig. 4, Hairy willow-herb site at Crocket Lake on Whidbey Island

Herbicide trials

Materials and Methods

The herbicide plots were established in Whatcom County. Dr. Tim Miller, Washington State University, Mount Vernon Research and Extension Unit, conducted the trials using various rates and formulations of herbicide and surfactants. Laurel Baldwin the Coordinator for the Whatcom County Noxious Weed Control Board assisted Dr. Miller (Figures 5 & 6).



Fig. 5, Approximately 3 WAT



Fig. 6, Approximately 9 MAT

Hairy willow-herb (*Epilobium hirsutum*) infesting the Britton Loop area of Bellingham was treated with various herbicides on July 17, 2006. Hairy willow-herb plants were about five feet tall and predominantly in bud stage at the time of the treatment. Few open flowers were present in the infestation at that time. Products tested were glyphosate (Aquamaster at 5%), imazapyr (Habitat at 0.5 and 1.0%), imazamox (Clearcast at 0.5 and 1%), triclopyr (Renovate at 1 and 1.5%), aminopyralid (Milestone at 0.5%), and several combination treatments (Aquamaster + Habitat, Aquamaster + Clearcast, Aquamaster + Renovate, Habitat + Renovate, and Clearcast + Renovate). Treatments were applied using a single thin-line wand on a CO₂-pressurized backpack sprayer. Foliage was dry, temperature was about 75 F, skies were clear, and the breeze was 2 to 5 mph from the NW. Plots measured 12 by 25 ft. and 2 L of solution was applied, resulting in an effective application rate of 76 gallons per acre. All treatments were mixed with 0.25% (v/v) DyneAmic surfactant prior to application.

Hairy willow-herb plants in each plot were visually rated for percent control (100% = dead hairy willow-herb plants, 0% = healthy hairy willow-herb) on August 4 (three weeks after treatment, WAT) and September 11, 2006 (2 months after treatment, MAT), and on August 30, 2007 (13 MAT). The statistical design was a Randomized Complete Block with four replicates. A general linear models procedure was used to analyze the data and Fisher's Protected LSD (P = 0.05) was used to separate the means.

Results

Differences in product performance on hairy willow-herb at 2 and 13 MAT were slight (89 to 100% control at 2 MAT, 95 to 100% at 13 MAT) (Table). In fact, at 13 MAT, these differences are considered to be primarily due to skips in the application, as the living weeds in these plots were, for the most part, located at the far north side of the plots where weeds were somewhat screened from direct herbicide application occurring from the south side of the plots. Grass species (tall fescue (*Lolium arundinaceum*), quackgrass (*Elymus repens*), reed canarygrass (*Phalaris arundinacea*), and common velvetleaf (*Holcus lanatus*) were the predominant species still occurring in the plots at 13 MAT. There were also substantial amounts of native willow-herb species in the plots (*Epilobium* spp.) and scattered red alder (*Alnus rubra*). None of the plots were bare. Based on these results, it appears that all of these herbicides at the tested rates provide excellent control of hairy willow-herb at one year after application.

Table 1. Hairy willow-herb (*Epilobium hirsutum*) control after treatment with several herbicides.

Treatment ^a	Rate	8/4/06 (3 WAT) ^b	9/11/06 (2 MAT) ^b	8/30/07 (13 MAT) ^b
	% product	%	%	%
Aquamaster (glyphosate)	5.0	65	100 a	100 a
Habitat (imazapyr)	0.5	15	99 a	100 a
Habitat (imazapyr)	1.0	20	95 abcd	100 a
Clearcast (imazamox)	0.5	15	89 d	100 a
Clearcast (imazamox)	1.0	35	90 cd	100 a
Renovate (triclopyr)	1.0	70	96 abc	100 a
Renovate (triclopyr)	1.5	75	98 ab	100 a
Aquamaster + Habitat (glyphosate + imazapyr)	3.0 + 0.5	60	95 abcd	100 a
Aquamaster + Clearcast (glyphosate + imazamox)	3.0 + 0.5	50	99 a	99 a
Aquamaster + Renovate (glyphosate + triclopyr)	3.0 + 1.0	65	93 abcd	97 ab
Habitat + Renovate (imazapyr + triclopyr)	0.5 + 1.0	75	91 bcd	95 b
Clearcast + Renovate (imazamox + triclopyr)	0.5 + 1.0	70	94 abcd	97 ab
Milestone (aminopyralid)	0.5	50	91 bcd	100 a
LSD _{0.05}	---	ns	7	3

Means within a column followed by the same letter are not statistically different.

^aAll treatments were applied July 17, 2006, and were mixed with 0.5% nonionic surfactant, v/v (DyneAmic).

^bWAT = weeks after treatment; MAT = months after treatment.

Non-herbicide control trials

As previously mentioned, various non-chemical control methods were explored including mowing, pulling, covering and biological control. It was determined that mowing would not serve to adequately control (nor eradicate) infested sites and may in fact serve to spread propagules via mowing equipment. Hand pulling (grubbing) would be effective only if all of the

extensive root and rhizome fragments could be removed along with the above ground plant parts. Therefore field trials for these two methods of control were not conducted. It should be noted however that part of the Island County site has been repeatedly mowed by the landowner and a few seedlings were visible scattered throughout the mowed area.

The covering plots were established in Klickitat and Island counties. Jenifer Parsons, Department of Ecology, Bridget Simon and Greg Haubrich, WSDA, conducted the trials with assistance from Susan Horton the Coordinator for the Island County Noxious Weed Control Board and Marty Hudson the Coordinator for the Klickitat County Noxious Weed Control Board.

Klickitat County Site – Three plots were established on private land at Six Prong Creek in Klickitat County on June 20, 2007.

- Three 8 x 11 ft plots were established. Each corner was marked with a bamboo stake painted orange at the top (see figures 7 - 12). Hairy willow-herb (hwh) was up to 8 ft tall and flowering at this time. See Table 2 for the treatment description of each plot.
- All plots were 99-100% covered with hwh. The only exception was one or two individual cattail plants located in the plots (1% cover or less).
- The water level in the plots varied from a few inches up to knee deep. The hwh plants were dense enough that workers usually walked on it rather than the creek bottom.



Fig. 7, Plot 1, cutting plants with a line trimmer **Fig. 8, Plot 1, before covering with tarp**



Fig. 9, Plot 1, covered with tarp



Fig. 10, Plot 2, plants knocked over



Fig. 11, Plot 2, covered with tarp



Fig. 12, Plot 3, control plot

Revisited plots on September 18, 2007 (3 MAT) (see figures 13-15)

- Removed tarps from the two plots that were covered, each tarp had a small hole in it.
- In both treatment plots the plants under the tarps appeared to be dead.
- The water level seemed the same as the June visit when the plots were established.
- *Chara* sp. (a submersed aquatic plant) was growing in the newly opened water of the plots.
- Untreated plants in the control plot and elsewhere at the site were producing seed.
- Did not replace the tarps.



Fig. 13, Plot 1, cut stems still evident



Fig. 14, Plot 2, knocked over stems still evident



Fig. 15, Plot 3, control plot

Revisited the site to document re-growth May 28, 2008 (11 MAT)

- Relocated all of the plots (see figures 16-18).
- In general the plants were 2-3 ft tall and not flowering yet probably due to a cold spring that likely delayed their growth.
- Both treatment plots still had some open water in the middle, but plants were encroaching from the edges, the cut plot was the most open.
- The control plot had 99% hwh cover (except where an animal had made a trail though it).
- See Table 2 for a summary of the treatments.



Fig. 16, Plot 1, open water in center



Fig. 17, Plot 2, some open water in center



Fig. 18, Plot 3, control plot

Table 2: Summary of cover treatments at Klickitat County site.

Date	Plot 1	Plot 2	Plot 3
6-20-07	East plot Cut plants off above water line with a gas powered line-trimmer cleared stems Covered with tarp	Middle plot Knocked plants over toward plot center Covered with tarp	West plot Control
9-18-07	Removed tarp Cut stems still standing Small cattails emerging	Removed tarp Dead-looking knocked-over stems still present	99% hwh cover
5-28-08	Hwh plants encroaching from the edges, about 40% of the original plot area remained as open water in the center	Hwh plants encroaching from the edges, about 20% of the original plot area remained as open water in the center	99% hwh cover

Island County Site – Three plots were established on private land near Coupeville Washington on August 7, 2007.

- Three 4 x 8 ft plots were established and each corner was marked with metal rebar posts. In plot 1, the plants were cut using hand cutters. In plot 2 the plants were trampled down and plot 3 was a control. The hairy willow-herb (hwh) plants were large and robust; with many over 6 feet tall (see figures 19 and 20). The plants were just past peak bloom. See Table 3 for treatment description of each plot.
- All plots were 95-100% covered with hwh. Giant horsetail (*Equisetum*) was scattered throughout the site (2% cover or less). Cattails, bulrush, reed canarygrass and Canada thistle were growing adjacent to the hwh.
- The site was very wet with soft muddy soil and standing water just below the surface.



Fig. 19, Site in Island County



Fig. 20, Cut stem plot with tarp in place

Revisited the plots on August 21, 2008 (12 MAT).

- Relocated the plots which was difficult due to the density of the untreated plants.
- The untreated plants and the control plot were in flower and there were no seeds present.
- The tarps were pulled back and there were no visible plants growing in either treatment plot.
- Roots/rhizomes were encroaching from adjacent non-treated plants however they were not turned up and were not trying to break through the tarp (see figures 21 and 22).
- The treatment plots were recovered with the tarps.



Fig. 21 & Fig. 22, Roots present under the tarps

Revisited the plots on September 25, 2009 (25 MAT).

- Relocated all plots (see figure 23).
- The untreated plants and the control plot were post-flowering stage and producing seeds.
- The tarps were removed from treatment plots.
- Both treatment plots still had no visible plants growing under the tarp area.
- As with the August visit, there were white roots/rhizomes under the tarps but it was unclear whether they were generated by the controlled plants or were encroaching from adjacent non-treated plants (see figure 24).
- See Table 3 for a summary of the treatments.



Fig. 23, Cut plant plot before tarp removal



Fig. 24, Roots under the tarps

Table 3: Summary of cover treatments at Island County site.

Date	Plot 1	Plot 2	Plot 3
8-7-07	South plot Cut plants off near ground level with hand clippers, cleared stems and covered with tarp	Middle plot Control	North plot Knocked plants over (trampled) and covered with tarp
8-21-08	Removed tarp. No visible live green plants. Roots were encroaching from adjacent plants. Replaced tarp.	Virtually 100% hwh cover	Removed tarp. Results same as for plot #1. Replaced tarp.
9-25-09	Tarp still intact. No plants poking through the tarp. Many roots and rhizomes present. Unclear if encroaching from plants adjacent to the control plot or from the roots of the original controlled plants.	Virtually 100% hwh cover	Same as plot #1

Biological Control – There are no known classically introduced biological controls for hairy willow-herb. However in June 2005, the moth, *Mompha epilobiella*, was collected in a hairy willow-herb population in Island County by Jennifer Andreas, Integrated Weed Control Project Director, WSU. This was the first known North American record. Since that time, the moth was found in all Western Washington hairy willow-herb sites, and the distribution may be more widespread than originally thought.

The adult moths are commonly noticed in July and August. The larval stage of this moth is destructive to hairy willow-herb. The larvae, probably not true leaf rollers, are found in the terminal bud of the auxiliary stems. Other leaf material is used for protection, as part of its home. The impact by the larva damages the flower buds and fresh new growth all the way up the stem. There is damage later in the year to the flowers.

More research is needed to determine whether the moths are a viable means of control.

Education/Communication Components

15,000 postcards were developed and printed. These postcards are currently being distributed to nurseries, county weed boards and state, federal, and tribal land management agencies. The cards will be available online at the WSNWCB website.

Project Results

All of the original project goals were met or exceeded.

Control with several different herbicides and combinations of herbicides appear to be very effective and are recommended for sites that have more than a few plants. The selection of which herbicide(s) to use is dependent upon the treatment site.

Covering/tarping seems to be a viable option for sites having a few plants. It is important that all of the plants at the site be covered. There appears to be no difference in whether the plants are cut, mowed or trampled prior to having the tarps installed. Keeping the covers in place throughout the entire growing season is important as is repairing any holes that might occur in the tarps.

Although field trials were not conducted for hand pulling/grubbing, if all plants and plant parts including all root and rhizome fragments can be removed this would be a viable control option for small sites.

Anecdotal observations appear to show that repeated mowing may at least reduce the overall population and should eliminate or reduce seed production. Care must be taken to prevent spreading propagules via mowing equipment.

Biological control is not currently available however an accidentally introduced moth may provide some damage to plants.

Printing 15,000 postcards exceeded the original goal of 3,000 and they are currently being distributed statewide to nurseries, county weed boards and state, federal and tribal agencies.

Proposed Management for Future Years

Hairy willow-herb is currently listed as a Class “C” noxious weed in Washington State. Taking into account the results of this project; (1) that except in a few areas this plant does not appear to be widely spread in Washington and (2) it appears to be effectively controlled by several herbicides and by covering/tarping, it may be prudent to pursue reclassification of this species to Class “B” status. WSDA staff will present the results of this report to the Noxious Weed Committee of the Washington State Noxious Weed Control Board at their next meeting and request that the committee make such a change to the classification. Control could be required in all areas of the state with the exception of Island and perhaps Whatcom, Klickitat and Franklin counties. Other affected counties have reported having less than 10 acres each and should be working toward eradication. This would help prevent the spread to non-infested regions of the state. This species is already included on WSDA’s quarantine list making it illegal to buy, sell or transport plants or plant parts thereby reducing the chances of intentional introduction.

The extensive infestation at Crockett Lake will continue to be a problem as it is a politically sensitive site with several property owners. It is located in Ebey's Landing National Historical

Preserve and according to the U.S. Fish and Wildlife Service, the lake is an important habitat for resident and migratory birds, and provides estuarine rearing and foraging habitat for salmonids and other fish species. Reportedly the Audubon Society is opposed to the use of herbicide's which adds to the challenge of controlling this infestation. It would be advisable to form a working group to develop a plan for addressing the hairy willow-herb at Crockett Lake. Staff from WSDA will work with staff from the Island County Weed Board, the Washington State Noxious Weed Board, the Department of Ecology and other interested parties (such as The Whidbey Camano Land Trust, Audubon Society, Nature Conservancy, National Park Service, etc.) to explore the potential for forming a Cooperative Weed Management Area or other cooperative partnership to begin to address this issue.

APPENDIX A – Current known distribution of hairy willow-herb in Washington State

Hairy Willow-herb (*Epilobium hirsutum*) Distribution in Washington State

(12/27/09)



No warranty is made by WSDA as to the accuracy, reliability, or completeness of this data for individual or aggregate use with other data. Data was compiled from County, National Weed Control Board staff, WSU Cooperative Extension, and other sources. This product may be updated without notification. Informational use only. Not for legal use.



APPENDIX B – Hairy willow-herb postcard

Front View

Have you seen this invasive plant?
Hairy willow-herb is a wetland plant that grows 3-6 feet tall with pink-purple flowers and long, tapered leaves placed opposite on the stem.
Learn more at www.nwcb.wa.gov

Flowers bloom in early spring, are 1/2 inch across, and have four heart-shaped petals.

Opposite leaves lack stalks and clasp the stem, and the entire plant is covered with soft hairs.

Seed pods are long and slender and tiny seeds have long, wispy hairs attached.

Logos: WSDA, WASHINGTON STATE UNIVERSITY EXTENSION, UAS, Washington State Noxious Weed Control Board

Back View

Why is hairy willow-herb (*Epilobium hirsutum*) a noxious weed?

- This non-native plant outcompetes wetland plants, reducing food sources and habitat for local wildlife.
- If hairy willow-herb is not controlled, it will continue to spread in wetlands of both eastern and western Washington.

Where do you find hairy willow-herb?

- Thriving and dominating in wetlands and along roadsides, in ditches, and in gardens.

What can you do?

- Learn to identify this Class B noxious weed. At first glance it may look similar to our native fireweed, but it's easy to learn how to tell them apart.
- Do not buy it and plant it in your garden.
- Check with your county weed control board to see if control is required in your area.
- Remove individual plants, including rhizomes when possible. For larger sites, develop a management plan that combines several control methods.
- Please report any sightings to your county noxious weed control board or to noxiousweeds@agr.wa.gov.

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APPENDIX C – Photo Credits

Fig. 1, 20, 21, 22, 23, 24, - Bridget Simon, WSDA

Fig. 2, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 – Jenifer Parsons, Ecology

Fig. 3, 4 - Susan Horton, Island County Noxious Weed Board

Fig. 5, 19 - Greg Haubrich, WSDA

Fig. 6 – Laurel Baldwin, Whatcom County Noxious Weed Board