

# **Integrated Weed Management Strategy Focusing on Early Detection/Rapid Response for the Kenai Peninsula - Cooperative Weed Management Area<sup>1</sup>**

**December, 2007<sup>2</sup>**

## **I. INTRODUCTION:**

A common operating approach to the management of noxious weeds and other invasive plants is to focus strictly on specific sites. Infestations may be treated, but the relationship of the treatment to the entire problem in an area is not addressed. In addition, individual landowners and managers in a given area attempt to manage invasive plant species based on narrowly defined objectives, independent of each other.

Treatment of specific invasive plants and sites remains a critical component of an effective strategy. However, successful long-term solutions to the problem of invasive plants and noxious weeds must include a broad-scale approach to weed management. A cooperative weed management area is a broad-scale, landscape approach that places specific species and treatment sites in context with geographic distribution of invasive plants, susceptible habitats and feasibility of management. The focus of the weed management area is to find solutions to invasive plant problems across a landscape, rather than strictly focusing on treatments within specific land ownerships.

The Kenai Peninsula - Cooperative Weed Management Area (KP-CWMA) was convened in 2003 by Soil and Water Conservation Districts on the Peninsula in partnership with US Forest Service – State and Private Forestry. The CWMA is composed of all relevant and interested agencies, organizations, tribal landowners and other groups throughout the Peninsula through a signed cooperative agreement, referred to as the Memorandum of Understanding (MOU), which formally recognizes the organization and intent of the group. The following plan further outlines the strategic, landscape approach with an emphasis on early detection and rapid response to specific invasive plant species on the Kenai Peninsula in Southcentral Alaska.

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<sup>2</sup> Plan updated April 2010

## **II. PURPOSE:**

The KP-CWMA is intended to bring together those responsible for invasive plant management within the region, to develop common management objectives, set realistic management priorities, facilitate effective treatment, and coordinate efforts along logical geographic boundaries with similar land types, use patterns and problem species.

## **III. COOPERATIVE WEED MANAGEMENT AREA GOALS:**

The following are the four primary goals of the CWMA:

1. Prevent the introduction, reproduction and spread of designated noxious weeds<sup>3</sup> and other invasive<sup>4</sup> plants into and within the KP-CWMA.
2. Reduce the extent and density of newly established invasive plants to minimize spread and damage to natural resources.
3. Implement the most economic, effective and safe control methods for priority species.
4. Facilitate cooperation among those working to manage invasive plants on the Kenai Peninsula.

## **IV. TECHNICAL ADVISORY COMMITTEE:**

Cooperators of the weed management area currently include agencies, non-profit organizations, tribal entities and other interested and concerned groups. An advisory committee has been organized from interested cooperators to jointly accomplish the following:

- Develop and maintain an up to date, comprehensive inventory of invasive plant species recorded on the Peninsula;
- Establish control priorities and develop specific management objectives;
- Develop priorities for area-wide informational, educational, and public awareness material;
- Coordinate the efficient use of resources and personnel to treat designated infestations; and
- Ensure science-based management of designated invasive plants utilizing an integrated approach.

## **V. COOPERATIVE WEED MANAGEMENT AREA BOUNDARIES:**

The initial group involved in development of the CWMA agreed that it should include the entire contiguous Kenai Peninsula. Although a large area, the Peninsula is a discrete region, bounded by natural barriers to weed invasion on nearly all sides by the Cook Inlet, Turnagain Arm, Blying Sound and Prince William Sound. Consequently, including the entire Peninsula in the CWMA encompasses all areas of immediate concern, allowing

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<sup>3</sup> Noxious weeds are problematic species listed by various US states and by the Federal Noxious Weed Act of 1974.

<sup>4</sup> Invasive species are defined by Executive Order 13112.

for maximum impact of time invested in planning and helping to prioritize limited resources. To facilitate the management of information and cooperation among landowners the CWMA is divided into logical management units based on Federal land management boundaries and Soil and Water Conservation District boundaries which include Borough, State, tribal and private lands.

These units are:

Chugach National Forest

Kenai National Wildlife Refuge

Kenai Fjords National Park

Homer Soil and Water Conservation District

Kenai Soil and Water Conservation District

Alaska Soil and Water Conservation District

Recognizing that different regions within the Peninsula may have different specific invasive plant problems and slightly different scopes of interest, regional units within the CWMA will provide localized support and coordination in order to maintain long-term stewardship for a particular area. A map of the CWMA and associated management units is included in Appendix A.

## **VI. INVASIVE PLANTS CURRENTLY RECORDED WITHIN THE KENAI PENINSULA – COOPERATIVE WEED MANAGEMENT AREA**

A number of non-native plant surveys have been completed within the KP-CWMA, focusing primarily on disturbed habitats along roadways and trails where exotic species are likely to establish (Duffy, 2003; DeVelice, 2004; Kreideman, 2004; Chumley & Klausner, 2005; Barnett and Simonson, 2007). A few efforts have also been made to sample backcountry sites on the Peninsula and to extract records from existing vegetation datasets (US Fish and Wildlife Service, 2006). Although most current survey data are somewhat biased towards areas of likely establishment and have been completed using both systematic and non-systematic methods - they provide a reasonable baseline on which to prioritize regional management activities. Survey results and other non-native plant records are currently available through the Alaska Exotic Plant Inventory Clearinghouse database at <http://akweeds.uaa.alaska.edu>.

For the purposes of this plan, a current list of exotic plant species recorded on the Peninsula was prepared from the database source listed above. A final list of invasive plants for the KP-CWMA (listed in Table 1) was created from those exotic plant species listed to be “of the greatest concern for Alaska” (AKEPIC, 2005). A few species were also included because of their particular biology, status as a noxious weed elsewhere or the potential for spread in habitats common to the Peninsula. The purpose of the list below, and the intent of this plan, is to narrow the list of species for coordinated management to those that are considered highly invasive (Table 1) and of limited distribution (“new invaders” listed in Table 2).

**TABLE 1: NON-NATIVE PLANT SPECIES RECORDED ON THE KENAI PENINSULA WITH ALASKA NATURAL HERITAGE PROGRAM INVASIVNESS RANKING (UPDATED APRIL, 2010)**

USDA CODE	Latin Name	Noxious Weeds <sup>1</sup>	AK Noxious Weed <sup>2</sup>	Common Name	AKNHP RANKING <sup>3</sup>
ACPT	<i>Achillea ptarmica</i>			sneezeweed	46
ANCO2	<i>Anthemis cotula</i>			stinking chamomile	41
BRINI	<i>Bromus inermis ssp. inermis</i>			smooth brome	62
BRTE	<i>Bromus tectorum**</i>	✓		cheatgrass	78
CABU2	<i>Capsella bursa-pastoris</i>	✓		sheperd's purse	40
CAAR18	<i>Caragana arborescens</i>			Siberian peashrub	66
CEBI2	<i>Centaurea stoebe ssp. micranthos</i>	✓		spotted knapweed	86
CEFOV2	<i>Cerastium fontanum ssp. vulgare</i>	✓		big chickweed	39
CHALA	<i>Chenopodium album var. album</i>	✓		lamb's quarters	35
CIAR4	<i>Cirsium arvense</i>	✓	✓	Canada thistle	76
CIVU	<i>Cirsium vulgare</i>	✓		bull thistle	61
CRETE3	<i>Crepis tectorum</i>			narrowleaf hawkweed	54
CYSC4	<i>Cytisus scoparius</i>	✓		scotch broom	69
DAGL	<i>Dactylis glomerata</i>			orchard grass	53
ELRE4	<i>Elymus repens</i>	✓	✓	quackgrass	59
GABI3	<i>Galeopsis bifida</i>			splitlip hempnettle	40
GATE2	<i>Galeopsis tetrahit</i>		✓	brittlestem hempnettle	40
HIAU	<i>Hieracium aurantiacum</i>	✓		orange hawkweed	79
HICA10	<i>Hieracium caespitosum</i>	✓		meadow hawkweed	79
HIUM	<i>Hieracium umbellatum</i>			narrowleaf hawkweed	46
HOJU	<i>Hordeum jubatum</i>			foxtail barley	63
IMGL	<i>Impatiens glandulifera</i>	✓		ornamental jewelweed	82
LEDE	<i>Lepidium densiflorum</i>			common pepperweed	25
LEVU	<i>Leucanthemum vulgare</i>	✓		oxeye daisy	61
LIVU2	<i>Linaria vulgaris</i>	✓	✓	butter and eggs	69
LOPEM2	<i>Lolium perenne spp. multiflorum</i>			Italian rye grass	41
MADI6	<i>Matricaria discoidea</i>			pineapple weed	32
MEOF	<i>Melilotus officinalis &amp; alba</i>			sweetclover	65
PHAR3	<i>Phalaris arundinacea</i>		✓	reed canarygrass	83
PHPR3	<i>Phleum pratense</i>			timothy	56
PLMA2	<i>Plantago major</i>		✓	common plantain	44
POAN	<i>Poa annua</i>		✓	annual bluegrass	46
POCO	<i>Poa compressa</i>			Canada bluegrass	39
POPRI2	<i>Poa prantensis ssp. irrigata</i>			spreading bluegrass	52
POPRP2	<i>Poa prantensis ssp. pratensis</i>			Kentucky bluegrass	52

USDA CODE	Latin Name	Noxious Weeds <sup>1</sup>	AK Noxious Weed <sup>2</sup>	Common Name	AKNHP RANKING <sup>3</sup>
POAV	<i>Polygonum aviculare</i>			prostrate knotweed	45
PRPA5	<i>Prunus padus</i>			European bird cherry	74
RAACA3	<i>Ranunculus acris var. acris</i>			showy buttercup	54
RARE3	<i>Ranunculus repens</i>			creeping buttercup	54
RUAC3	<i>Rumex acetosella</i>			sheep sorrel	51
RUCR	<i>Rumex crispus</i>			curly dock	48
RULO2	<i>Rumex longifolius</i>			dooryard dock	48
SEVU	<i>Senecio vulgaris</i>			common groundsel	35
SILAA3	<i>Silene latifolia ssp. alba</i>			bladder campion	45
SINO	<i>Silene noctiflora</i>			nightflowering silene	45
SOAR2	<i>Sonchus arvensis</i>	✓	✓	perennial sowthistle	61
SOAU	<i>Sorbus aucuparia</i>			European mountain ash	59
SPAR	<i>Spergula arvensis</i>			corn sandspurry	32
STME2	<i>Stellaria media</i>			common chickweed	42
TAVU	<i>Tanacetum vulgare</i>	✓		common tansy	57
TAOFO	<i>Taraxacum officinale spp. officinale</i>			common dandelion	58
TRHY	<i>Trifolium hybridum</i>			alsike clover	57
TRPR2	<i>Trifolium pratense</i>			red clover	53
TRRE3	<i>Trifolium repens</i>			white clover	59
TRPE21	<i>Tripleurospermum perforata</i>			scentless false mayweed	48
VICR	<i>Vicia cracca</i>	✓		bird vetch	75

<sup>1</sup> **Noxious Weeds** – Species currently listed as noxious weeds by one or more states in the US according to the USDA Plants Database at <http://plants.usda.gov>

<sup>2</sup> **AK Noxious Weeds** – Also currently listed as a noxious weed by Alaska State Statute (11 AAC 34.020)

<sup>3</sup> **KNHP Ranking** is an Alaska-specific invasiveness ranking (a high rank indicates greater invasiveness) provided by the Alaska Natural Heritage Program. Current ranking and methodology available at: [http://akweeds.uaa.alaska.edu/akweeds\\_ranking\\_page.html](http://akweeds.uaa.alaska.edu/akweeds_ranking_page.html).

\*\* Historical record from Kenai National Wildlife Refuge herbarium, 1958

## **VII. INTEGRATED MANAGEMENT SYSTEM FOCUSING ON EARLY DETECTION AND RAPID RESPONSE:**

Integrated weed management "... is a system for the planning and implementation of selected methods of management for preventing, containing, or controlling undesirable plant species or group of species using all available strategies and techniques." (Federal Noxious Weed Act, 1974).

Together these strategies and techniques are economically and environmentally more effective than any single option. Control methods are available and prescribed on a species/infestation specific basis. Elements of integrated management included in this plan are: prevention and education/awareness, early detection and rapid response, inventory, treatment and monitoring.

### **A. Prevention and Education/Awareness**

Prevention measures are practices that reduce the potential for the introduction, establishment and spread of weeds. Because prevention is the most cost effective and successful way to manage noxious weeds. It is considered a high priority for strategic planning. The following list of land management activities are key areas to implement prevention methods, including, but not limited to:

- Timber management
- Road and railroad construction/reconstruction and maintenance
- Construction and use of sand and gravel extraction sites
- Range management activities
- Recreational activities (including construction and maintenance of recreational sites, and areas of concentrated use such as campsites, trailheads and trails, and off-road vehicle use)
- Mining activities
- Wildlife management and enhancement projects
- Fire suppression and rehabilitation
- Farm management

Education and awareness programs foster public understanding of the threat invasive, exotic plants can pose to the diverse natural resources of the Kenai Peninsula. Education can also help describe the techniques used to manage weeds and the role humans can play in the dispersal and establishment of invasive weeds. Education also includes the training of district and agency personnel, private landowners and the general public in weed identification, management techniques, monitoring protocols and other skills needed for the management of noxious and invasive weeds. Awareness provides an important first step in the detection of new invaders. Education efforts for the KP-CWMA will focus on new and potential invaders (Table 2) to improve awareness of these species and facilitate public reporting of early infestations as part of an early detection network.

## B. Early Detection/Rapid Response

After prevention activities, early detection and rapid response is considered the next highest priority to mitigate the introduction and spread of invasive weeds. The goal for early detection and rapid response is to find incipient populations of invasive plants and eradicate them before they begin to spread. This approach, as defined by the National Invasive Species Council (2003), is the most effective means for eradicating invasive species and is intended to be the keystone of invasive plant management within the KP-CWMA. Many of the necessary elements of an early detection and rapid response system currently exist for the Peninsula. This includes several baseline inventories for non-native plants within the KP-CWMA and tools for assessing current and future weed infestations such as species-specific invasiveness rankings.

## C. Inventory

The collection, documentation, and storage of information (i.e. inventory) of the extent and location of invasive weeds within the KP-CWMA are a critical part of integrated management. A current inventory of weed species provides necessary information for establishing site-specific and regional priorities, management objectives, and for prescribing treatment methods.

## D. Treatment Methods

Under the integrated approach, all control methods are considered. It is typically the use of all appropriate options, with respect to a particular species, in combination that results in the most successful control program. Specific treatment prescriptions are determined by the biology of the particular plant species, site characteristics and management objectives. Successful management and eradication of invasive plant infestations typically require several years of treatment and follow-up monitoring. The following management techniques of noxious weed control will be considered on a site-specific and plant species basis:

**Physical/Mechanical:** The use of physical or mechanical methods for weed control can be effective on small infestations of annual or biennial species. Hand grubbing, mowing, tilling, and burning are commonly used to physically destroy weeds or interfere with their reproduction. To be effective, treatment must typically take place before seed production. Plants that have flowered must be removed from the site and destroyed. Repeated mowing or tilling during the growing season is required with most weed species. Generally this approach is not recommended as a sole method for control of species that spread vegetatively.

**Chemical:** Herbicides are an effective and efficient tool for the control of noxious weeds. Chemical control methods, along with appropriate cultural practices, are likely to be the best option for larger infestations and for tough to control perennial species. Herbicide application and rates are dependent on specific site characteristics, target plant, location, non-target vegetation and land use. Herbicides are a particularly important method of treatment when complete eradication of a plant population is the management objective. Treatment at the earliest stage of invasion will greatly reduce the future need for additional herbicide applications. It is critical to follow all label instructions, site-specific directions and safety precautions when using any herbicide.

**Cultural/Land Use:** Cultural practices are activities that purposefully enhance and maintain the growth of desired vegetation. Practices that retain, enhance, or introduce desirable plant species that out-compete exotic plant species can serve as important prevention and control measures. Examples that are applicable include seeding, planting, fertilizing and retaining brush and tree canopy cover where appropriate. Grazing prescriptions that are designed to maintain or enhance perennial vegetation in a healthy state or maintain soil cover is an important practice in slowing the spread of invasive plants. Minimizing the extent and duration of exposed soil during management actions can also reduce the risk of weed establishment.

**Biological:** Biological weed control involves the deliberate introduction and establishment of natural enemies to reduce the target plant's competitive or reproductive capacities. Insects are the most common agent released against noxious weeds. Plant pathogens, such as fungi, are increasing in use. Sheep and goats have also been effective in reducing densities and limiting spread of specific weed species. Biological control can be a slow process, often requiring 10 to 20 years to be effective. Its purpose is not eradication but a reduction in densities and rate of weed spread to an acceptable level. It is most effective on dense weed infestations over large areas. As such, this is not expected to be a treatment option in the near future for the KP-CWMA.

## E. Monitoring

Monitoring is the collection of information to determine the effectiveness of management actions in meeting the prescribed objectives. Noxious weed management focuses upon density and rate of spread of invasive exotic plant species and the effect these aggressive plants have on natural resources. If eradication is a management goal, monitoring of the site for several years following treatment is essential. A species is considered to be locally eradicated when the seed bank, based on persistence reported in scientific literature, has been

extinguished. Persistent species will likely take five or more years of follow-up control and monitoring.

Cooperators are also interested in the effectiveness of prescribed actions on the target plant and the response of desirable vegetation. Monitoring will help determine if treatments and management activities are accomplishing the goals and objectives established by KP-CWMA partners.

## **VIII. SPECIES CLASSIFICATION, PRIORITIZATION AND MANAGEMENT OBJECTIVES:**

The following species classifications are based on current inventory data collected within the KP-CWMA. This list will be updated as needed with approval of the KP-CWMA Technical Advisory Committee and revised no later than January, 2012.

### **A. Invasive and Noxious Weed Classification:**

- **Established Invaders:** Invasive plant species firmly established and somewhat wide spread throughout the KP-CWMA.
- **New Invaders:** Invasive plants found to occur in the KP-CWMA with very limited distribution and density. For these species, eradication is currently considered a feasible goal for certain management units.
- **Potential Invaders:** Invasive plants not known to be located within the KP-CWMA but occurring in other regions of Alaska or considered to have imminent potential for introduction and pose a future threat to resources.

**Table 2: INVASIVE AND NOXIOUS WEED SPECIES CLASSIFICATION - (UPDATED APRIL, 2010)**

Established Invaders	New Invaders	Potential Invaders to the KP-CWMA	Potential Invaders not yet recorded in Alaska
Orange hawkweed* <i>Hieracium auranticum</i>	Cheat grass** <i>Bromus tectorum</i>	Purple loosestrife* <i>Lythrum salicaria</i>	Cordgrass <i>Spartina alterniflora</i>
Quackgrass* <i>Elymus repens</i>	Canada thistle* <i>Cirsium arvensis</i>	Garlic mustard <i>Alliaria petiolata</i>	Giant hogweed <i>Heracleum mantegazzianum</i>
Hempnettle* <i>Galeopsis spp.</i>	Bull thistle <i>Cirsium vulgare</i>	Tansy ragwort <i>Senecio jacobaea</i>	Leafy spurge* <i>Euphorbia esula</i>
Butter and Eggs* <i>Linaria vulgaris</i>	Meadow hawkweed <i>Hieracium caespitosum</i>	Winter vetch <i>Vicia villosa</i>	Eurasian watermilfoil <i>Myriophyllum spicatum</i>
Reed Canary grass <i>Phalaris aurundinacea</i>	Mouse ear hawkweed <i>Hieracium pilosella</i>	Japanese knotweed <i>Polygonum cuspidatum</i>	White waterlily <i>Nymphaea odorata ssp. odorata</i>
Bird Vetch* <i>Vicia cracca</i>	Narrowleaf hawkweed <i>Hieracium umbellatum</i>	Giant knotweed <i>Polygonum sachalinense</i>	Hydrilla <i>Hydrilla verticillata</i>
Oxeye daisy <i>Leucanthemum vulgare</i>	Ornamental jewelweed <i>Impatiens glandulifera</i>	Bohemian knotweed <i>Polygonum x bohemicum</i>	Perennial pepperweed <i>Lepidum latifolium</i>
	Perennial sowthistle* <i>Sonchus arvensis</i>	Himalayan blackberry <i>Rubus discolor</i>	False brome <i>Brachypodium sylvaticum</i>
	Scentless false mayweed <i>Tripleurospermum perforate</i>	Western salsify <i>Tragopogon dubious</i>	European (black) alder <i>Alnus glutinosa</i>
	Common tansy <i>Tanacetum vulgare</i>	Spotted knapweed <i>Centaurea stoebe ssp. micranthos</i>	Musk (plumeless) thistle <i>Carduus nutans</i>
	Sweetclover <i>Melilotus alba &amp; officinalis</i>	Scotchbroom <i>Cystis scoparius</i>	Leporinum barley <i>Hordeum murinum ssp. Leporinum</i>
	Creeping buttercup <i>Ranunculus repens</i>		Dalmation toadflax <i>Linaria dalmatica</i>
	Narrowleaf hawksbeard <i>Crepis tectorum</i>		Sulfur cinquefoil <i>Potentilla recta</i>
	Fall Dandelion <i>Leontodon autumnalis</i>		Dwarf eelgrass <i>Zostera japonica</i>
	Wild Buckwheat* <i>Polygonum convolvulus</i>		

\*Currently listed as a prohibited or restricted noxious weed by Alaska State Statute (11AAC 34.020)

\*\* Historical record from Kenai National Wildlife Refuge herbarium, 1958

Currently, Federal land management agencies within the KP-CWMA are at various stages in the process of planning invasive plant management efforts. The US Forest Service has developed an Invasive Plant Management Plan that identifies the overall goals of management within the Chugach National Forest (DeVelice et al., 2005). Although management objectives and specific priorities are not identified in the Plan, the Seward Ranger District has developed a list of species for potential eradication (E. Bella, pers. comm.).

The Kenai National Wildlife Refuge is currently preparing an invasive plant management plan and pesticide use permit for implementation in 2008. The goal of this plan will be to protect the interior of the refuge by keeping trail heads, public boat launches, heavy equipment yard, airport hangar, and the float plane launch on Headquarters Lake free of invasive plants. New regulations will be proposed to mandate certified weed-free forage for horse packers. Additionally, the refuge will work with the industrial operators of the Swanson and Beaver Creek oil and gas units to contain and, in some cases, eradicate invasive plant species (J. Morton, pers. comm.).

National Park Service is currently preparing an invasive plant management plan and environmental assessment for all Alaska National Parks which will provide guidance for management of invasive plants within Kenai Fjords National Park. The Park is currently managing the two species recorded in the Park, listed in Table 3, for eradication (J. Heys, pers. comm.).

The regional management objectives in Table 3 have been proposed based on current survey data and are intended to be a guideline for the coordination of common management objectives within the CWMA. It is recognized that land management agencies will independently develop future plans for management. This Plan does not directly affect the development of agency management objectives and priorities.

However, the intention of the CWMA and this plan is that proposed priorities and objectives will be adopted by land management agencies for coordinated management. If adopted, this will begin to focus resources where they are the most effective and to manage the following species and other future incipient invaders for Peninsula-wide eradication: bull thistle, Canada thistle, mouseear hawkweed, ornamental jewelweed, perennial sowthistle, scotchbroom and spotted knapweed.

#### **B. General Management Priorities for the Kenai Peninsula Cooperative Weed Management Area:**

1. Prevent the establishment of potential invaders (refer to Table 2 for classification of species as established, new and as potential invaders).
2. Eradicate new invaders and any species subsequently introduced from the list of potential invaders (early detection/rapid response).

3. Treat transportation corridors and areas of concentrated activities, such as roads, trails, campgrounds, trailheads parking lots and gravel pits and/or treat satellite infestations.

4. Reduce the density or slow the spread of widespread established invaders.

#### C. Management Objective Definitions:

- Eradicate. The noxious or invasive weed species is eliminated from the KP-CWMA, including all viable seeds and/or vegetative propagules.
- Control. Seed production is prevented throughout the target patch, and the area coverage of the weed is decreased over time. Prevent the weed species from dominating the vegetation of the area but accept low levels of the weed.
- Contain. Weeds are geographically contained and are not increasing beyond the perimeter of the infestation. Treatment within established infestations may be limited, but populations are controlled or eradicated outside those areas.

**TABLE 3: MANGEMENT OBJECTIVES FOR INVASIVE PLANTS BY KENAI PENINSULA - CWMA  
MANAGEMENT UNITS (UPDATED APRIL, 2010)**

Invasive Plant:	Chugach NF	Kenai NWR	Kenai Fjords NP	Homer SWCD	Kenai SWCD	Alaska SWCD*
bird vetch <i>Vicia cracca</i>	contain	eradicate		eradicate	contain	eradicate
bull thistle <i>Cirsium vulgare</i>				eradicate		
butter and eggs <i>Linaria vulgaris</i>	control	eradicate	eradicate	contain	contain	control
Canada thistle <i>Cirsium arvense</i>				eradicate	eradicate	
cheat grass <i>Bromus tectorum</i>		**				
common tansy <i>Tanacetum vulgare</i>	control	eradicate		eradicate	control	
hempenettle (spp.) <i>Galeopsis bifida and tetrahit</i>	control	contain		contain	contain	eradicate
meadow hawkweed <i>Hieracium caespitosum</i>		contain				
mouseear hawkweed <i>Hieracium pilosella</i>					eradicate	
narrowleaf hawkweed <i>Hieracium umbellatum</i>	eradicate	control			contain	
orange hawkweed <i>Hieracium aurantiacum</i>	eradicate	eradicate		contain	contain	
ornamental jewelweed <i>Impatiens glandulifera</i>					eradicate	
oxeye daisy <i>Leucanthemum vulgare</i>	control	eradicate	eradicate	contain	contain	control
perennial sowthistle <i>Sonchus arvensis</i>	eradicate			eradicate		
quackgrass <i>Elymus repens</i>	control	contain		contain	contain	control
reed canarygrass <i>Phalaris arundinacea</i>	eradicate	control		contain	contain	

Invasive Plant:	Chugach NF	Kenai NWR	Kenai Fjords NP	Homer SWCD	Kenai SWCD	Alaska SWCD*
scentless false mayweed <i>Tripleurospermum perforata</i>	control	eradicate		eradicate		eradicate
scotch broom <i>Cytisus scoparius</i>		eradicate				
spotted knapweed <i>Centaurea stoebe ssp. micranthos</i>						
sweetclover (ssp.) <i>Melilotus officinalis &amp; alba</i>	control	contain		eradicate	eradicate	eradicate
<p>Note: Blanks indicate that the species has not currently been recorded in the management unit. If these species are subsequently detected or reported the management objective will be eradication.</p> <p>*Alaska SWCD includes all private lands in Hope, Coopers Landing, and Seward.</p> <p>**Historical record from Kenai National Wildlife Refuge herbarium, 1958</p>						

Refer to Page 10 for management definitions. Within any Containment Area, if satellite infestations appear beyond the containment line, the management objective for that outbreak is to eradicate. Species currently recommended for Peninsula-wide eradication are: bull thistle, Canada thistle, mouseear hawkweed, ornamental jewelweed, perennial sowthistle, scotchbroom and spotted knapweed.

## **IX. SPECIFIC MANAGEMENT RECOMMENDATIONS:**

### **A. Education/Awareness**

Creating awareness of the threat to Kenai Peninsula resources and the need to manage weeds will provide the foundation for active treatments, early alert programs, and prevention practices. Continued education of practitioners may ensure that effective strategies and new technologies will be incorporated into management actions. Efforts should generally focus on those species that are new or potential invaders to increase the likelihood of identifying and eradicating infestations early in their establishment. The following Education/Awareness focus will be incorporated into the KP-CWMA strategy for managing noxious weeds:

1. Conduct annual invasive weed workshop and tours.
2. Develop and maintain a weed management display for public gatherings such as fairs, expos, conventions, and shows. Current focus includes Kenai Peninsula State Fair, Kenai River Festival and various garden and home shows.
3. Develop interpretive signs to alert the general public of the threat of weeds and the efforts in the CWMA.
4. Post weed identification signs and other outreach materials at trailheads, road turnouts, and other public places.
5. Conduct periodic weed pull events that include groups such as garden clubs, Boy Scouts, and recreation clubs.
6. Provide presentations to classrooms and special interest groups such as horse council, Off Highway Vehicles (OHV) groups, fishing groups etc.
7. Develop brochures and pamphlets specific to the CWMA. Examples include weed-free feeds, early alert posters, and local overview of existing weeds.
8. Facilitate communication and coordination of cooperators and partners in the CWMA.
9. Develop demonstration plots for treatment and management techniques.
10. Develop annual accomplishment briefs for the KP-CWMA Technical Advisory Committee about current projects and programs.

## B. Recommended Prevention Strategies

Cooperators will strive to integrate appropriate prevention measures into management activities and promote the use of practices that reduce rates of weed spread throughout the KP-CWMA. Cooperators will work with agencies, organizations, and individuals in the development and implementation of prevention practices that could be effective in reducing dispersal and establishment. The following measures are provided as examples. Adopted practices need not be limited to those listed below.

1. Minimize disturbance in areas or habitats highly susceptible to weed invasion.
2. Use native plant species when practicable and when conditions are not favorable for natural succession to a vigorous native plant community following disturbance.
3. Encourage the use of high quality seed that is free of noxious weeds. Consider having the seed tested for “all state noxious weeds”, prior to planting.
4. Promote and support the use of “certified noxious weed free”, and/or other weed free feeds.
5. Keep gravel pits free of weeds. Noxious weed risks should be considered during new pit and/or road construction. The placement of gravel from infested pits should be mitigated through early monitoring and necessary treatment.
6. Clean equipment and vehicles, by washing or the use of compressed air, when transporting between sites (including logging equipment if the equipment is to be used off road).
7. Manage high human use areas, such as campgrounds, trailheads, turnouts, parking lots, equipment yards, scaling sites, in a weed-free state.
8. Maintain existing weed free areas.
9. Maintain rangeland and open forest sites in healthy condition.
10. Maintain existing tree and brush cover, where practicable and appropriate.
11. Limit access through heavily infested areas, where feasible.

12. Maintain road shoulders or drainage ditches that are covered by desirable herbaceous cover. If disturbed, they should immediately be reseeded with an appropriate, weed-free seed mix.
13. Provide guidance for road maintenance practices, such as mowing prior to seed set to prevent the spread of noxious weeds.
14. Avoid use of sites infested with invasive weeds as staging areas for large projects such as fires, construction, landings, gravel stockpiles, etc.
15. Provide invasive and noxious weed identification training and discuss the connection between weed spread and human activities.
16. Reduce risk of transporting invasive and noxious weed seed via livestock by:
  - Placing livestock in a transition pasture free of designated weeds for at least 14-20 days prior to moving animals to non-infested areas. Maintain the transition pasture in a weed free state.
  - Moving animals to weed free areas after the animal has shed.
  - Hosing down the legs of livestock as they move through a handling corral.
  - Avoid moving livestock through infested areas.
  - Grazing livestock in weed infested areas when weeds are not flowering or producing seeds.
17. Reduce risk of spreading weeds by pack and saddle stock.
  - Feeding pack and saddle stock “certified noxious weed free” feed for at least two to three days prior to traveling in the backcountry.
  - Brushing stock to remove any weed seed.
  - Excluding stock from dense weed sites, where the risks are high that the animals will spread the weeds off site.
18. Maintain an early alert program where cooperators and interested public communicate the location of potential invasive plants or locations of new invasive plant infestations.
19. Develop and maintain an inter-agency team that can appropriately respond to incipient infestations from the list of new and potential invaders.

### C. Inventory

A coordinated weed inventory should be maintained for the entire management area as funding and personnel allow. At a minimum, the inventory will include

information required to meet standards of the Alaska Exotic Plant Information Clearinghouse (AKEPIC Collaborators Manual, 2005). The agencies involved will be responsible for furnishing necessary maps for the lands under their jurisdiction. All cooperators will offer input into the location and types of infestation.

A statewide database, the Alaska Exotic Plant Information Clearinghouse, will house geospatial data of invasive and noxious weeds recorded within the KP-CWMA. Cooperators should include their inventory and treatment efforts to this resource to facilitate sharing of information among those working to identify and manage infestations within the KP-CWMA.

Table 1 summarizes the current list of invasive and noxious weeds recorded by inventories by a variety of agencies throughout the CWMA since 2003. The information can also be accessed at <http://akweeds.uaa.alaska.edu>. The summary provides an initial assessment of the extent and distribution of problem weeds within the management area. This inventory will be continually updated with new reports of weed infestations, inventories and management efforts.

#### D. Species Management Objectives

It is assumed that the elements of education, prevention, early detection, and inventory will be integrated concurrently with specific control actions. Management objectives are listed for each weed species by management units in Table 3. The objectives are developed in context with the geographic distribution, habitat relationships, invasiveness, relative abundance and treatment feasibility of specific weeds.

Established and widespread weed species within the management units may be stratified into management zones within identified land management units. Units with low population levels of the target plant would be managed for eradication. Those with moderate to high population levels of target plants would focus on containment and other sites maintained as weed free.

##### 1. Long-Term Spread of Weeds:

Monitoring of weed spread and/or suppression will be accomplished through existing database tools and GIS layer through the Alaska Exotic Plant Information Clearinghouse. Inventory to re-map infestations should be completed in five years to compare with previous surveys. Yearly treatment summaries will also be used to assess weed spread. All management activities should be included in the Alaska Exotic Plant Information Clearinghouse under the “control” attribute, listing the type of control as: manual, mechanical; broadcast, spot or aerial herbicide or other (see AKEPIC Collaborators Manual, 2005).

## 2. Post-treatment Monitoring:

Treatments will be monitored and assessed following two general intensity levels as permitted by funding and personnel.

a. Visual: Personnel will conduct visual reconnaissance of the treated area after chemical application to determine the presence or absence of target plants, and/or desirable vegetation.

b. Systematic: Within selected infestations sample plots will be established to document changes in target plant densities, and species composition and cover of desirable vegetation.

## 3. Biocontrol Agents:

Biocontrol agents are generally considered only for very large and densely infested areas. The release of a biocontrol agent is a complex and laborious process requiring extensive review and is very difficult to accomplish successfully. It is not expected for biocontrol to be part of management activities in the KP-CWMA in the near future.

## **X. REFERENCES:**

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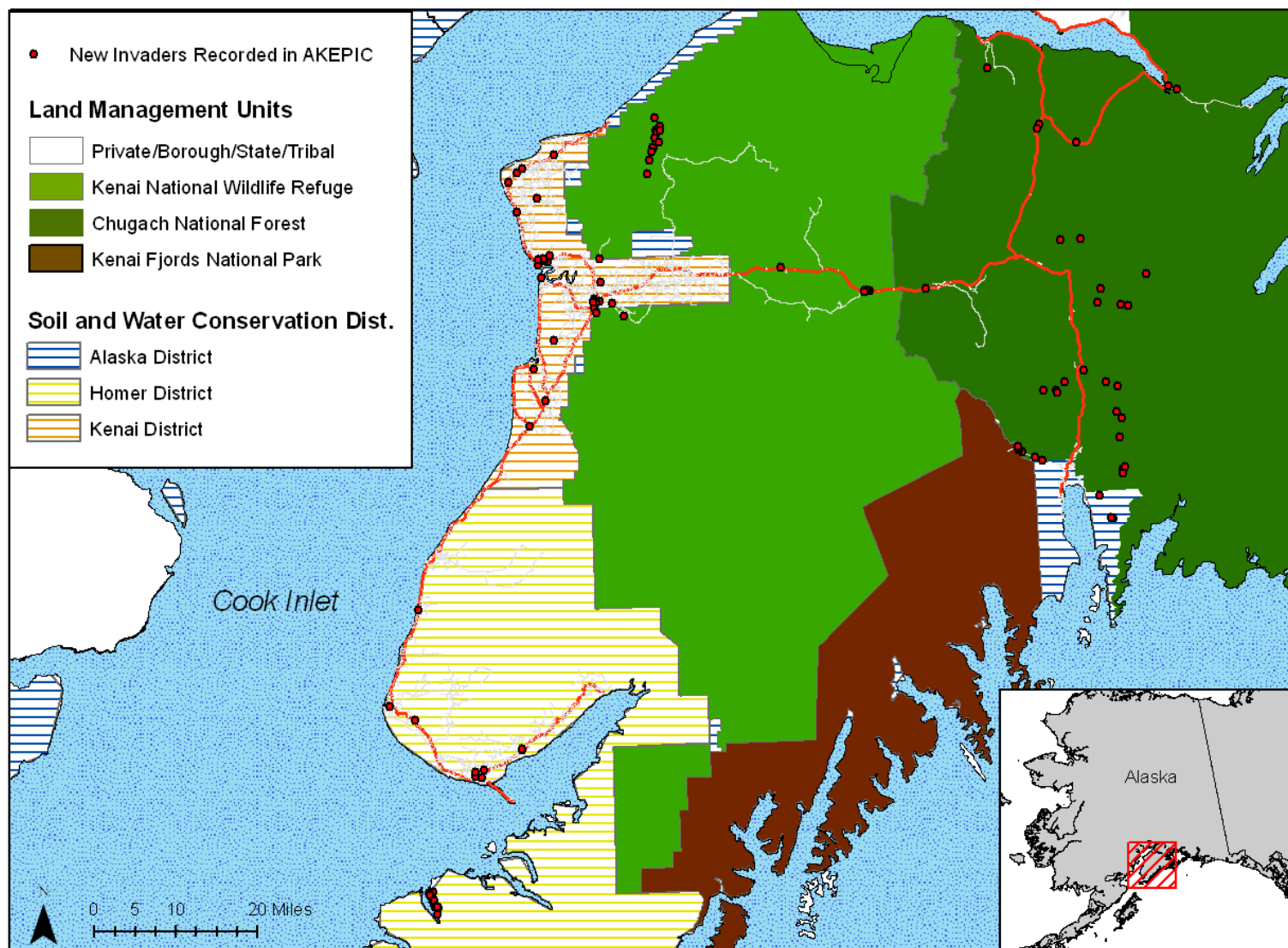
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*This plan was developed using the Idaho State Department of Agriculture's Cost Share Handbook template for CWMA Strategic Plans (Exhibit 6) available at: <http://www.idahoag.us/Categories/PlantsInsects/NoxiousWeeds/costshareapp.php>*

## APPENDIX A: MANAGEMENT UNITS WITHIN THE KENAI PENINSULA – COOPERATIVE WEED MANGEMENT AREA



New Invaders in AKEPIC Database  
Recorded on the Kenai Peninsula, Alaska 2007

Homer Soil & Water Conservation District  
4014 Lake St., Suite 201  
Homer, AK 99603



## APPENDIX B. REVISIONS.

The following revisions to the strategic plan were made April 2010.

Updates to table 1 pages 4 and 5.

The following plant species were added to table:

<i>Achillea ptarmica</i>	<i>Polygonum aviculare</i>
<i>Anthemis cotula</i>	<i>Prunus padus</i>
<i>Bromus inermis ssp. inermis</i>	<i>Ranunculus acris var. acris</i>
<i>Capsella bursa-pastoris</i>	<i>Ranunculus repens</i>
<i>Caragana arborescens</i>	<i>Rumex acetosella</i>
<i>Cerastium fontanum spp. vulgare</i>	<i>Rumex crispus</i>
<i>Chenopodium album var. album</i>	<i>Rumex longifolius</i>
<i>Crepis tectorum</i>	<i>Senecio vulgaris</i>
<i>Dactylis glomerata</i>	<i>Silene latifolia ssp. alba</i>
<i>Hordeum jubatum</i>	<i>Silene noctiflora</i>
<i>Lepidium densiflorum</i>	<i>Sorbus aucuparia</i>
<i>Lolium perenne ssp. multiflorum</i>	<i>Spergula arvensis</i>
<i>Matricaria discoidea</i>	<i>Stellaria media</i>
<i>Phleum pratense</i>	<i>Taraxacum officinale ssp. officinale</i>
<i>Plantago major</i>	<i>Trifolium hybridum</i>
<i>Poa annua</i>	<i>Trifolium pratense</i>
<i>Poa compressa</i>	<i>Trifolium repens</i>
<i>Poa pratensis ssp. irrigata</i>	
<i>Poa pratensis ssp. pratensis</i>	

*Centaurea biebersteinii* was updated to *Centaurea stoebe spp. micranthos*. And its AKNHP Ranking was updated from 88 to 86.

*Galeopsis bifida* and *Galeopsis tetrahit* AKNHP Ranking was updated from 43 to 40.

*Hieracium aurantiacum* and *Hieracium caespitosum* ANKNP ranking was updated from 71 to 79.

*Hieracium pilosella* was removed from the table.

*Melilotus officinalis* and *alba* were combined into one row.

Table 2 page 9

*Vicia cracca* was updated from New Invader to Potential Invader.

*Centaurea biebersteinii* was updated to *Centaurea stoebe spp. micranthos* and from New Invader to Potential Invader.

*Cytisus Scoparius* was updated from New Invader to Potential Invader.

Table 3 pages 13 and 14.

Scientific names were added to all plants species.

*Melilotus officinalis* and *Melilotus alba* were combined into one row.

The following changes were made under the corresponding heading -

**Chugach National Forest** – *Vicia cracca* was updated from eradicate to contain.

**Kenai Soil and Water Conservation District** –

*Tanacetum vulgare* was updated from eradicate to control.

*Tripleurospermum perforata*, *Cytisus scoparius*, and *Centaurea stoebe ssp. micranthos* were removed, as they were eradicated from the management unit.

*Melilotus officinalis* was added as eradicate.

**Alaska Soil and Water Conservation District** –

*Vicia cracca* added as control.

*Galeopsis* spp. added as eradicated.

*Leucanthemum vulgare* added as control.

*Elymus repens* added as control

## **A Strategic Approach to Managing Reed Canarygrass on the Kenai Peninsula 28 February 2011**

### **Background**

On 1 Dec 2010, a working group of the Kenai Peninsula Cooperative Weed Management Area (KP-CWMA; <http://www.kenaiweeds.org/>) met to discuss a spatially-explicit, strategic approach to invasive plant management. Participants included Janice Chumley (UAF Cooperative Extension Services), Michelle Martin (Kenai Watershed Forum), Rob Develice and Betty Charnon (US Forest Service), Brian Maupin (Homer Soil & Water Conservation District), Jen Kain (Alaska Association of Conservation Districts), Mike Edwards and Heather Fuller (USFWS Kenai Fisheries Office), and John Morton, Dawn Magness and Toby Burke (USFWS Kenai National Wildlife Refuge). In this document, we lay out a spatially-explicit plan for a coordinated approach to managing reed canarygrass (*Phalaris arundinacea*) on the Kenai Peninsula.

### **Need**

Alaska is relatively pristine and generally in the early stages of invasion by exotic vascular plants. Models of invasive species management from the Lower 48, where exotic plants are well established in much of the landscape, may be inappropriate. We suggest that management strategies in Alaska should be focused on invasion vulnerability to prevent the introduction of seeds and other propagules, eradication of incipient populations (particularly of novel species), and containment of populations that are well established but geographically discrete. Long-term control (especially when herbicides are involved) is not a reasonable solution unless the goal is to minimize dispersal to other areas or in situations where a population is beginning to actually impair ecosystem function (e.g., stream flow).

The Kenai Peninsula currently has 110 species of exotic vascular plants [note: only 105 species used in the following analysis]. Of these, reed canarygrass is considered to be one of the most invasive and dispersed, and potentially the most injurious species, certainly to anadromous fisheries. To date, reed canarygrass has been recorded at 749 locations in 30 watersheds on the Kenai Peninsula (Table 1). Efforts to treat infestations are underway by several agencies and organizations including the Kenai Watershed Forum, Kenai National Wildlife Refuge, Chugach National Forest, and the Homer and Kenai Soil & Water Conservation Districts. However, the treatments vary greatly in their goal (i.e., eradication, control or containment) and efficacy (e.g., glyphosate, "tarping", or mechanical removal). Although the KP-CWMA strategic plan has identified reed canarygrass as one of its target species, the plan does not provide guidance on how best to coordinate well-intentioned but disparate efforts. This document is intended as an appendix to the existing (albeit aspatial) strategic plan approved by the KP-CWMA in December 2007.

### **Objective**

Because reed canarygrass has the potential to directly impair stream systems, we chose to use watershed as the management unit rather than administrative boundaries. We identified 127 watersheds on the Kenai Peninsula (KENWR unpublished data). Our objective was to assign all

watersheds into three categories that reflect a minimum management response: eradicate, contain, and control based on their vulnerability to reed canarygrass invasion. By *eradicate*, we mean that reed canarygrass is eliminated from the watershed, including all viable seeds and/or vegetative propagules. By *control*, we mean that seed production is prevented throughout the watershed and the area coverage is decreased over time, but low population levels are acceptable. By *contain*, we mean that reed canarygrass infestations are geographically contained and are not increasing beyond the watershed boundaries; treatment within established infestations may be limited, but populations are controlled or eradicated outside those areas.

### **Criteria**

In order to define the default minimum management response we considered:

- **Isolation:** Isolated watersheds have no road access, while open watersheds have roads. These include roads with restricted access; i.e., oilfield roads, mining roads, and roads accessible only by ferry.
- **Discreteness:** Discrete watersheds are fully contained and output into the ocean, while connected watershed output into another river.

We used the following variables to indicate the exposure probability to PHAR3 (Figure 2). These variables are used to define alternative minimum management response in watersheds that fall outside of the general expectations based on isolation and discreteness; specifically, consider eradication when (1) highway + railroad miles = 0; or (2) number of river crossings = 0 and highway + railroad miles < 10.

- **Number of River Crossings:** Count of river and stream crossings in the watershed from the KWF stream crossing database. Count includes culverts, bridges, and box culverts.
- **Miles of Highway and Railroad:** Length of highway and railroad in miles that occurs in the watershed.

We also used PHAR 3 locations (Figure 3) and exotic plant species richness (Figure 4) to verify the logic.

- **Number of PHAR3 Locations:** Count of the PHAR3 locations documented in watershed from 1997 to present in AKEPIC database and supplemented with 2010 data from Homer SWCD, KENWR, KWF and USFS.
- **Exotic Richness:** Number of exotic vascular plant species that have been documented in watershed in AKEPIC database from 1997 to present.

Other variables were compiled but were not used in analysis:

- proportion federal land
- miles of anadromous river
- number of parcels
- watershed size

### **Rationale**

At a coarse scale, the vulnerability of a watershed to invasion is a function of both its hydrologic discreteness and geographic isolation (Figure 2). Discreteness refers to whether the watershed is discrete (e.g., Anchor River) or part of a larger watershed (e.g., Funny River flows into the Kenai River).

Isolation refers to whether or not the watershed is connected to the road system. The green boxes in Figure 1 show the default management responses based on watershed discreteness and isolation.

At finer scales, however, the probability of exposure also affects watershed vulnerability and therefore, management response (Figure 3). Because PHAR3 is primarily being dispersed along the transportation corridors that intersect stream crossings, we used the highway and railway miles and number of river crossings to index exposure probability. Alternative management responses (i.e., red pie piece in Figure 1) are identified for watersheds where PHAR 3 exposure is outside general expectations based on access and discreteness.

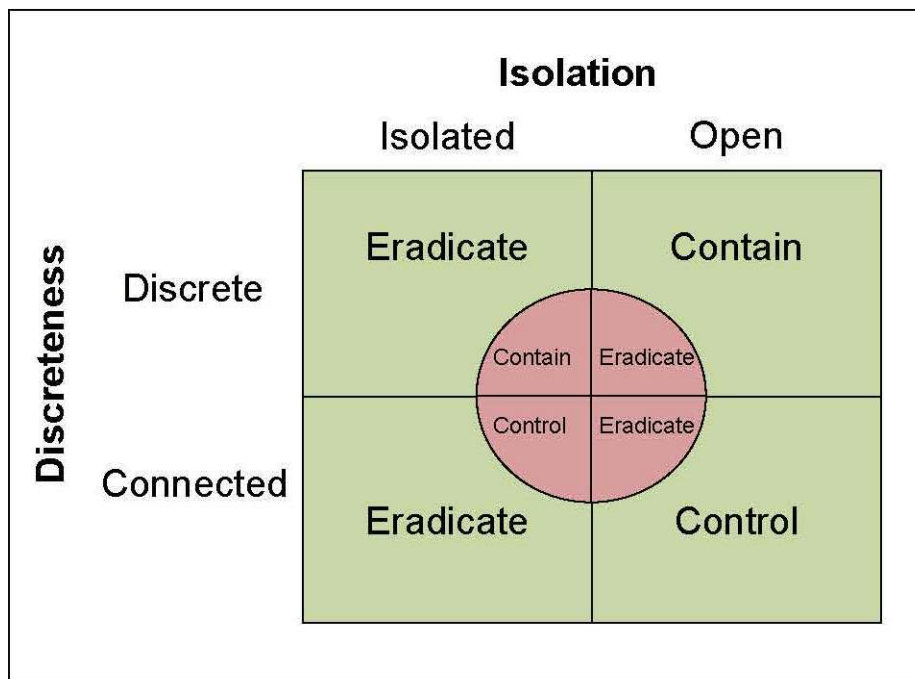


Figure 1. Decision matrix for assigning 127 watersheds on the Kenai Peninsula to one of three management responses to reed canarygrass infestation: eradication, containment, and control.

#### Watershed Classification into Minimum Management Response

- 1) Connected & Isolated (e.g., Funny River): default = ERADICATE, except CONTROL when populations become well established.
- 2) Connected & Open (e.g., Kenai River): default = CONTROL, except ERADICATE when either exposure index is low or populations are incipient.
- 3) Discrete & Isolated (e.g., Sheep Creek): default = ERADICATE, except CONTAIN when populations become well established.
- 4) Discrete & Open (e.g., Anchor River): default = CONTAIN, except ERADICATE when exposure index is low or populations are incipient.

***Final model***

Figure 5 shows the final assignment of the 127 watersheds on the Kenai Peninsula to one of three management responses: eradication, containment, and control. In 86 watersheds, the eradication of reed canarygrass will be the management response. Because this response is so unequivocal in its goal, early detection and an effective response is critical, including the use of herbicides. In the coming growing season (2011), reed canarygrass infestations in Swift, Jakolof, and Hidden Creeks should be among the highest priorities of KP-CWMA members for eradication.

In 24 watersheds, containment of reed canarygrass is the only viable response because population abundance and/or distribution has reached a level that eradication is currently infeasible, and the goal is now to prevent its spread to new watersheds. More often than not, this will likely involve critical thinking about vectors and bottlenecks (e.g., Hazard Analysis and Critical Control Points), as well as land ownership (which can affect treatments under consideration). Containment does not mean “do nothing”. It can mean aggressive actions to prevent infestations within a contained watershed from serving as seed/propagule sources for other watersheds. It may still require chemical treatment along the Seward or Sterling Highway. It may require asking HEA/KPB/DOT to wash down maintenance vehicles before exiting from contaminated right-of-ways. It may require outreach efforts to anglers. It may require getting local forage growers to become certified as weed-free. It may require treating infestations in upper watersheds to prevent moose from carrying seeds into adjacent pristine watersheds. Once contained within a watershed, populations can be further treated, but this is a local-scale decision.

In 17 watersheds, all but one of which are tributaries of the Kenai River, control of reed canarygrass is currently deemed the minimum response. Control is most often used in the Lower 48 to reduce the impairment of ecological function or services that an invasive population has imposed. On the Kenai Peninsula, however, at least at this point in time, control is most likely to be used to reduce the risk (and therefore the rate) of an infestation spreading within a watershed, and into connected but still-pristine watersheds (e.g., Killey River) that flow into the main trunk of the Kenai River.

These assignments should be considered the *minimum* response at the peninsula-wide scale. This model does not constrain an agency or organization to pursue a more aggressive response in specific locales. For example, these watersheds consist of multiple tributaries that could be individually managed if deemed necessary. Needless to say, this model is also dynamic, and will need to be revised as reed canarygrass populations increase or decrease within a watershed.

Our approach is significantly different from the current paradigm in Alaska in that it brings focus to where reed canarygrass is absent rather than where it already occurs. As such, Figure 5 can be used as a meaningful metric with which the KP-CWMA can assess the success of its collective efforts at combating reed canarygrass invasion. Eighty-six of 127 watersheds are still considered pristine in 2010. Our peninsula-wide goal should be to not only keep these 86 watersheds pristine, but to work aggressively towards restoring the ecological integrity of the other 41 watersheds.



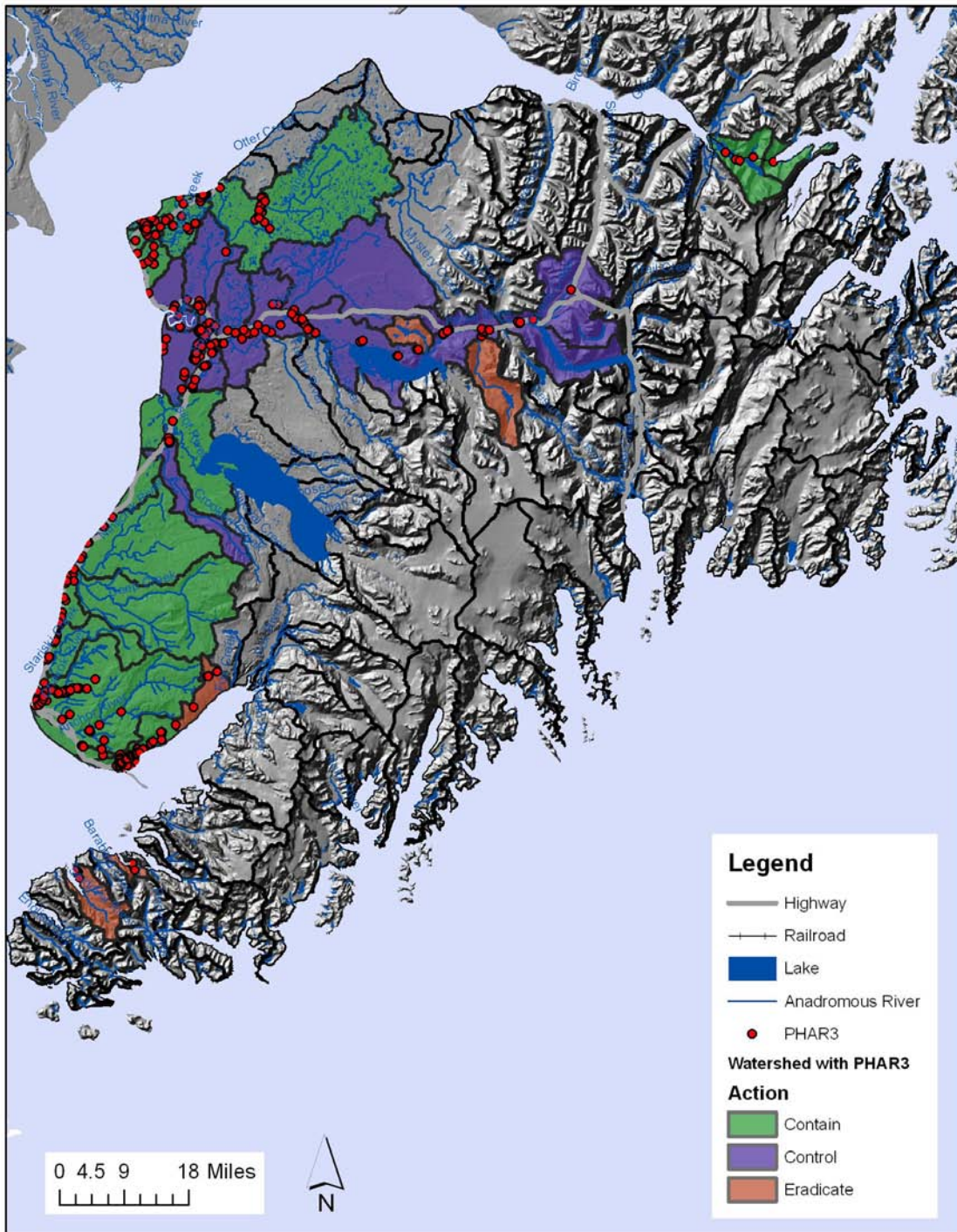


Figure 3. Initial assignment of minimum management response (eradication, containment or control) to watersheds (n = 30) that are already known to have infestations (n = 749) of reed canarygrass.

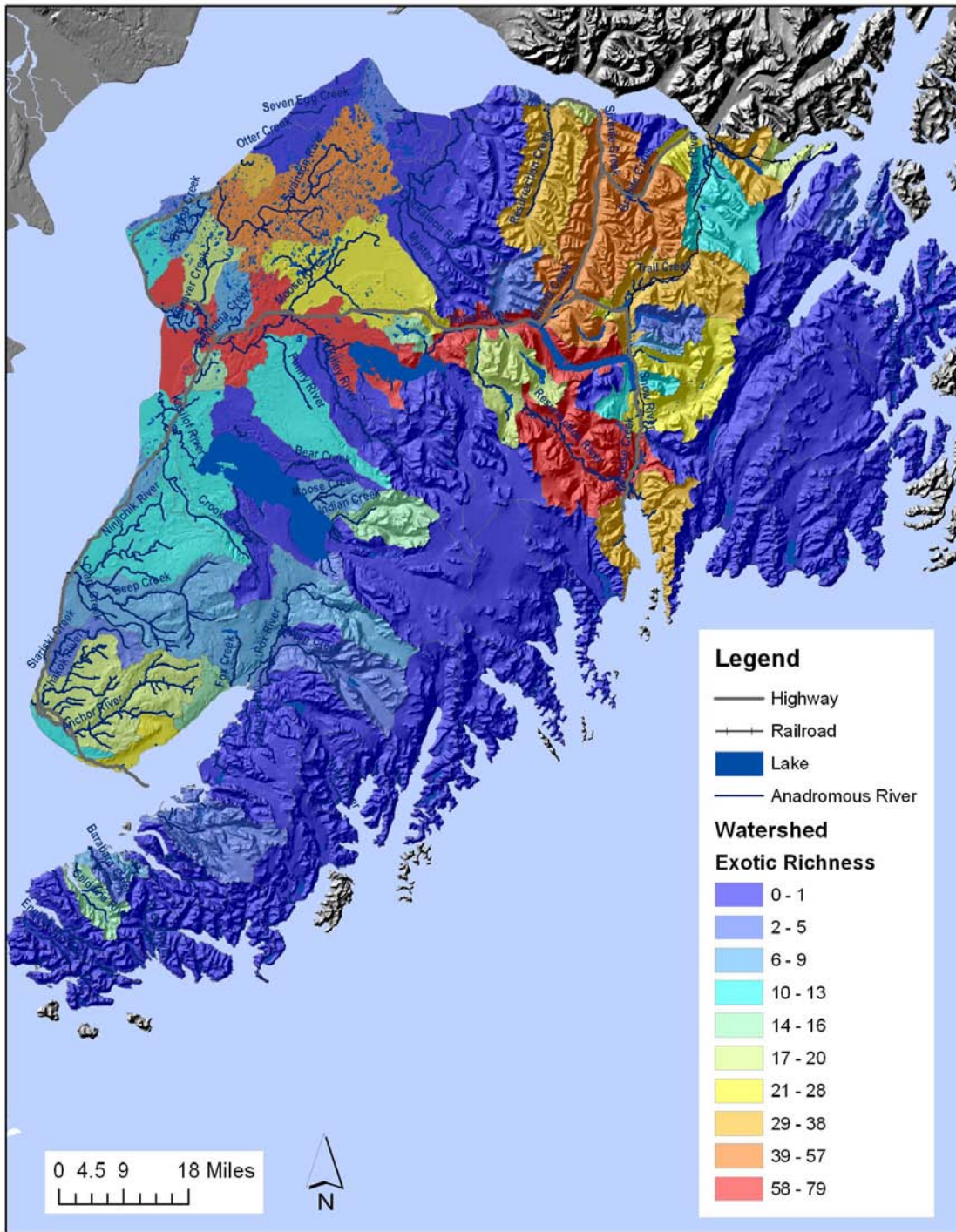


Figure 4. Distribution of 105 exotic vascular plant species by watershed on the Kenai Peninsula.

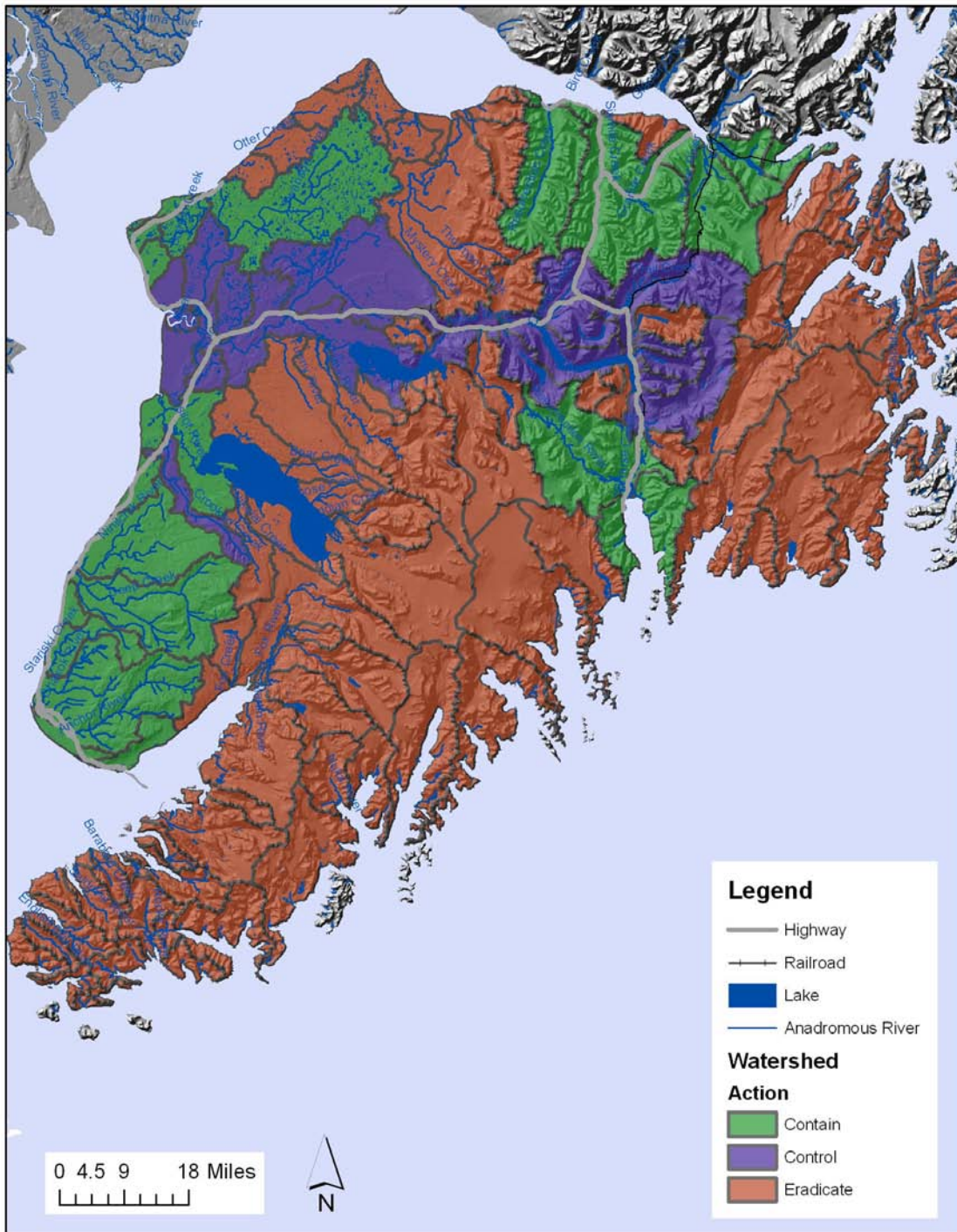


Figure 5. Final assignment of 127 watersheds on the Kenai Peninsula to one of three management strategies for reed canarygrass by the KP-CWMA: eradication (n = 86), containment (n = 24) or control (n = 17).

**Table 1. Attributes of 30 watersheds known to be contaminated by 749 infestations of reed canarygrass on the Kenai Peninsula.**

Name	Action	Discrete	Isolation	Highway & Railroad Miles	Number River Crossings	Number PHAR3 Locations	Exotic Richness	Proportion Federal Lands	Anadromous River Miles	Size (ha)
<b>Anchor River</b>	Contain	Discrete	Open	22.5	74	290	17	0.00	170.2	59441
<b>Kenai River</b>	Control	Connected	Open	62.2	93	113	79	0.64	190.8	111755
<b>Slikok Creek</b>	Control	Connected	Open	6.5	12	72	15	0.55	61.5	6692
<b>Bishop Creek</b>	Contain	Discrete	Open	7.9	15	58	6	0.09	21.4	9097
<b>Fritz Creek</b>	Contain	Discrete	Open	10.0	2	56	23	0.00	0.2	10220
<b>Swanson River</b>	Contain	Discrete	Open	3.7	12	23	57	0.99	81.8	73658
<b>Bernice Creek</b>	Contain	Discrete	Open	8.5	0	22	12	0.00	0.0	3776
<b>Crooked Creek</b>	Control	Connected	Open	5.0	14	13	11	0.44	56.9	14221
<b>Stariski Creek</b>	Contain	Discrete	Open	6.7	24	12	4	0.00	32.1	14125
<b>Happy Creek</b>	Contain	Discrete	Open	6.8	3	12	7	0.00	0.0	4544
<b>Beaver Creek</b>	Control	Connected	Open	2.5	7	11	18	0.84	21.3	15985
<b>Ninilchik River</b>	Contain	Discrete	Open	9.9	57	11	11	0.02	69.7	42297
<b>Kenai Estuary</b>	Control	Connected	Open	1.2	22	10	7	0.00	31.7	3285
<b>Salamatof Creek</b>	Contain	Discrete	Open	6.4	0	7	11	0.00	0.0	5507
<b>Swift Creek</b>	Eradicate	Discrete	Open	0.0	1	6	16	0.00	0.0	7590
<b>Seldovia River</b>	Eradicate	Discrete	Open	0.0	1	6	16	0.00	12.2	11129
<b>Russian River</b>	Eradicate	Connected	Open	4.7	0	5	20	1.00	29.9	16548
<b>Deep Creek</b>	Contain	Discrete	Open	2.4	20	5	8	0.12	119.9	52265
<b>Boulder Point</b>	Contain	Discrete	Open	3.2	0	5	4	0.00	0.0	3135
<b>Soldotna Creek</b>	Control	Connected	Open	3.3	8	4	7	0.54	12.9	11283
<b>Portage Creek</b>	Contain	Discrete	Open	35.4	0	4	36	1.00	32.3	15114
<b>Jakolof Creek</b>	Eradicate	Discrete	Open	0.0	0	3	9	0.00	5.0	2885
<b>Hidden Creek</b>	Eradicate	Connected	Open	0.0	2	2	16	1.00	2.7	6022
<b>Jean Creek</b>	Control	Connected	Open	18.8	1	2	22	1.00	15.5	2846
<b>Diamond Creek</b>	Contain	Discrete	Open	6.3	1	2	10	0.00	0.0	5710
<b>Moose River</b>	Control	Connected	Open	17.4	6	1	23	0.96	61.1	58983
<b>Quartz Creek</b>	Control	Connected	Open	19.4	19	1	49	1.00	28.0	28861
<b>Kasilof River</b>	Contain	Discrete	Open	7.1	10	1	13	0.74	58.4	57310
<b>Passage Canal</b>	Contain	Discrete	Open	11.6	0	1	18	1.00	3.5	6463
<b>Falls Creek 1</b>	Contain	Discrete	Open	11.6	5	1	6	0.00	0.0	6907