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.

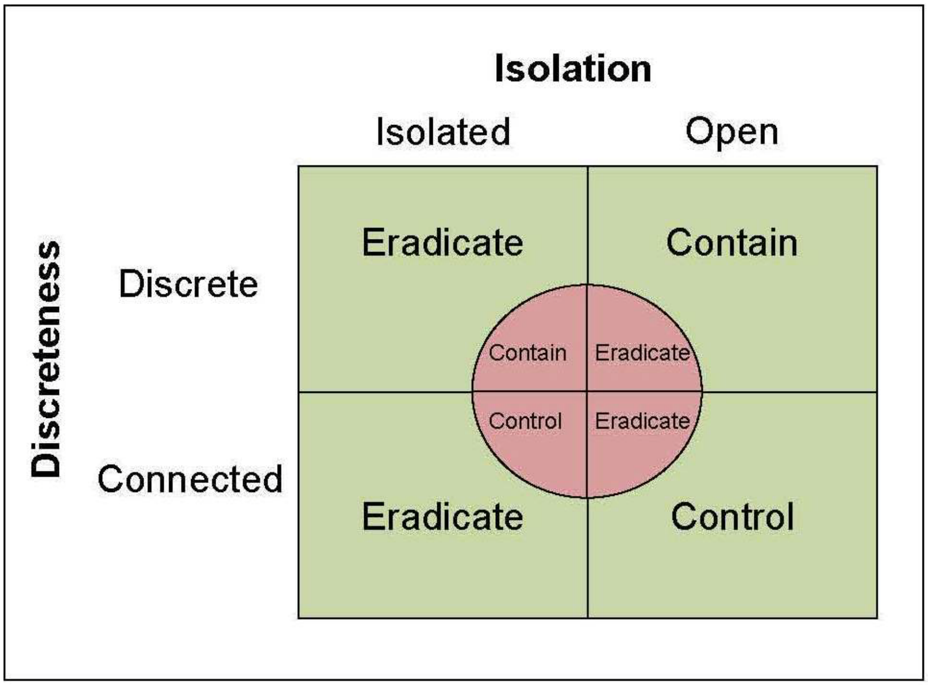

Figure 1. Decision matrix for assigning 127 watersheds on the Kenai Peninsula to one of three management responses to reed canarygrass infestation: eradication, containment, and control.

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.

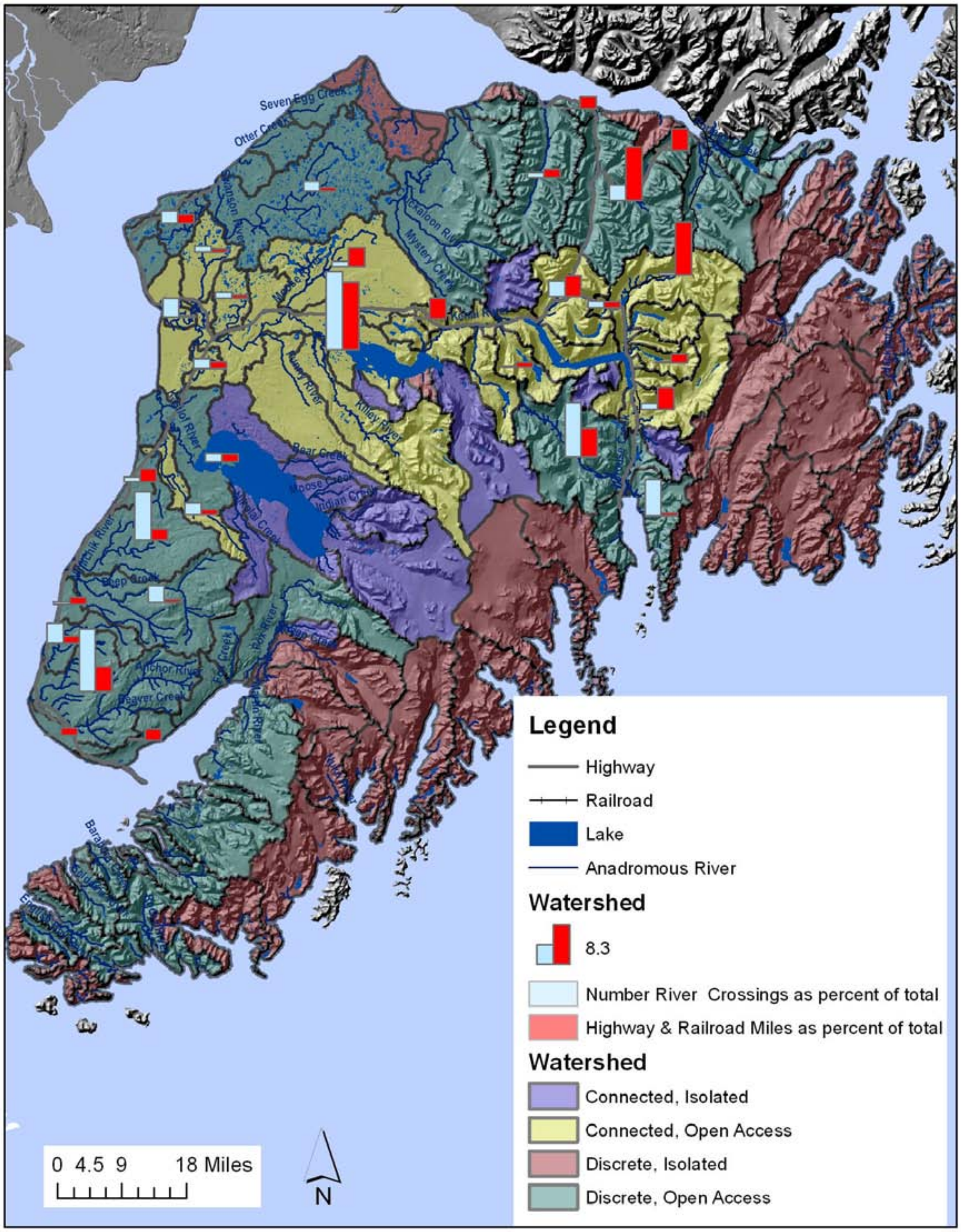

Figure 2. Coarse-scale categorization of 127 watersheds based on isolation and discreteness, without considering exposure probability. Bars represent the percentage of river crossings (blue), and highway and railroad miles (red), within each watershed.

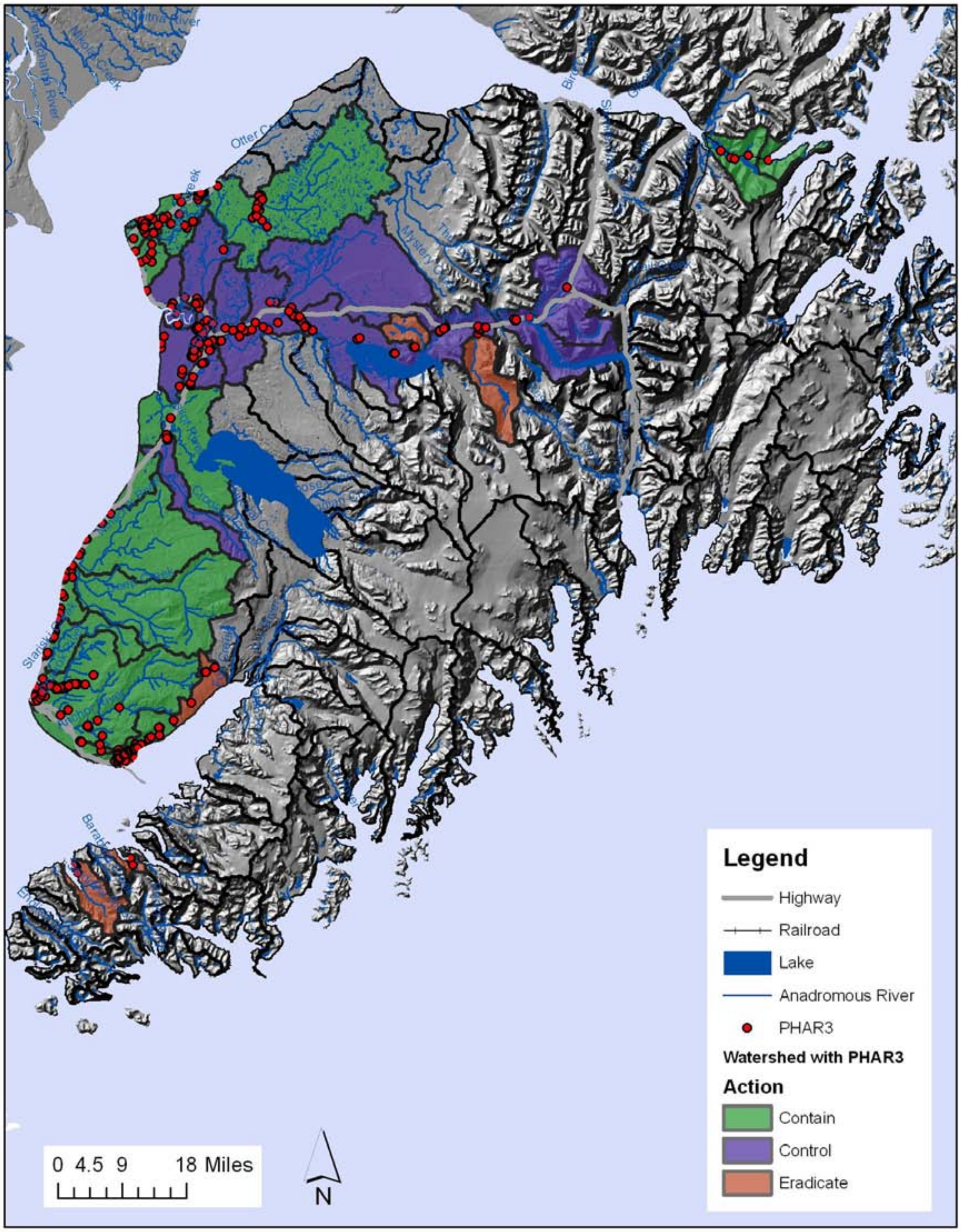

Figure 3. Initial assignment of minimum management response (eradication, containment or control) to watersheds (n = 30) that are already known to have infestations (n = 749) of reed canarygrass.

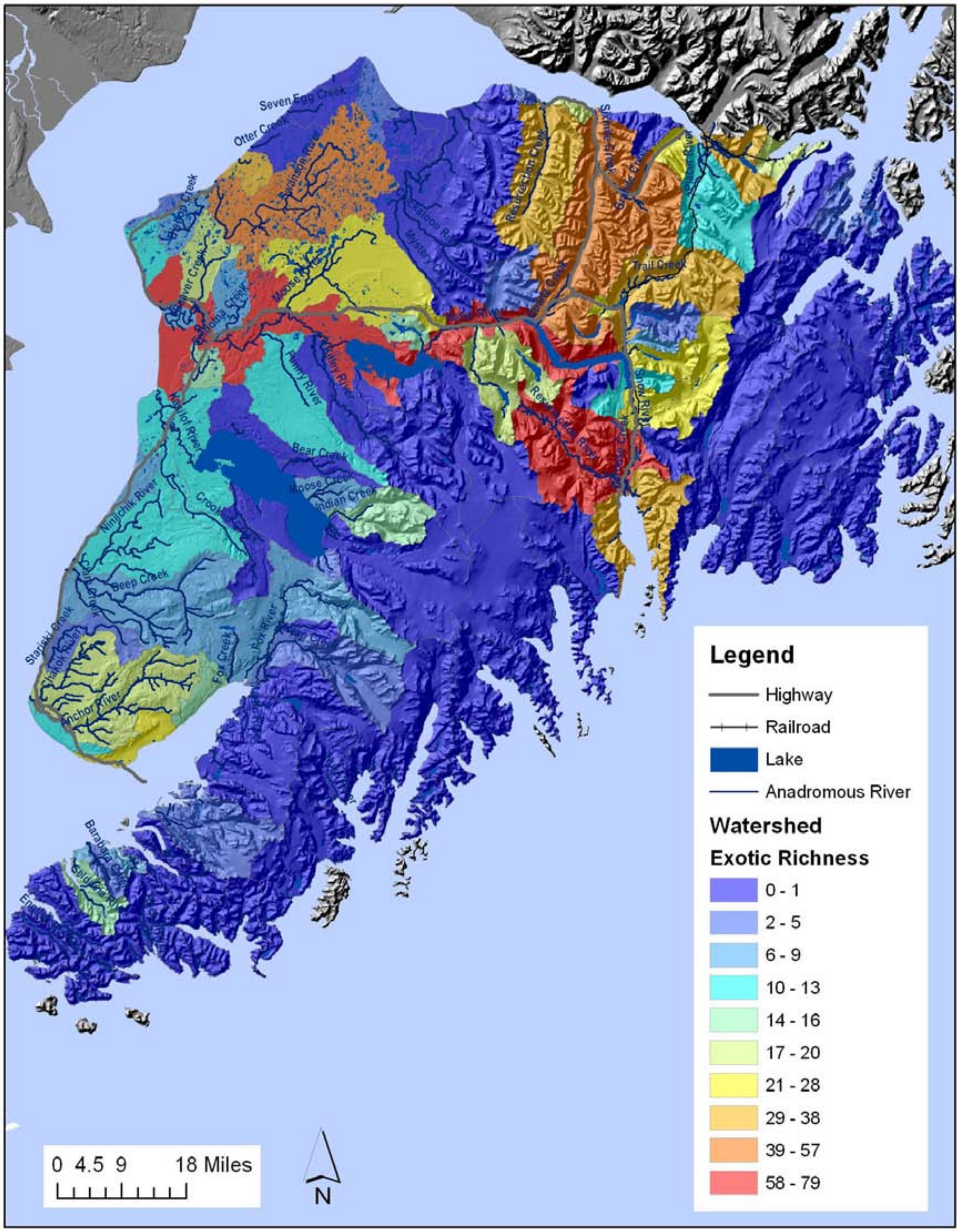

Figure 4. Distribution of 105 exotic vascular plant species by watershed on the Kenai Peninsula.

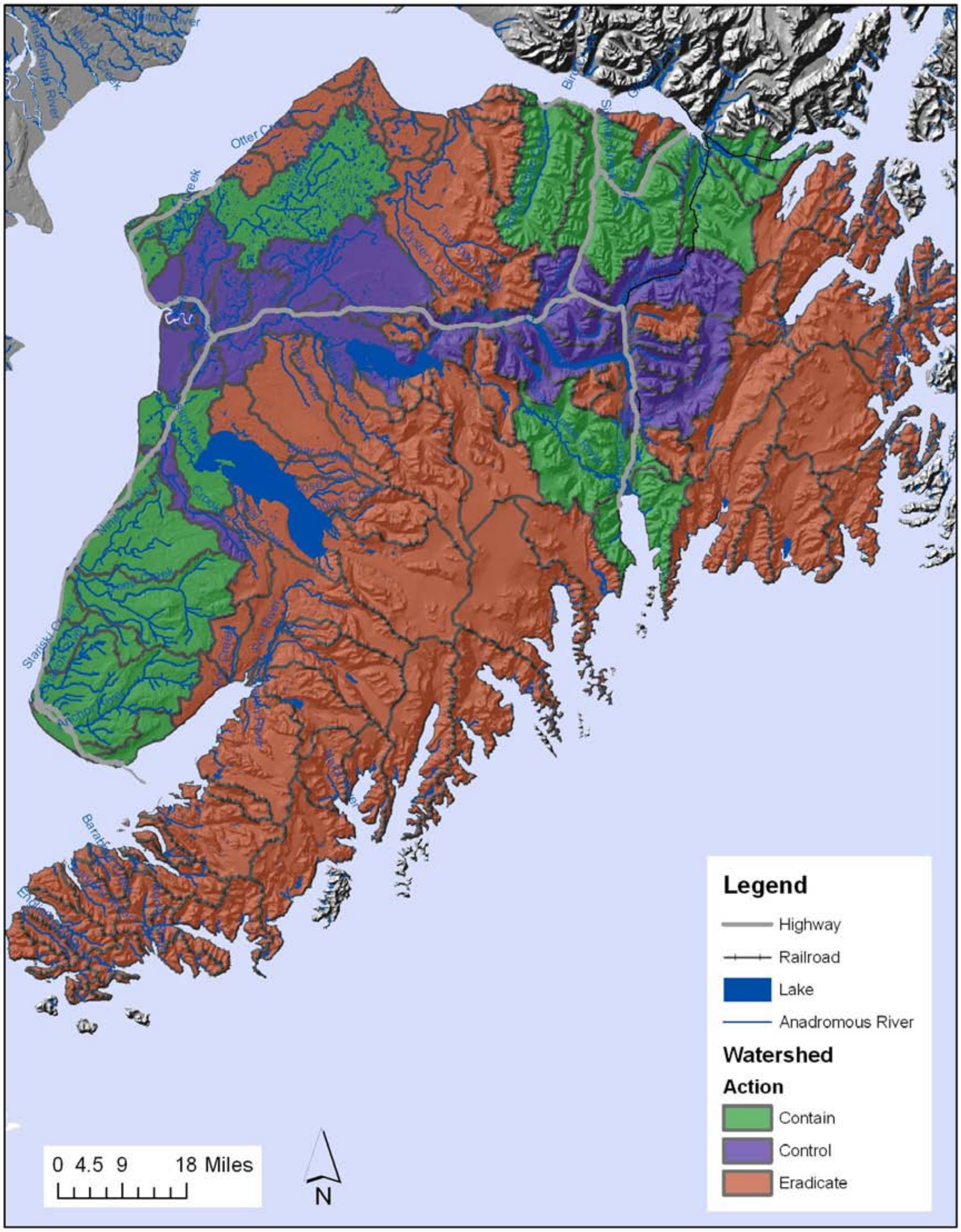

Figure 5. Final assignment of 127 watersheds on the Kenai Peninsula to one of three management strategies for reed canarygrass by the KP-CWMA: eradication (n = 86), containment (n = 24) or control (n = 17).

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