## Goal H: Fill gaps in knowledge that will facilitate prevention, management and understanding of invasive weeds and agricultural pests.

Research about invasive weeds and agricultural pests is imperative to make wise management decisions. Much of the research completed elsewhere is applicable to Alaska. However, the cold climate, different habitats, and lack of development in Alaska compared to other parts of the world can harbor differences that deserve research. Pesticides may behave differently in colder soils, some species invasive elsewhere may not become invasive in Alaska, other species that are not considered invasive elsewhere may become invasive in Alaska (Table 6), and the natural resource based economy may be impacted differently.

The Alaska Natural Heritage Program (AKNHP) worked with invasive plant management experts around the state to evaluate the invasive potential of individual species and determine to which regions (Figure 10) of the state they pose a threat (http://akweeds.uaa.alaska.edu/, Carlson et. al. 2008). While 107 species have been ranked, including 15 species not present in Alaska, other plant species that have not been ranked, have been found in Alaska and deserve evaluation.

**Table 6. A selection of plants that are considered invasive in Alaska and their status in other parts of North America**

| Problems in Alaska | Problems in other parts of North America* |
|---|---|
| Sweetclover, *Melilotus officinalis* | No |
| Narrow leaved hawkweed, *Hieracium umbellatum* | No |
| Bird vetch, *Vicia cracca* | No |
| European birdcherry, *Prunus padus* | No |
| Knotweed complex, *Polygonum cuspidatum, sachalinensis,* and *x bohemicum* | Yes |
| Orange hawkweed, *Hieracium aurantiacum* | Yes |
| Narrowleaf hawksbeard, *Crepis tectorum* | Yes |
| Canada thistle, *Cirsium arvense* | Yes |
| Perrenial sowthistle, *Sonchus arvensis* | Yes |
| Reed canarygrass, *Phalaris arundinacea* | Yes |

**Problem plant defined as listed noxious in other states according to the USDA plants database (http://plants.usda.gov/).*

***Table 6** depicts a selection of invasive weeds that are problematic in other parts of North America that are also problematic in Alaska. The table also shows that Alaska has some species that are invasive in the north that do not appear to be problems in other parts of North America, demonstrating a need for research in Alaska.*

**Figure 10. Ecogeographic regions of Alaska used in the Ranking Project**

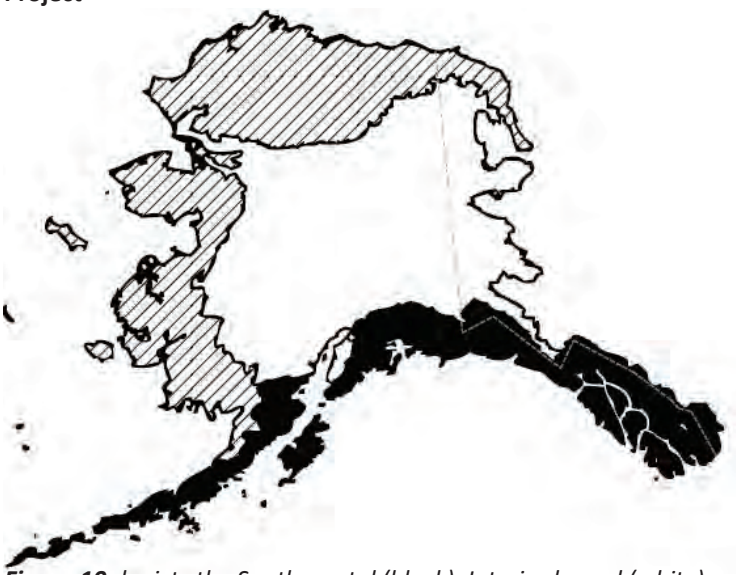

***Figure 10** depicts the Southcoastal (black), Interior boreal (white) and Arctic alpine (hashed) ecogeographic regions of Alaska used in the ranking project to determine climatic similarity between locations a non-native species is found in other parts of the world and the ecogeographic region. Graphic taken from Carlson et. al. 2008, adapted from Nowaki, et. al. 2001*

While exotic agricultural pests, such as Asian longhorned beetle and birch leaf miner, are known in Alaska, their relative threat to the resources of the state have not been evaluated. Ranking systems for non-plant taxa of agricultural pests presently found in, and threatening to infest, Alaska are needed to assist resource managers in prioritizing infestations to manage.

Determining how invasive weeds, agricultural pests, and their management will impact Alaska economies is another important tool in prioritizing management actions. Economics in Alaska are highlighted by some key areas such as fisheries, tourism and resource extraction. Other important sectors include agriculture, and non-timber forest products such as berries. Research is needed to determine what the impact of invasive weeds, agricultural pests and their management will be to these economic resources. To date, no research on economic impacts of invasive weeds or agricultural pests has been completed in Alaska.

The ecological impacts of invasive weeds and agricultural pests to natural and managed ecosystems are often understudied. Completed research of ecological impacts and spread of invasive weeds is done by the University of Alaska Fairbanks, the Agricultural Research Service and others. One such study demonstrates that white sweetclover (*Melilotus officinalis* formerly *alba*) spreads to river floodplains reducing recruitment of native species (Spellman 2008). Another

**Figure 11. Orange hawkweed at Karluk Lake before and after treatment**

***Figure 11*** *shows an orange hawkweed, Hieracium aurantiacum, infestation before (left) and after (right) 6 years of treatment with an appropriate herbicide. Notice the hawkweed, if left untreated, excludes the native grasses and forbs from the infested area. While little effort has been placed in studying the impacts of hawkweed to Alaska ecosystems situations like the one shown here lend strong evidence that it does impact Alaska ecosystems. Photos courtesy Bill Pyle USFWS*

study demonstrated that white sweetclover, and narrowleaf hawksbeard (*Crepis tectorum*) have moved from roadside infestations into recently burned areas, and may have a competitive advantage over native plants in recruitment after fire disturbance (Villano 2008). These studied ecological impacts represent those that have quantified scientific proof. Impacts of other species likely exist; however remain unquantified (Figure 11).

New research is going on elsewhere in North America regarding ecosystem services, and invasive species impacts to those services. Ecosystem services are those less tangible/quantifiable functions an ecosystem provides for people. These functions include air and water filtration, pollination, recreation, nutrient cycling and other services. While these services are more difficult to quantify, they can have significant value in ecosystem function. In Alaska, examples of ecosystem services include clean water, vast open areas, and abundant wildlife.

Research needs for management options are necessary in Alaska. As mentioned earlier efficacy and fate of pesticides in cool climates needs further understanding. As well, cultural, mechanical and other management options deserve study (Figure 12). Of particular importance in management research are efficacy, off target impacts, and cost of application.

Prevention is highly important to invasive weeds and agricultural pest management, making research on possible pathways and analysis of prevention mechanisms highly important. Some research has been completed in Alaska regarding the horticultural trade and forage/straw as pathways for invasive plant introduction and movement into Alaska (Conn et al 2008 and Conn 2006). Further research is needed to rank pathways and commodities of introduction, and identify practices that can be put in place to prevent introductions.

## Public Identified Priorities

Scoping comments depicted research on impacts to resources and economics in Alaska as a high need. The resources include both natural resources and agricultural resources. However, with regards to agricultural resources, respondents often felt the impacts from invasive species are very well NMFSumented and not as high of a priority for research. There is also a strong sentiment that, given the extensive research regarding invasive weeds' and agricultural pests' ecological, management and economic impacts, Alaska should look to other parts of North America and the world to determine what research has been completed instead of repeating the same studies in Alaska.

**Figure 12. Plot treatments for reed canarygrass comparing a chemical and non-chemical control**

***Figure 12*** *shows treatment of reed canarygrass, Phalaris arundinacea, plots that compared chemical and non-chemical treatments. Plot treatment research is necessary for some invasive plants in Alaska to determine which methods of treatment provide the desired result with the least amount of impact to area resources and cost of application.*

## Objective 1:
## Research impacts of invasive weeds and agricultural pests to natural resources and the economy.

**Action Strategies**

1. Complete economic impact analysis for five high priority invasive weeds to agriculture, tourism, subsistence and other affected industries.
   *Suggested participants:* DNR, DOA, DOF, University Researchers, ISER, USDA, DOI, NMFS
   *Timeline:* June 2016

2. Continue research for five high priority invasive species to identify and predict natural resource impacts including ecosystem services. Special attention may be given to species of agricultural concern and species that are invading natural areas in Alaska.
   *Suggested participants:* DNR, DOA, University Researchers, USDA, DOI, NMFS
   *Timeline:* June 2016

3. Increase number of ranked species annually using inventory results and research identifying likely invaders from imported commodities to identify those species.
   *Suggested participants:* AKNHP, UAF CES, Fed agencies, DNR, DOA
   *Timeline:* June 2016

4. Develop understanding of the influence climate change will have on the establishment, spread and impacts of invasive species in Alaska.
   *Suggested participants:* AKNHP, UAF, DOI, DOA, USDA, NMFS
   *Timeline:* June 2016

## Objective 2:
## Develop an understanding of effective control techniques, and how those control techniques affect the surrounding environment.

**Action Strategies**

1. Research effective control techniques for five priority species in Alaska.
   *Suggested participants:* DNR, DOA, University Researchers, CES, ARS, USFS, USGS, NMFS, all parties involved in control work
   *Timeline:* June 2016

2. Research impact of control techniques to the surrounding ecosystems, and land management goals for five priority species including studying herbicide fate.
   *Suggested participants:* DNR, DOA, University Researchers, CES, ARS, USFS, USGS, NMFS, all parties involved in control work
   *Timeline:* June 2016

3. Utilize the relevant research from other parts of the world to predict impacts of invasive weeds and agricultural pests, efficacy of control practices and impacts of control practices to surrounding resources, resulting in a list of invasive weeds and agricultural pests with sufficient completed research and those in need of Alaska specific research.
   *Suggested participants:* DNR, DOA, University Researchers, CES, ARS, USFS, USGS, NMFS, all parties involved in control work
   *Timeline:* June 2014