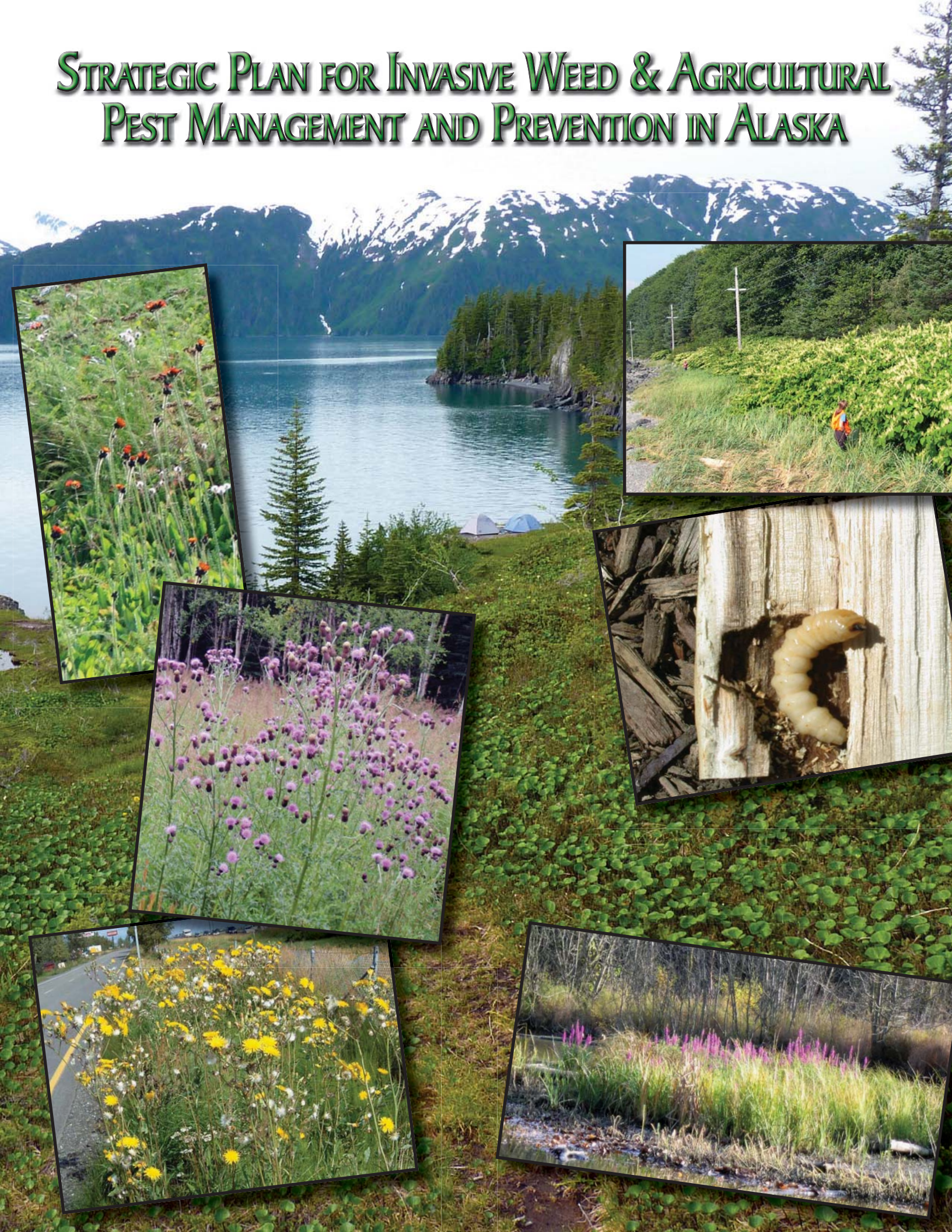
Strategic Plan for Invasive Weed & Agricultural Pest Management and Prevention in Alaska



2011-2016

Department of Natural Resources

Division of Agriculture
Plant Materials Center

April 2011

Cover photos, clockwise from top right:
Japanese knotweed - Tom Heutte, USDA Forest Service, Bugwood.org ; Asian long-horned beetle - Thomas B. Denholm, New Jersey Department of Agriculture, Bugwood.org ; Purple loosestrife - Michael Shephard, USDA Forest Service ; Perennial sowthistle - Michael Rasy, University of Alaska, Bugwood.org ; Canada thistle - Alaska Natural Heritage Program ; Orange hawkweed - Alaska Division of Agriculture
Background - Blackstone Bay, Prince William Sound; *Photo courtesy Theresa Heckart*

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Introduction

Invasive species are typically recognized as non-native species that once introduced accidentally or on purpose, spread beyond control to affect natural and agricultural resources or human health. Not all non-native species are invasive, and many are highly beneficial for agricultural or ornamental purposes. An imported or established species has a higher probability to become invasive when the species is considered invasive in other parts of the world (Daehler et al 2004). Agricultural pests, in the context of this strategic plan, are considered native or non-native species that cause harm to agricultural resources of the state, including timber and non-timber forest products of the state.

Invasive plants and agricultural pests cause significant economic losses to agriculture and wild lands across North America. As of 2005, economic impacts to agriculture and wild lands in Montana from Spotted knapweed (*Centaurea stoebe*) were estimated to cost approximately $42 million annually (Sheley et al. 2005). In Alaska, Spotted knapweed and many other notorious invasive agriculture and wild land weeds are not present, have a very limited distribution in the state, or have yet to invade natural areas (Table 1). However, several invasive weeds such as Canada thistle (*Cirsium arvense*), perennial sowthistle (*Sonchus arvensis*), and orange hawkweed (*Hieracium aurantiacum*) are presently impacting agricultural and/or wild lands (Table 1).

In Alaska, invasive insects and diseases are also present, and cause severe damage to forests. Some insect pests such as Spruce Bark Beetle are native to Alaska. Monitoring for non-native insect and disease pests in Alaska began in the early 2000s. These monitoring efforts have not detected any established non-native destructive beetles or wood boring insects (Division of Forestry 2010). However, increased trade and inspection activities have demonstrated the potential for exotic pest movement through discoveries of Asian Gypsy Moth egg masses on vessels arriving from Asian ports. Further insect and disease damage to Alaska forests is tracked each year and these surveys have found over 600,000 acres of forest affected by insect and disease activity from at least 16 different pests (Appendix E, U.S. Forest Service 2011). With these pest interceptions and widespread activity of forest insects and diseases continued monitoring for the introduction and establishment of non-native insect and disease pests is imperative.

In Alaska, plant biologists and natural resource managers are tracking 332 non-native plants for potential invasiveness (AKEPIC download http://akweeds.uaa.alaska.edu/akweeds_tracking.htm 10-12-2010) that occupy an estimated minimum cumulative total of 19416 acres (computed from AKEPIC download http://akweeds.uaa.alaska.edu/index.htm 10-12-2010). The number of tracked species is large however, a small proportion of those species may establish in natural areas, and an even smaller portion will cause significant ecological harm (Williamson 1996). Predicting which of these species will cause significant ecological harm is difficult, and can lead to mistakes, making monitoring of most non-native species important to natural resource protection.

Invasive weeds and agricultural pests are introduced to an area in a variety of ways. Hay imported to Alaska can carry significant numbers of weeds (Conn 2006). Horticultural products can carry seeds of weeds, presently the amount of seed carried varies with the type of product (Conn et. al. 2008). Invasive species can also be introduced in ballast, on vehicles, shoes, firewood, wood packaging materials, gravel, and pets. Recent research indicates an increase in the rate of non-native plants recorded (from one per year to almost three per year) as part of the Alaska flora which corresponds to the increase in commerce, development and tourism (Carlson and Shephard 2007).

Ideally an invasive species is managed when it first arrives before it has impacted resources (Figure 1 Lag Phase). This strategy for management is also known as Early Detection

Table 1. Selected invasive plants known to invade natural areas or currently confined to the human footprint in Alaska

Invading natural area	Rank*	Confined to human footprint	Rank*
Canada thistle, *Cirsium arvense*	76	Giant hogweed, *Heracleum mantegazzianum*	81
European bird cherry, *Prunus padus*	74	Garlic mustard, *Alliaria petiolata*	70
Narrowleaf hawksbeard, *Crepis tectorum*	54	Himalayan blackberry, *Rubus armeniacus*	77
Orange hawkweed, *Hieracium aurantiacum*	79	Japanese knotweed, *Polygonum cuspidatum*	87
Purple loosestrife, *Lythrum salicaria*	83	Scotchbroom, *Cytisus scoparius*	69
Reed canarygrass, *Phalaris arundinacea*	83	Spotted knapweed, *Centaurea stobe*	86
White sweetclover, *Melilotus officinalis* (formerly *alba*)	81	Yellow toadflax, *Linaria vulgaris*	61

**Rank represents the relative invasiveness from 0-100 where 100 is most invasive (Carlson et al. 2008).*

***Table 1** shows a subset of plants that are known in Alaska to invade natural areas, and a subset of invasive plants that are present in Alaska, but are currently confined to the human footprint.*

and Rapid Response (EDRR). For example, only two infestations of garlic mustard (*Alliaria petiolata*) are known in Alaska, both in Juneau, and managed by the Juneau CWMA and Tongass National Forest. Other invasive species like spotted knapweed (Figure 2) with only five remaining known infestations are in the same category for management.

Figure 1. Typical species invasion curve

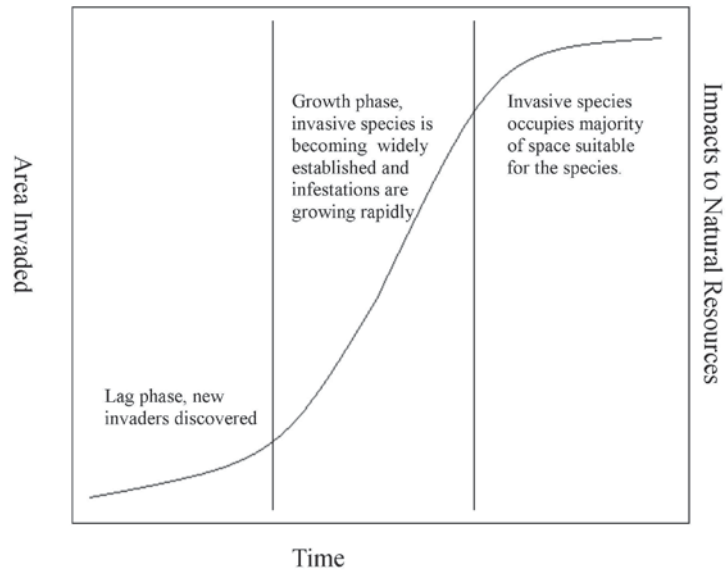


***Figure 1** illustrates the typical species invasion curve. During the lag phase, fewer impacts are seen to natural resources and invasive species have a high probability of eradication. A population of invasive species enters the growth phase, and begins to spread rapidly, impacting natural resources. At some point the introduced species will reach its ecological amplitude where it occupies all the space available to the species, and has maximized impacts to resources.*

Several invasive weeds, in Alaska, have begun to spread rapidly and impact native vegetation. The most widely recognized example involves white sweetclover, which was first introduced in 1913 for agricultural purposes (Irwin 1945). Herbarium records indicate sweetclover was first recorded as present in Alaska outside cultivation in 1931 (http://arctos.database.museum/SpecimenSearch.cfm Search for *Melilotus* 7-28-2009). Now, nearly 100 years after the first recorded introductions, sweetclover has spread to several river floodplains in Alaska where it reduces the survival of establishing native plants (Spellman 2008). Ideally sweetclover and other invasive weeds and agricultural pests are recognized and managed before they become problematic (Figure 3).

Invasive weeds and agricultural pests are managed by a variety of entities in Alaska including state, federal, borough, private land managers, non-profits and the general public. Coordination of management is critical because invasive weeds and agricultural pests spread beyond management boundaries. To address coordination issues, the Alaska Committee for Noxious and Invasive Plant Management (CNIPM), Alaska Invasive Species Working Group (AISWG), Alaska Pest Risk Assessment Committee (AKPRAC) and local Cooperative Weed Management Areas (CWMA) were established to address statewide and local issues. Many Soil and Water Conservation Districts (SWCD) are also very active in invasive weeds and agricultural pest management and education. Despite these coordination groups very few agency staff members have substantial duties related to the issue of invasive weeds and agricultural pests in Alaska resulting in inadequate attention to the issue.

The state strategic plan for invasive weeds and agricultural pest management is intended to help guide the various land managers, natural resource managers, and other groups involved in invasive weeds and agricultural pest management. A clear need for state leadership on management of invasive weeds and agricultural pests was identified by the 2008 Alaska State Legislature, who delegated the role of providing leadership and strategic planning to the Department of Natural Resources (*AS 03.05.027 Appendix C*).

Figure 2. Spotted knapweed

***Figure 2**. Spotted knapweed infests a limited number of locations in Alaska (left), but has great potential to affect natural resource production and ecosystem services. Shown on the right is a spotted knapweed infestation in Montana where impacts to agricultural and natural resources from the weed are prevalent.*
Photos courtesy of Michael Rasy, University of Alaska, Bugwood.org (left) and L. L. Berry, Bugwood.org (right).

Figure 3. Examples of invasive species with apparent impacts

***Figure 3**. Shown on left is white sweetclover, Melilotus officinalis, (Photo courtesy Michael Shephard, USDA Forest Service, Bugwood.org) and on the right orange hawkweed, Hieracium aurantiacum, (Photo courtesy Bill Pyle, USFWS). Both these weeds were introduced to Alaska many years ago, and are now invading wild lands. Management of these species prior to their wide establishment in urban and natural areas may have prevented the current problematic invasions.*

Purpose of the Strategic Plan

This strategic plan for invasive weeds and agricultural pest management was written to help guide prevention and management of these invasive species by the DNR and its partners. The plan allows for flexibility in implementing action strategies and identification of emerging issues that may warrant action before a new plan is written. The strategic plan provides overall direction to the Division of Agriculture, DNR, partners, and stakeholders in invasive weeds and agricultural pest management.

What is the Plan

This strategic plan is a guiding document for the Division of Agriculture (DOA) and its partners to utilize when managing invasive weeds and agricultural pests. The plan will include three components: the strategies outlined in the plan, the Annual Implementation plan for the DOA, and an Annual Report.

Strategic plan

The strategic plan was developed with the partners of the DOA. After planning and receiving input from the public and partners the DOA identified objectives, and outlined action strategies. The objectives and action strategies will help guide the DOA and its partners in developing annual goals. The strategic plan may also be used as a supporting document when partners are trying to garner funds from various sources to accomplish projects aligned with the plan.

Annual operating plan

The DOA will develop an annual operating plan from the objectives and action strategies outlined in the plan. The annual operating plan will match identified priorities with budget initiatives and other resource allocations. The annual operating plan will be developed by the invasive weeds and agricultural pest management coordinator, other staff working with the DOA, and partners.

Annual report

Around the end of each calendar year, the invasive weeds and agricultural pest management coordinator will develop an annual report of the accomplishments for that year and priorities for the coming year. The annual report will cover the fiscal year from July through June.

Annual review and emerging issues

The strategic plan will be reviewed annually by the DOA while generating the annual report and annual operating plan. The annual review will identify which action strategies are of the highest priority for implementation that year, and which are complete. Annual review will allow for identification of emerging issues not already addressed in the plan. These emerging issues will be discussed in the annual report and considered for inclusion in the annual operating plan or the next strategic plan.

What the Plan is Not

The objectives and action strategies in the plan reflect new initiatives identified as priorities by the DOA and its partners for invasive weeds and agricultural pest management. The plan is not a list of all the activities that the DOA or its partners will accomplish over the five year life of the plan. Other activities are presently carried out by the DOA and its partners that are of equal importance to those identified in this plan. The plan is not intended to take the place of local planning efforts of land managers or organized weed management areas. The plan does not include invasive species that fall under the management purview of ADFG (e.g. rats and northern pike) and DEC (e.g. bed bugs).Overlap may exist for animal diseases or introduced animal species that adversely affect agricultural production or natural resources.

Scope, Mission & Vision

Scope of Plan

This strategic plan for invasive weeds and agricultural pest management applies to all terrestrial invasive weeds and agricultural pests other than exotic small and large game species, which the Alaska Department of Fish and Game has management authority. The plan, however, does include action strategies that are best suited for agencies other than the DNR to implement. Research goals, objectives, and action strategies for example are best lead by the USDA Agricultural Research Service and the University of Alaska. Such goals, objectives and action strategies are included in this plan to support efforts of other entities in furthering invasive weeds and agricultural pest management needs.

Mission Statement

"The Department of Natural Resources manages noxious weeds, invasive plants, and agricultural pests to maintain uninterrupted productivity of natural and agricultural resources."

Vision Statement

"The Department of Natural Resources envisions continued natural resource productivity and public use of natural resources, uninterrupted by noxious weeds, invasive plants and agricultural pests."

Where are the salmonberries? Japanese knotweed infestation on a beach in Southeast Alaska.

Photo: Tom Huette, USDA Forest Service, Bugwood.org

Prevention

Goal A: Prevent the introduction and spread of invasive weeds and agricultural pests.

Prevention is the most critical aspect of invasive plants and agricultural pest management. Establishing strong prevention measures such as quarantine and inspection of commodities that are common vectors of invasive plants and agricultural pests can be significantly less expensive than resource losses and management expenses for established invaders.

Trade of commodities, particularly those that likely harbor pests such as hay, horticultural plants, imported fire wood, and gravel or fill material are a significant pathway for the introduction of invasive weeds and agricultural pests. Intentionally introduced invasive weeds and agricultural pests have the advantage of active participation by humans in spreading individuals, and result in significant spread to natural and agricultural lands. Insects and other pests of agriculture may be introduced deliberately for other reasons including: bio-control agents, pets, and as game species. Livestock and other imported animals may be vectors if they carry a pest disease or contain a weed seed on their fur or in their digestive tract. Packaging materials may also be important vectors of invasive weeds and agricultural pests, in particular, wood packaging materials which can carry invasive insects such as Asian Longhorned Beetle.

The horticulture and forage trade are two critical pathways of introduction and spread that have been well studied in Alaska (Table 3). Studies assessing hay imported into Alaska, have shown the potential threat of introduction this pathway poses (Conn 2006). These studies suggest action can be taken to considerably reduce the risk of introduction of invasive weeds from these pathways.

Alaska has several important prevention authorities under the Department of Natural Resources (DNR) and the Division of Agriculture (DOA). Included amongst these is the authority to regulate the entry of seeds, plants, horticultural products, and products related to horticulture or agriculture (*AS 03.05.010*). Inspections and quarantines of products may be established to prevent introductions (*AS 03.05.010*). Maintenance of statewide databases for invasive plants and agricultural pest are authorized (*AS 03.05.027*), and can facilitate prevention of the intrastate movement of pests. Education of the public to assist in prevention of invasions is also an authority of the DNR (*AS 03.05.027*).

Under the above described authority, the DOA has established regulations. Seed regulations exist to prevent seeds on the "prohibited" or "restricted" noxious weeds list from being sold deliberately or imported as a contaminant above allowable tolerances (*11 AAC 34.020*). Further, anything found to be contaminated with these seeds may be regulated by the DOA, and required to be free of these seeds or returned to the point of origin (*11 AAC 34.077*). Quarantines and inspection stations may be adopted for seeds, "pests" of plants, and things that may harbor pests (*11 AAC 34.105- 11 AAC 34.190*).

Table 2. Contaminant species found in nursery stock

Contaminant species found in nursery stock
Canada thistle, *Cirsium arvense*
Narrowleaf hawksbeard, *Crepis tectorum*
Perennial Sowthistle, *Sonchus arvensis*
Common Tansy, *Tanacetum vulgare*
Western salsify, *Tragapogon dubious*
Common Mullein, *Verbascum Thapsus*
Foxtail barley, *Hordeum jubatum*

Table 2 *shows species of highest concern that were found as contaminants in the study completed by Conn et al. 2008.*

Table 3. The level of concern for nursery stock contamination based on nursery plant type and planting medium

Planting mediums and plant types of greatest concern	Planting mediums and plant types of least concern
Soil-based potting mixes	Soil-less potting mixes
Mineral potting mixes	Vegetable starts and herbs
Perennial plants	Bare root perennials*
Small woody vegetation	
Large woody vegetation	
Balled and burlapped vegetation	

Table 3 *lists the types of plants and growing media that are of greatest concern, and media of least concern, according to Conn et al. 2008.*

**Bare root perennials were not included in Conn et al. 2008 because they are not transported in a growing medium. The study analyzed growing media of plants for sale.*

Public Identified Priorities

Participants in scoping for this strategic plan identified a screening process to determine the invasive potential of an imported plant or agricultural pest as important to highly important. Participants felt it is important to identify unintentional pathways for introduction of invasive weeds and agricultural pests. Participants felt increasing inspections of vectors is highly important to prevention. Participants felt it is important to encourage certification and use of weed free forage, straw and gravel. Respondents to the survey felt it is

important to establish inter and intrastate quarantines for invasive weeds and agricultural pests. However, individual comments indicated this step could do more to harm industry than is necessary at the current time. Survey respondents did feel it was important for the state to require appropriate measures to clean vectors of invasive weeds and agricultural pests before they are brought into the state. Overwhelmingly survey respondents felt that establishment of best management practices are highly important to the state.

Objective 1:
Facilitate production and distribution of certified weed free products.

Action Strategies

1. Provide annual training for individuals who will certify hay fields and gravel pits as weed free.
   Suggested participants: DNR, DOA, SWCD, public land managers, CWMA, CES, DOT
   Timeline: June 2012

2. Distribute previously developed information to producers and purchasers of hay/straw.
   Suggested participants: DNR, DOA, SWCD, public land managers, CWMA, CES, DOT
   Timeline: June 2012

3. Develop weed free gravel certification program.
   Suggested participants: SWCD, public land managers, CWMA, DNR, DOA, DOT, gravel producers.
   Timeline: Summer 2013

4. Determine potential availability of and need for weed free forage and weed free gravel in Alaska, including the increase in profit for producers of such products.
   Suggested participants: SWCD, CWMA, DOA, forage, straw and gravel producers, DOT, public land managers
   Timeline: March 2012

5. Using data developed in action 4 of this objective, encourage state and federal land managers to adopt policies that include using certified weed free materials on public lands.
   Suggested participants: DNR, DOA, DOI, USDA
   Timeline: October 2012

Photo: Amy Pettit, Alaska Division of Agriculture

A disc mower cuts hay in a field in Palmer, Alaska

Euphorbia line drawing: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 2: 473.

Objective 2:
Prevent introductions by addressing vectors that spread invasive weeds and agricultural pests.

Action Strategies

1. Increase inspection of articles and vectors by at least one type of commodity associated with a key pathway for spreading invasive weeds and/or agricultural pests.
   Suggested participants: DNR, DOA, APHIS, CBP
   Timeline: June 2012

2. Educate two new groups per year that are potential importers of invasive species or vectors.
   Suggested participants: SWCD, CWMA, CES, DNR, DOA, APHIS, DOF
   Timeline: June 2016

3. Identify high priority carriers and vectors of invasive weeds and agricultural pests.
   Suggested participants: SWCD, CWMA, CES, DNR, DOA, APHIS, ARS, DOF, others
   Timeline: June 2012

4. Require appropriate measures to clean identified high priority carriers and vectors of invasive weeds and agricultural pests.
   Suggested participants: DNR, DOA, APHIS, CBP, BLM-AFS
   Timeline: June 2013

5. Establish Best Management Practices (BMP) for land managers to aid in preventing the introduction and spread of invasive weeds and agricultural pests.
   Suggested participants: Public land managers, DOT, DNR, DOA, CES, SWCD, NRCS, NMFS, USFS, USFWS, DOF, Native Corporations and Associations
   Timeline: Summer 2012

6. Encourage travelers to wash vehicles at approved locations before or shortly after entering the state of Alaska by way of road or ferry.
   Suggested participants: DOT, DOA, CES, USFWS, CBP
   Timeline: Summer 2011

7. Educate purchasers and importers of aquatic plants about identified invasive aquatic species to prevent their introduction to Alaska.
   Suggested participants: DOA, ADFG, CES, USFWS, NMFS aquarium and pet trade, horticultural trade
   Timeline: February 2012

Photo: John H. Ghent, USDA Forest Service, Bugwood.org

Asian gypsy moth larva

Euphorbia line drawing: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 2: 473.

Regulations and Policy

Goal B: Establish and enforce sound invasive weeds and agricultural pest regulations and policies

The Alaska Department of Natural Resources (DNR) has several authorities related to invasive weeds and agricultural pest management. Many of these authorities were granted at the time of statehood with few revisions since their adoption. In recent years Alaska State government and agencies realizing the growing threat of invasive weeds and agricultural pests have pushed for updates to regulations and increased management and prevention activity.

The response of Alaska's state government is very timely. Alaska has a rare opportunity to prevent the costly and often irreversible damage to natural resources, wild areas and the agricultural industry caused by invasive species. Effective regulations are one of the most important elements to invasive species prevention and management. Now is the time to address these issues before Alaska suffers the preventable losses experienced in the other 49 states and around the globe.

The State of Alaska, DNR, and Division of Agriculture (DOA) have several tools that pertain to prevention, regulation, and enforcement (Appendix D). The Environmental Law Institute (ELI) reviewed existing state laws for invasive species and developed "Model" invasive species laws to assist states in developing their laws (ELI 2002). According to ELI there are many state tools that are important for effective invasive species management and they encourage the addition of components that foster control, management, and coordination.

Alaska regulations have several of the ELI identified state tools in place and several that are missing (Appendix D). Already present is the authority to declare pests, inspect infested areas, quarantine, and eradicate pests. Missing is a process to declare a pest, clearly linking invasive plants as part of pest management, clear description of what happens and who is responsible when applicable invasive species are found, regional prioritization of regulated species, and a board or council. According to the ELI 2002 study Alaska is missing three tools to have just more than the minimum required invasive species regulations and authorities in place. These missing tools are a definition of invasive species, an authorized board or council, and emergency authority.

Another study (Rice 2008) looked at structures for invasive species management lists that are used, and evaluated the pros and cons for different approaches. The DOA hosts a noxious weeds list that is subject to review under *AS 03.05.027*. Table 4, modified from Rice 2008, summarizes possible categories for invasive weeds and agricultural pests regulatory listing.

Table 4. Possible categories for invasive weed and agricultural pest lists

Category	General Purpose
Clean list	Plants considered non-invasive and not subject to regulation
Watch list	Collect information on potentially invasive plants
Quarantine for complete exclusion	Prevent introduction into the state
Eradicate	Eradicate or contain new invaders already in the state
Contain	Regionally abundant weeds. Suppression or eradication where appropriate
Suppress	Suppress statewide abundant weeds
Quarantined Beneficial	Containment of established beneficial plants with invasive traits
Emergency	New weeds to the state, previously not thought to be capable of establishing themselves.

***Table 4**, modified from Rice 2008, describes categories that are used for invasive species regulatory lists in other parts of the world.*

Public identified priorities

Participants in scoping had mixed levels of understanding of the current regulations for invasive weeds and agricultural pests. Participants overwhelmingly found development of an invasive species list separate from the weed seed list to be important to highly important. Respondents tended towards wanting lists separated by taxa. The majority of respondents felt it is important to identify the priority for management for a pest when developing a regulatory list for invasive weeds and agricultural pests. All respondents found value in promoting voluntary cooperation. All respondents found value in increasing the inspections of commodities known to be vectors of invasive weeds and agricultural pests.

Objective 1:
Ensure appropriate invasive weeds and agricultural pest regulations are established.

Action Strategies

1. Review and revise regulations to make them more comprehensive and easier to understand.
   Suggested participants: DNR, DOA
   Timeline: June 2011

2. Develop noxious weed list separate from the current Prohibited and Restricted Noxious Weed Seed Lists.
   Suggested participants: DNR, DOA, SWCD, CWMA, CES, and stakeholders
   Timeline: June 2012

3. Develop agricultural pests list separate from the invasive weeds list.
   Suggested participants: DNR, DOA, SWCD, DOF and stakeholders
   Timeline: June 2012

4. Biannually, establish and update invasive plant and agricultural pest lists that identify species for quarantine, eradication, containment or suppression.
   Suggested participants: DNR, DOA, stakeholders
   Timeline: June 2012 with biannual updates

5. Coordinate development and regularly review of local priority lists of invasive plants and agricultural pests identifying species for eradication, containment and suppression for established CWMA or SWCD groups.
   Suggested participants: SWCD, conservation organizations, DNR, DOF, DOA Local land managers
   Timeline: June 2012 with biannual updates

Photo: Gino Graziano, Alaska PMC

Canada thistle contaminants in an ornamental tree imported to Alaska

Photo: Alaska Natural Heritage Program

Canada thistle infestation in wet meadow:
Chester Creek, Anchorage, Alaska

Objective 2:
Promote cooperation with established regulations, and increase enforcement where necessary.

Action Strategies

1. Educate the public to promote compliance by developing a fact sheet about invasive plant and agricultural pest laws in Alaska.
   Suggested participants: DNR, DOA, SWCD, CES, CWMA, DOF and others
   Timeline: June 2012

2. Increase the number of state regulatory inspections of domestic items for invasive weeds and agricultural pests by at least five additional inspections annually.
   Suggested participants: DNR, DOA
   Timeline: June 2012-2016

Cirsium arvense line drawing: USDA-NRCS PLANTS Database / USDA NRCS. Wetland flora: Field office illustrated guide to plant species. USDA Natural Resources Conservation Service.

Coordination

Goal C: Coordinate invasive weeds and agricultural pest management strategies statewide & locally

Weeds and agricultural pests do not respect property and land management boundaries making coordination between managers of adjacent lands essential to effective management. In Alaska, several semiformal statewide and local organizations exist around the state to coordinate invasive species prevention, education, and management issues. The Alaska Pest Risk Assessment Committee (AKPRAC), Alaska Committee for Noxious and Invasive Plant Management (CNIPM, www.CNIPM.org), and the Alaska Invasive Species Working Group (AISWG, www.alaskainvasives.org) have a statewide focus. Local groups include Cooperative Weed Management Areas (CWMA) which are formed or forming in several different areas of the state (Figure 5). As invasive species management moves forward it is imperative that coordination is strengthened within and amongst these statewide and local organizations.

The accomplishments of the invasive species management bodies, both local and statewide, exemplify the cooperative spirit of invasive species managers in Alaska. The Alaska Pest Risk Assessment Committee (AKPRAC) has established communication about pest interceptions between the CBP and the other committee members. CNIPM and AISWG hold monthly teleconferences, host a joint annual meeting that draws between 100 and 200 participants, and features speakers from around the United States and neighboring Canadian provinces. CNIPM helped coordinate creation of an online data submission system for recording invasive plant locations in Alaska (AKEPIC akweeds.uaa.alaska.edu/), a citizen Early Detection and Rapid Response educational pamphlet and reporting system (www.eddmaps.org/alaska/report/), an invasive plant identification field guide (AKEPIC 2005), and development of a weed free forage certification program. CNIPM participants continue to expand existing efforts, while initiating projects including weed free gravel certification, coordinating research, control work, and other activities.

Figure 4. Cooperative weed management area locations in Alaska

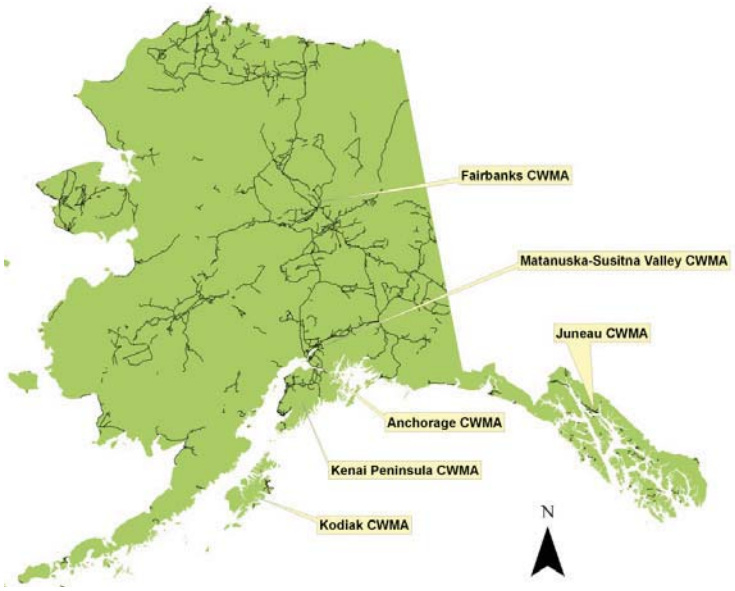


Figure 4 *shows the location of six, Alaska Cooperative Weed Management Areas (CWMA) in existence at the time this strategic plan was developed.*

The main weakness of CNIPM and AISWG lays in the voluntary cooperation component which results in irregular participation of some key agencies, and underrepresentation of certain stakeholder groups. Formation of an invasive weeds or invasive species board or council is one way to accomplish broader more official coordination. Boards and councils ensure that all affected agencies and stakeholders are brought to the decision making table. They are better able to communicate across political and agency divisions to solve problems while remaining sensitive to the missions and goals of all stakeholders. States that have boards or councils that address invasive weeds or agricultural pests are often viewed as examples of excellent programs that are highly effective at coordinating and producing results on the ground.

CWMAs from around the state work on local eradication and control work projects, and provide outreach to key audiences at local events. The work of CWMAs is presently completed by the Soil and Water Conservation Districts, nonprofits and their partners. While their efforts have been exemplary in addressing priorities, the funding for these groups is nearly entirely grant oriented making sustainability of their coordinated efforts an ongoing challenge.

Public Identified Priorities

Scoping participants viewed local and statewide coordination efforts consistently as a high value. Participants overwhelmingly identified establishment of an invasive weeds and agricultural pest management board as highly important to management of invasive weeds and agricultural pests. Respondents were divided with regards to separating an invasive weed board from a board or council that addressed all invasive species. Further comments provided indicated that weed management was a large enough issue to require a board all its own, and requires different disciplinary backgrounds. Others felt separation was not necessary because a weed board could be a part of the invasive species council or board.

Objective 1:
Formalize coordination efforts amongst land managers and interest groups associated with invasive weeds and agricultural pest management.

Action Strategies

1. Encourage development and formalization of CWMAs around the state, resulting in establishment of five new CWMAs.
   Suggested participants: SWCD, DOA, DOT, Native Corporations and Associations, and other land managers
   Timeline: June 2016

2. Further formalize statewide interagency/stakeholder coordination groups by revisiting, and updating MOUs for the established groups.
   Suggested participants: State and Federal agencies and other participating groups
   Timeline: June 2016

3. Formalize interagency coordination through development of an invasive weed board and/or invasive species council.
   Suggested participants: legislature, commissioners or their designees of state agencies, federal agencies, representatives of stakeholder groups.
   Timeline: June 2012

4. Develop formal partnerships between invasive weed and agricultural pest managers in Alaska and the neighboring Canadian Provinces resulting in sharing information about location and management of invasive species.
   Suggested participants: State and Federal Agencies, Canadian Agencies, Invasive Plant Council of British Columbia, representatives of stakeholder groups
   Timeline: June 2013

5. Increase quality of information shared by CBP with AKPRAC members for pest interceptions.
   Suggested participants: CBP, DOA, DOF, DOI, USDA
   Timeline: June 2012

Photo: U.S. Forest Service

Photo: John H. Ghent, USDA Forest Service, Bugwood.org

Asian Gypsy Moth, *Lymantra dispar*

An outbreak of alder canker on the Little Susitna River

Objective 2:
Facilitate invasive weeds and agricultural pest managers in contacting appropriate land managers and permitting groups when implementing projects.

Action Strategies

1. Develop interagency contact list organized by region.
   Suggested participants: All state, federal and local government agencies
   Timeline: June 2011, update annually

Polygonum line drawing: USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 1: 676.

Early Detection and Rapid Response (EDRR)

Goal D: Facilitate and implement EDRR for invasive weeds and agricultural pests that are beginning to arrive to Alaska or regions within Alaska.

Early Detection and Rapid Response (EDRR) involves finding species that are new invaders to an area and responding rapidly to prevent their establishment and spread. After prevention, EDRR is considered the least costly and most effective way to manage invasive species. Once a species is well established and spreading it can cost a substantial amount of money to manage and remove from areas of concern, and chances for successful eradication diminish.

The Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW) has developed a National Early Detection and Rapid Response System (EDRR) for Invasive Plants in the United States (http://www.fws.gov/ficmnew/FICMNEW_EDRR_FINAL.pdf). The plan identifies several action strategies, and outlines the major elements of an EDRR system. These major elements include:

1. Detection and Reporting
2. Identification and Vouchering
3. Rapid Assessment
4. Planning
5. Rapid Response

The state plan incorporates elements of the National EDRR system where items were not previously accomplished.

Model EDRR programs involve coordinated state, federal, and local efforts. In a state as large as Alaska one region may not have a species that is ubiquitous in another making that species a priority for early detection in the region it is not known. Engaging local groups such as an SWCD is imperative to identify these priorities and efficiently coordinate early detection and rapid response activities.

Currently EDRR in Alaska is accomplished at the federal, state and local levels where infrastructure and support are available. State employees trap bugs and conduct surveys for invasive species in partnership with the APHIS Cooperative Agricultural Pest Survey (CAPS) program and Forest Health Protection. Local Cooperative Weed Management Areas (CWMA) coordinate EDRR in partnership with state and federal agencies.

The Alaska Association of Conservation Districts (AACD) working with several partners in an EDRR subcommittee of the CNIPM worked to establish a citizen reporting system that consists of a pamphlet explaining EDRR, how to report a sighting and which species to look out for. The reporting system involves a simple online report served through the Early Detection and Distribution Mapping System, EDDMapS (http://www.eddmaps.org/alaska/report/report.cfm). Such reporting systems can be expanded with trainings for citizen scientist groups with established volunteers accustomed to environmental monitoring and reporting.

Public Identified Priorities

The majority of survey respondents had participated in some EDRR activities including survey, control or education

Figure 5. Examples of Early Detection & Rapid Response in Alaska

Purple loosestrife (left) and spotted knapweed (right) are both species worthy of EDRR in Alaska because of the threat they pose, and their limited distribution in the state. Knapweed photo courtesy of Michael Rasy, University of Alaska, Bugwood.org

activities. A variety of issues were identified as a challenge to detecting an EDRR species in a given area including identification of species, funding, and knowing where to look. Those that had found EDRR species in the past identified a variety of methods as leading to discovery of an infestation. Survey participants felt almost equally that knowing a control strategy, needing to get a permit, or gaining landowner permission are barriers to management. Further comments on this question followed a similar theme identifying time, landowner and land management issues as barriers.

Survey participants felt the state should focus EDRR efforts on directed surveys of areas with high potential for invasion. The public expressed the need for the state to be involved in training the public and other staff working in the field to conduct passive surveys. Modeling tools were identified as an important aspect of EDRR to determine where to look for new invaders.

Objective 1:
Increase efforts for early detection of invasive weeds and agricultural pests.

Action Strategies

1. Develop predictive modeling abilities to facilitate detection and deliver model reports to land managers and CWMAs.
   Suggested participants: AKNHP, DOA, USDA, DOI, NMFS, DOF, UAF
   Timeline: June 2016

2. Establish one new monitoring program each year for identified pathways, vectors and/or associated areas.
   Suggested participants: DOA, DOF, APHIS, USDA, DOI, NMFS and local CWMA groups
   Timeline: annual increase starting June 2012

3. Encourage and support research to determine risk of introducing invasive weeds and agricultural pests through vectors and pathways such as gravel, contaminated seed, commercial vehicles, automobiles, boats and other vehicles, plant products, bird seed and landscape products.
   Suggested participants: USDA, DOI, CES, DOA, NMFS, DOF
   Timeline: June 2016

4. Assess risk for introduction of invasive insects through interstate movement of commodities such as firewood, and wood packing material.
   Suggested participants: USDA, DOI, CES, DOA, DOF
   Timeline: June 2016

5. Complete directed surveys for five EDRR species and initiate eradication of those species if they are found.
   Suggested participants: USDA, DOA, NMFS, CWMA groups, SWCD, DOF
   Timeline: June 2016

6. Identify additional ports that are a priority for exotic insect trapping, and add at least 5 of those priority ports to the trapping program.
   Suggested participants: USDA, DOI, DOF, DOA, CES
   Timeline: June 2013

7. Engage citizen science monitoring programs that are likely to participate in early detection and reporting invasive weeds and agricultural pests. For each CWMA or SWCD gain participation of at least one citizen science group in monitoring for and reporting of early detection species.
   Suggested participants: CES, CWMA groups, SWCDs, AKNHP, DOA, DOF, USDA, DOI, NMFS, Native Corporations and Associations
   Timeline: June 2012

8. Host workshops in 2012 to provide information and training to land managers that may happen on EDRR species (e.g. field crews) during regular field work so that they will identify and report infestations.
   Suggested participants: CES, ADFG, DNR and divisions, DOT, SWCD, USDA, DOI, NMFS, Native Corporations, Associations
   Timeline: March 2012

9. Develop an invasive weeds and agricultural pest identification confirmation network.
   Suggested participants: CES, DOF, DOA, AKNHP, USDA, NMFS, DOI
   Timeline: May 2011, and update network annually

Centaurea stoebe line drawing: 1. USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 3: 558.

Objective 2:
Speed the rapid response to invasive weeds and agricultural pests.

Action Strategies

1. Develop strategies to gain landowner or land manager cooperation in management of priority species.
   Suggested participants: DOA, SWCD and CWMA
   Timeline: June 2012

2. Analyze the pesticide use permit process to determine if changes are necessary to facilitate treatment of EDRR species.
   Suggested participants: DEC, DOA, EPA
   Timeline: June 2016

3. Establish a rapid assessment team for unranked species that are new invaders to Alaska.
   Suggested participants: DOA, DOF, USDA, DOI, AKNHP, CES, NMFS
   Timeline: June 2012

4. Establish rapid response teams and/or partnerships working with CWMA groups or SWCDs for example, to ensure that a confirmed species report is responded to quickly with the most effective method of management.
   Suggested participants: DOA, DOF, CES, SWCD, CWMA, Federal Agencies, State land management agencies, Native Corporations and Associations
   Timeline: June 2012

5. Develop eradication strategies for high priority invasive insects that are likely to be detected at monitored ports.
   Suggested participants: DOA, DOF, CES, USDA, DOI, Native Corporations and Associations
   Timeline: June 2013

Photo: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org

Asian long-horned beetle

Objective 3:
Coordinate state and local groups to effectively address EDRR priorities.

Action Strategies

1. Encourage development of local EDRR priority lists by CWMA groups, SWCDs and/or other relevant groups.
   Suggested participants: DNR, DOA, CWMA groups, SWCD, Native Corporations and Associations
   Timeline: May 2012

2. Develop a flowchart identifying the roles of different entities in rapid response to new invaders to Alaska.
   Suggested participants: DOA, DOF, ADFG, DOT, DEC, USDA, DOI, CBP, SWCD, NMFS, Native Corporations and Associations
   Timeline: May 2012

3. Increase information sharing between agencies and local entities regarding early detection reporting and pest interceptions.
   Suggested participants: DOA, DOF, USDA, DOI, CBP, SWCD, ADFG, CWMA groups, NMFS, Native Corporations and Associations
   Timeline: April 2012

Centaurea stoebe line drawing: 1. USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 3: 558.

Control and Management

Goal E: Decrease invasive weeds and agricultural pest presence in Alaska through strategic management using integrated pest management strategies.

Control and management may include eradication, containment or suppression depending on the extent of the infestation and potential harm that the species may cause (Table 2). If few isolated populations of an invasive species exist in an area of Alaska eradication may be the priority. However, once the species is well established, containment to a particular region or ecosystem (such as roadsides) may be the most appropriate option. Suppression is used to manage invasive weeds and agricultural pests that are widespread throughout the state and do not present an immediate risk to agriculture and public resources. For example, weeds that are ranked by the Alaska Natural Heritage Program (AKNHP) as 59 or less are considered modestly, weakly or very weakly invasive (Carlson et al 2008). Species such as dandelion (*Taraxacum officinale*) rank in this category and are widespread in the state. Eradication, control and containment of such weeds are not likely to succeed, however, efforts to suppress their growth and spread should occur where possible.

Regardless of the management goal: eradication, control and containment, or suppression, the principles of integrated pest management (IPM) should be used. IPM seeks to use the most effective combination of methods available to manage an invasive weed or agricultural pest (Figure 4). The most effective combination will likely cost less over the long term, and provide greater benefit to the areas natural and agricultural resources. Methods used in effective IPM plans include cultural, mechanical and chemical controls either in combination or alone. The Environmental Protection Agency (EPA) has significant information about IPM available online (http://www.epa.gov/opp00001/factsheets/ipm.htm).

Paramount in prioritizing which species to manage is the potential affect the species will have on resources of concern. To aid in this prioritization with invasive plants the Alaska Natural Heritage Program developed a ranking system (Carlson et al 2008). The Alaska Committee for Noxious and Invasive Plant Management (CNIPM) developed a "Treatment Prioritization Tool" that uses the ranking and other factors to help guide organizations in managing infestations in their area (AKEPIC 2005). Tools such as these are important guides to development of local management plans, particularly when funding limits the number of infestations that can be managed.

Public Identified Priorities

During the scoping process several issues were identified as important to control and management. The Alaska Natural Heritage Program ranks of invasive plants were interpreted as valuable with the majority of respondents stating they use or would like to use this information to develop their weed management strategies. Respondents stated the treatment prioritization tool in Invasive Plants of Alaska (AKEPIC

Table 5. Invasive weeds and their potential for eradication

May not eradicate infestations > 1 hectare	Cumulative Hectares	Rank*	Can eradicate infestations < 1 hectare	Cumulative Hectares	Rank*
Melilotus alba,** White sweetclover	*1062*	*81*	*Centaurea stoebe,* Spotted knapweed	*0.52*	*86*
Phalaris arundinacea, Reed canarygrass	380	83	*Cytisus scoparius,* scotchbroom	*0.42*	*69*
Vicia cracca, Bird vetch	168	73	*Bromus tectorum,* cheatgrass	*0.20*	*78*
Hieracium aurantiacum, Orange hawkweed	*74*	*79*	*Lythrum salicaria,* Purple loosestrife	*0.24*	*83*
Cirsium arvense, Canada thistle	*25*	*76*	*Iris pseudacorus,* Yellow flag iris	*<0.01*	*NA*
Polygonum cuspidatum, Japanese knotweed	*20*	*87*	*Rubus armeniacus,* Himalayan blackberry	*<0.01*	*77*

** Rank is identified from Carlson et al. 2008*

*** Melilotus alba is considered Melilotus officinalis by the USDA however, still treated as M. alba in AKEPIC.*

***Table 5** depicts selected invasive weeds in Alaska, and their potential for successful eradication. Cumulative size of the infestations is used as a measure of potential for eradication as it relates to a study by Rejmanek and Pitcairn 2002 which shows that exotic weed eradication is usually possible when professionals act on infestations smaller than 1 hectare. Certain species of weed may be more or less vulnerable to eradication when infestations are smaller or larger than 1 hectare. Data is derived from AKEPIC downloaded 12-08-09 (http://akweeds.uaa.alaska.edu/index.htm).*

Figure 6. Cooperative weed management area locations in Alaska

Figure 6 *shows an example of a well implemented IPM strategy coordinated by the Homer Soil and Water Conservation District (SWCD) to manage 2 small isolated patches of Canada thistle (Cirsium arvense) on private property. The infestations were mowed multiple times during the growing season to starve this perennial of its root reserves and prevent it from flowering. Subsequently, the infestations were treated with herbicides in the fall. By 2009, the 1 acre patch had been reduced to 1% Canada thistle cover, while the 1/2 acre patch had been completely eliminated. An outreach effort was implemented that resulted in discovery of two additional infestations which were promptly treated with the same management strategy. The implemented IPM strategy resulted in achieving the desired outcome while using a minimum amount of herbicide (Slemmons and Graziano 2008, Photos courtesy Caleb Slemmons, Homer SWCD).*

2005) is used less often indicating low value. However, many participants were unfamiliar with the tool indicating it is not promoted well enough to encourage use. Developing a treatment prioritization tool and ranking species were identified as a high priority for agricultural pests other than weeds. Participants overwhelmingly found it important for the state to provide guidance to land managers, volunteers and concerned citizens in determining when an infestation can be managed with or without herbicides.

Barriers to management were identified in the scoping process. Regulations, public perception and funding were the most often cited because pesticide use permits are necessary in most situations and public opposition to pesticide use is common. Respondents felt access to land is sometimes an important barrier to management. Access issues exist for both public and private lands where permission to manage infestations is needed, or infestations are remote and difficult to get to. Other barriers identified include lack of information on control practices, species locations, and identifying high priority infestations for management.

Objective 1:
Facilitate utilization of IPM strategies for strategic management of invasive weeds and agricultural pests.

Action Strategies

1. Develop online interactive control manual, modeled after or coordinated with Invasipedia (http://wiki.bugwood.org/Invasipedia) including steps to ensure safe application and describe the specificity of application methods.
   Suggested participants: DOA, DEC, DOI, USDA, CES, EPA, NMFS
   Timeline: Set up website by June 2012 update site annually

2. Increase the use of the treatment prioritization tool through development of trainings and/or incorporation in the control manual described in action strategy 1.
   Suggested participants: DOA, CES, DEC, DOI, USDA, NMFS
   Timeline: June 2012

3. Work with partners to control 5 additional high priority species and/or infestations each year.
   Suggested participants: CWMA groups, SWCD, DOA, other local partners, Federal Land Managers, State Land Managers, Native Corporations and Associations
   Timeline: Average 5 additional per year

4. Control 5 additional infestations each year along pathways for invasive species movement such as roadsides, utility rights of way, and railroad tracks.
   Suggested participants: DOT&PF, SWCD, DOA, CWMAs, DOI, USDA, AKRR
   Timeline: Average 5 additional per year

Objective 2:
Address identified barriers to management of invasive weeds and agricultural pests.

Action Strategies

1. Develop regulatory lists that encompass invasive weeds and agricultural pest management priorities for local groups. For more information see "Regulatory and Policy" section.
   Suggested participants: DOA, SWCD, CWMA and other stakeholders
   Timeline: June 2012

2. Review DEC pesticide use permit requirements to explore easing the process for all legitimate management activities identified statewide and by local invasive weed and agricultural pest management groups.
   Suggested participants: DEC, DNR, DOT
   Timeline: June 2012

3. Improve public and agency perception and understanding of management through education and outreach about IPM, health and safety, and efficacy of chemical control practices by ensuring 5 outreach events per year are conducted.
   Suggested participants: DOA, SWCD, CES, DEC, DOT, USDA, DOI
   Timeline: June 2012

4. Develop funding mechanism or grant programs for control and management of invasive weeds and providing matching funds for federal grants.
   Suggested participants: Governor's Office, DNR, DOA, Federal Agencies
   Timeline: June 2012

5. Identify and establish permanent funding source for weed and pest management coordinators in SWCDs and CWMAs throughout the state.
   Suggested participants: Governor's Office, DNR, DOA, Federal Agencies
   Timeline: June 2013

Hieracium aurantiacum line drawing: 1. USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 3: 558.

Inventory and Monitoring

Goal F: Record the location and movement of invasive weeds and agricultural pests across the landscape.

Inventory and monitoring are two related activities that provide different types of information about invasive weeds and agricultural pests. Inventory involves determining what is present in a particular area and the extent of the infestation/s. Monitoring involves recording how the invasive weeds or agricultural pests respond to the Alaska environment, affect natural and agricultural resources, respond to various land use activities, and respond to treatments. It is essential to understand where and what is present in the state and how it responds to various external factors in order to begin effective prevention, detection, education, management, and regulation. Furthermore, species once thought to not be a threat in the state, with changing climate or exiting the lag phase, may become highly problematic at later dates. Monitoring will help to detect problems as they begin to occur.

Extensive inventory efforts are recorded for invasive plants in Alaska. The Alaska Natural Heritage Program hosts the Alaska Exotic Plant Information Clearinghouse (AKEPIC) an online dataset with locations of invasive plants (http://akweeds.uaa.alaska.edu/). Various participating agencies, nonprofits, contract organizations and individuals have contributed to this dataset which is one of the largest of its kind with over 95,000 records. The AKEPIC dataset is available free to the public and should be one of the primary tools that a person or organization interested in invasive plant management visits prior to beginning development of management, inventory and education activities in their area.

Figure 8. Funnel trap used to monitor for exotic insect pests

The Division of Forestry and partners lead efforts to trap exotic insects in an effort to monitor for pest species of concern.

Figure 7.
Purple loosestrife infestation in Westchester Lagoon, Anchorage

Purple loosestrife was long thought to not set viable seed during the short growing season in Alaska. This infestation of loosestrife found growing in Westchester Lagoon, Anchorage exemplifies the need to monitor non-native species with potential invasive characteristics. Photo courtesy Michael Shephard, USDA Forest Service.

Inventory and monitoring information for agricultural pests other than plants is not as readily available in comparison to the AKEPIC dataset. Significant aerial pest and disease inventory and insect pest trapping efforts for forest pests and diseases are conducted annually by the Forest Service, the Division of Forestry, and the Division of Agriculture. Other agricultural pests such as potato blight are checked for in annual harvests. Information for these non-plant taxa inventory and monitoring efforts are available in reports, but not in any simple publicly accessible database as they are with weeds.

Public Identified Priorities

Scoping participants identified training and funding as the most important challenges to inventory and monitoring efforts. Respondents felt the Division of Agriculture should use inventory data for species prioritization, geographic prioritization, and to provide reports to local land managers. Passive reporting by volunteers and citizen scientists is considered important. Participants overwhelmingly agreed that state efforts to monitor for invasive weeds should increase, and the state should support local efforts.

Objective 1:
Increase the capability of staff, partners and volunteers to accurately identify, inventory and monitor invasive weeds and agricultural pests.

Action Strategies

1. Increase training opportunities for partners in learning GIS and GPS technologies providing one training annually.
   Suggested participants: CES, DNR, DOA, NPS, AKNHP, USFS, AACD, BLM
   Timeline: March 2012

2. Provide more invasive weed and agricultural pest identification training opportunities with an annual training in Southeast, Southcentral and Interior regions of Alaska.
   Suggested participants: CES, AKNHP, DOA, CWMA, SWCD, NMFS, USDA, DOI
   Timeline: March 2012

Objective 2:
Identify and fill gaps in inventory and monitoring knowledge.

Action Strategies

1. Prioritize inventory efforts by species and geography, identifying five priority species and five priority geographic areas.
   Suggested participants: DNR, DOA, DOF, AKNHP, CWMA, SWCD, USDA, DOI, NMFS, Native Corporations & Associations
   Timeline: June 2012

2. Increase citizen scientist monitoring through education of five new groups and update existing outreach materials.
   Suggested participants: SWCD, DNR, DOA, AKNHP, CWMA, CES, APHIS, USFS, DOI, NMFS
   Timeline: June 2012

3. Facilitate acquisition of funds for local weed managers to regularly inventory and monitor invasive weeds and agricultural pests.
   Suggested participants: DNR, DOA, USFS, APHIS, DOI, NMFS, DOF, SWCD, CWMA, Native Corporations and Associations
   Timeline: June 2013

Objective 3:
Set up systems to ensure that all inventory and monitoring data is shared, and easily accessible for use by interested persons.

Action Strategies

1. Develop agricultural pest inventory database.
   Suggested participants: DNR, DOA, SWCD, CES, AKNHP, USFS, ADFG, DOF, CBP, APHIS
   Timeline: March 2012

2. Work with agencies collecting agricultural pest inventory data to encourage submission of data to the database identified in action strategy 1 of this objective.
   Suggested participants: DNR, DOA, SWCD, CES, AKNHP, USFS, ADFG, DOF, CBP, APHIS
   Timeline: March 2012

Melilotus alba line drawing: 1. USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 3: 558.

Education

Goal G: Educate the public about invasive weeds and agricultural pests.

Education, awareness and understanding about invasive plants and agricultural pests is paramount to fostering public, industry, and political support for prevention, control, and detection activities. Key stakeholders such as farmers, landscapers, foresters, the nursery and greenhouse industry, are groups that should have first hand knowledge of the impacts weeds and pests can have, and how to prevent their introduction. To date the SWCD, UAF CES, DOF, DOA and local CWMA members have participated in educating these key stakeholders. Engaging these groups is vital for successful community participation in invasive plant and agricultural pest management and prevention.

Alaska's youth are other stakeholders that can provide lasting impacts to community wide participation in invasive weed and agricultural pest prevention, control and detection activities. Invasive weed management groups in Alaska have developed two curricula for invasive weeds, one tailored to grades 9-12 and the other for grades K-6. Lessons are provided to youth in schools and other youth organizations such as 4-H and Girl Scouts of Alaska. Youth in Alaska that receive these lessons take the messages home to their families. They also represent the next generation of stewards of public resources in Alaska (Figure 9).

Other stakeholders that deserve attention in Alaska include industry representatives, agency personnel, and non-governmental organizations that represent various interests. These groups may affect invasive plants and agricultural pests in their regular activities. With education, these groups will likely become participants in prevention, detection and control work.

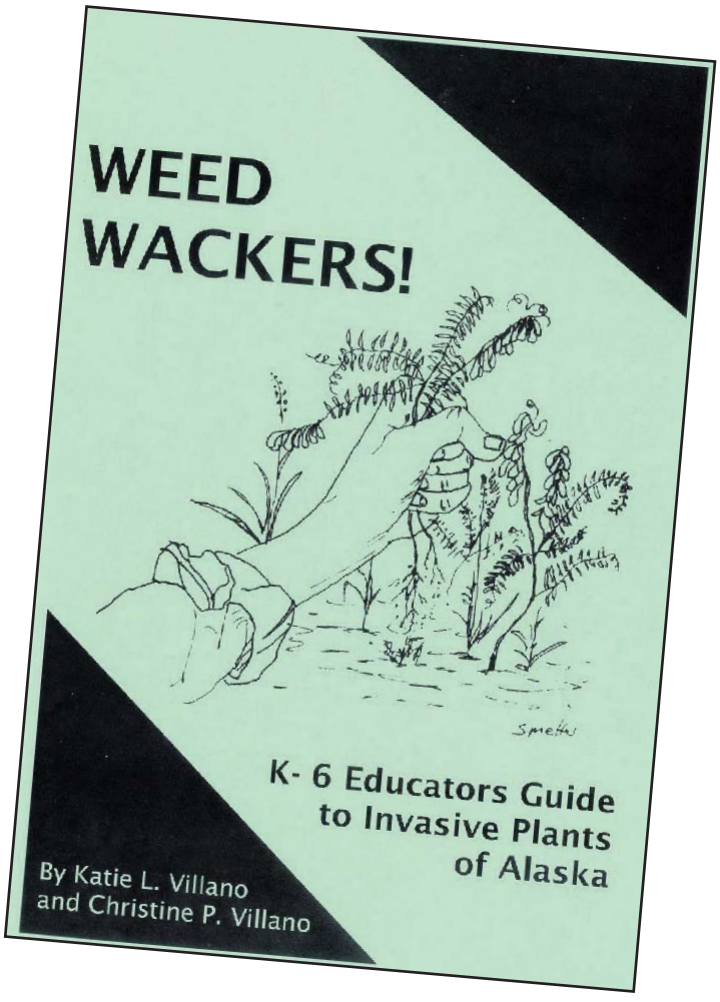
Figure 9. Educating youth has lasting impacts

Educating Alaskan youth is an important focus of invasive weeds and agricultural pest managers in Alaska. Shown here are youth receiving education about invasive weeds from the Center for Alaskan Coastal Studies and the Homer Soil and Water Conservation District.

Further education focus should be provided to rural communities. Many of these remote communities have few invasive weeds or agricultural pests because they have not experienced the development and commerce associated with weeds and pests in urban areas. These rural communities will continue to grow in Alaska, and with that growth introduction of new weeds and pests may occur. Educating rural communities about invasive weeds and agricultural pest prevention, detection and management will help those communities avoid problems occurring in other parts of Alaska.

Public Identified Priorities

The scoping process identified many audiences as at least "Somewhat Important" to receive education and training. The audiences that were frequently identified as important were nursery, greenhouse and other plant providers, public employees, and agricultural producers. Three topics stood out as the most important education topics were prevention, species of high concern and identification. Respondents felt it would be important for the State to facilitate completion of a K-12 curriculum about invasive plants. The modes of delivery for education with the highest perceived value were curriculum, fairs and public events, general outreach material and workshops.



Objective 1:
Target education work to priority subjects with key groups of people.

Action Strategies

1. Identify five key educational groups for early adoption of prevention, and management, and high priorities to prevent further introductions.
   Suggested participants: CES, SWCD, CWMA, DOA, USDA, DOI, Native Corporations and Associations, NMFS
   Timeline: June 2012

2. Develop and provide educational materials and presentations to identified key groups and rural communities.
   Suggested participants: CES, SWCD, CWMA, DOA, USDA, DOI, Native Corporations and Associations, NMFS
   Timeline: June 2013

3. Focus education on early detection and prevention providing 5 presentations annually about early detection to key educational groups, including public employees, greenhouses, landscapers, and transporters of freight.
   Suggested participants: CES, SWCD, DOA, USDA, DOI, NMFS
   Timeline: June, 2012

4. Identify five key venues for delivery of education.
   Suggested participants: DOA, CES, SWCD, CWMA, BLM-CTF, USDA, DOI, Native Corporations and Associations, NMFS-
   Timeline: June 2012

5. Focus education on early detection and prevention providing 5 presentations annually about early detection to key educational groups, including public employees, greenhouses, landscapers, and transporters of freight.

Objective 2:
Broaden educational awareness of all invasive weeds and agricultural pest management issues.

Action Strategies

1. Increase educational awareness of agricultural pests other than weeds by developing education materials and presentations for five highly invasive pests which are not plants.
   Suggested participants: CES, SWCD, DOA, USDA, DOA, Native Corporations and Associations
   Timeline: June 2013

2. Increase education regarding control measures for invasive weeds and agricultural pests by developing an online control manual.
   Suggested participants: CES, DOA, ARS, DEC, USFS, USFWS
   Timeline: June 2013

3. Continue placing advertisements discouraging the movement of firewood to Alaska from other states or Canada.
   Suggested participants: DOF, DOA, USDA, CES
   Timeline: June 2011, and ongoing

Vicia cracca line drawing: 1. USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 2: 409.

Objective 3:
Form lasting awareness of invasive weeds and agricultural pest issues through youth education.

Action Strategies

1. Complete K-12 curriculum for invasive weeds.
   Suggested participants: CES, SWCD, CWMA, DOA, USFS, School District Staff, BLM
   Timeline: June 2013

2. Work with the Alaska Department of Education and Early Development to include invasive species topics in the standards for education.
   Suggested participants: CES, SWCD, CWMA, DOA, USFS, School District Staff, BLM
   Timeline: June 2014

3. Promote use of K-12 invasive weeds curriculum to teachers and educators around the state holding annual teacher workshops rotating to different areas which are not yet exposed to the curriculum.
   Suggested participants: CES, SWCD, CWMA, DOA, USFS, School District Staff, USFWS
   Timeline: 2013-2016

Photo courtesy of Katie Villano

Demonstrating lessons from "Weed Whackers" during an educator training session

Vicia cracca line drawing: 1. USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 2: 409.

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

Appendix A: Key to Acronyms

AAC	Alaska Administrative Code
AACD	Alaska Association of Conservation Districts
ADFG	Alaska Department of Fish and Game
AFS	Alaska Fire Service
AISWG	Alaska Invasive Species Working Group
AKEPIC	Alaska Exotic Plant Information Clearinghouse
AKNHP	Alaska Natural Heritage Program
AKPRAC	Alaska Pest Risk Assessment Committee
AKRR	Alaska Rail Road
APHIS	Animal Plant Health Inspection Service
ARS	Agricultural Research Service
AS	Alaska Statute
BLM	Bureau of Land Management
BMP	Best Management Practice
CAPS	Cooperative Agricultural Pest Survey
CBP	Customs and Border Protection
CES	University of Alaska Fairbanks Cooperative Extension Service
CNIPM	Alaska Committee for Noxious and Invasive Plant Management
CTF	Campbell Tract Facility
CWMA	Cooperative Weed Management Area
DEC	Alaska Department of Environmental Conservation
DNR	Department of Natural Resources
DOA	Division of Agriculture
DOF	Division of Forestry
DOI	Department of the Interior
DOT&PF	Alaska Department of Transportation and Public Facilities
DMLW	Division of Mining Land and Water
EDDMapS	Early Detection and Distribution Mapping System
EDRR	Early Detection and Rapid Response
ELI	Environmental Law Institute
EPA	Environmental Protection Agency
GIS	Geographic Information Systems
GPS	Global Positioning System
IPM	Integrated Pest Management
ISER	Institute for Social and Economic Research
MOU	Memorandum of Understanding
NAWMA	North American Weed Management Association
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
SWCD	Soil and Water Conservation District
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

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Appendix C: Authorizing Legislation

Alaska Statutes Sec. 03.05.027.
Noxious weed, invasive plant, and agricultural pest management and education.

(a) The commissioner of natural resources shall employ or appoint a state coordinator for noxious weed, invasive plant, and agricultural pest management and education.

(b) The state coordinator employed or appointed under *(a)* of this section shall oversee the enforcement of state statutes and regulations regarding noxious weeds, invasive plants, and agricultural pests and shall coordinate with state and federal agencies, state land users, public groups, and private organizations to

(1) develop, implement, and annually review a comprehensive state strategic plan for the control of noxious weeds, invasive plants, and agricultural pests; the plan must include an early detection and rapid response system for invasive plants consistent with federal guidelines;

(2) design and execute a geographically based plant and pest management area program;

(3) develop and maintain a statewide database for mapping and monitoring noxious weeds, invasive plants, and agricultural pests;

(4) develop integrated plant and pest management programs;

(5) regulate and control the entry into the state and transportation of seeds, plants, and other horticultural products;

(6) contact and provide educational materials to state land users and other audiences regarding noxious weed, invasive plant, and agricultural pest issues, including identification, management, potential hazards, and landowner responsibilities;

(7) accept contributions of service, materials, or equipment, and, subject to appropriation of money from the United States or its agencies, from a department or agency of the state, or from any other source for use in carrying out the purposes of this section; and

(8) review and make recommendations to state departments and agencies concerning revisions to state regula tions and statutes, including revisions and additions to state noxious weed lists.

(c) Each state department, agency, and institution shall cooperate with the state coordinator employed or appointed under *(a)* of this section in carrying out the tasks specified in *(b)* of this section.

(d) The state coordinator employed or appointed under *(a)* of this section shall coordinate with the University of Alaska Cooperative Extension Service, the Alaska Association of Conservation Districts' board of directors, and the Department of Fish and Game in fulfilling the coordinator's responsibilities under *(b)* of this section.

Appendix D: Alaska Checklist of 33 State Tools for the Management of Invasive Species

Tool	Yes	No	Funding Identified
Definition of Invasive Species**		X	
Coordination			
Comprehensive invasive species council**		X	
Comprehensive Invasive species plan	X	X	X
Interagency invasive species council		X	
Prevention			
Identifying and mitigating future threats		X	
Detection			
Surveying for invasive species	X		
Mapping invasive species and sensitive locations	X		
Inspection authority**	X		
Introduction/import/Release requirements			
Standards**	X*		
Advisory committee		X	
Quarantines			
Specific species and facilities***	X		
Transportation**	X		
Mandatory		X	
Education	X		
Regulation			
Permits and licenses**	X*		X
Transportation and shipping requirements			
Prohibitions		X	
Permits and licenses**	X*		
Inspection authority**	X		
Labeling requirements	X		
Registration of shippers		X	
Monitoring		X	
Bonds and insurance		X	

** Tool is for Plants Pests and Diseases, excluding weeds and other invasive species.*
*** Tools required for a state to be considered to have more than the minimum authorities necessary to effectively manage invasive species.*

Tool	Yes	No	Funding Identified
Control and Management			
General control and management authority			
Authority over public and private lands**	X*	X	
Notice to state agency of presence of invasive species		X	
Statewide program	X		
Emergency powers**		X	
Biological control agents			
Permit and license		X	
Standards		X	
Restoration		X	
Enforcement and implementation			
Enforcement			
Criminal and civil sanctions**	X		
Liability for damages		X	
Positive incentives		X	
Funding**	X		

** Tool is for Plants Pests and Diseases, excluding weeds and other invasive species.*
*** Tools required for a state to be considered to have more than the minimum authorities necessary to effectively manage invasive species.*

The above table lists the recommended tools for invasive species management according to the Environmental Law Institute (ELI 2002). The chart is meant for use to grade state programs as Bronze (at least 13 tools), silver (at least 24 tools), and Gold (all 33 tools). For invasive weeds and agricultural pests Alaska has established statutes and regulations allowing government to implement 17 of the 33 tools. If analysis of the tools includes an implementation component associated with funding identified for each specific tool, far fewer tools are in place. Three key components are missing that according to ELI are necessary to have effective management of invasive species: Definition of invasive species, comprehensive invasive species council and emergency powers. While Alaska does not presently have a suite of regulations for invasive species that would place it into a gold standard by the ELI, it is recognized as having established several regulations allowing for effective management to begin. Effective regulations for Alaska do not necessarily require adoption of the gold standard.

Appendix E: Forest Insect and Disease Activity

2010 forest insect and disease activity as detected during aerial surveys in Alaska by land ownership[1] and agent. All values are in acres[2].

TABLE 1	national forest	native	other federal	state & private	Total ACRES
Abiotic causes[3]	968	2,274	2,970	*5,807*	*12,019*
Alder canker	**817**	*8,971*	*11,537*	*22,906*	*44,230*
Alder defoliation[4]	635	24	244	6,092	6,995
Aspen defoliation[4]				1,750	1,750
Aspen Leaf Miner		108,295	144,395	200,967	453,658
Birch defoliation[4]		154	4,295	28,842	33,290
Black-headed budworm		252		91	343
Cedar decline faders[5]	28,666	630		1,212	30,507
Conifer defoliation	4,408	4,005	2,187	2,454	13,053
Cottonwood defoliation[4]	178	4,612	4,027	5,268	14,085
Hardwood defoliation		715	865	665	2,245
Hemlock canker	314	83			397
Hemlock sawfly	6,932	1,236	110	824	9,101
IPS and SPB[6]		1,550	470	178	2,198
Ips engraver beetle		7,866	11,663	2,071	21,600
Large aspen tortrix		1,517	2,088	4,986	8,592
Porcupine damage	638	12		269	919
Spruce aphid	20,331	1,543	5,120	13,686	40,680
Spruce beetle	1,567	6,648	56,317	13,452	77,983
Spruce needle rust	61	144	501	50	756
Willow defoliation[4]	178	231,270	233,900	97,328	562,675
Willow dieback		37	199	489	725

1 *Ownership derived from 2008 version of Land Status GIS coverage, State of Alaska, DNR/Land records Information Section. State & private lands include: state patented, tentatively approved, or other state acquired lands, and of patented disposed federal lands, municipal, or other private parcels.*

2 *Acre values are only relative to survey transects and do not represent the total possible area affected. The affected acreage is much more extensive then can be mapped. Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe) which are not detectable in aerial surveys.*

3 *Damage acres from some types of animals and abiotic agents are also shown in this table. Acres recorded from abiotics include windthrow, freezing injury, flooding, snow slides and land slides*

4 *Significant contributors include leaf miners and leaf rollers for the respective host. Drought stress also directly caused reduced foliation or premature foliage loss.*

5 *Acres represent only spots where current faders were noticed.*

6 *These acreage values are a cumulative effect from IPS engraver beetle (Ips perturbatus) and Spruce Bark Beetle (Dendroctonus rufipennis) working in tandem on the same stand of trees.*

Appendix F: Action Strategy Completion Timeline

Strategies for completion July 2011- June 2012

Goal A: Prevent the introduction and spread of invasive weeds and agricultural pests.

Objective 1, action strategies 1, 2

Objective 2, action strategies 1, 2, 3, 6

Goal B: Establish and enforce sound invasive weeds and agricultural pest regulations and policies.

Objective 1, action strategies 1, 2, 3, 4, 5

Objective 2, action strategies 1, 2

Goal C: Coordinate invasive weeds and agricultural pest management strategies statewide and locally.

Objective 1, action strategies 1, 3, 5

Objective 2, action strategies 1

Goal D: Facilitate and implement EDRR for invasive weeds and agricultural pests that are beginning to arrive to Alaska or regions within Alaska.

Objective 1, action strategies 2, 7, 9

Objective 2, action strategies 1, 3, 4

Objective 3, action strategies 1, 2, 3

Goal E: Decrease invasive weeds and agricultural pest presence in Alaska through strategic management using integrated pest management strategies.

Objective 1, action strategies 1, 2, 3, 4

Objective 2, action strategies 1, 2, 3, 4

Goal F: Record the location and movement of invasive weeds and agricultural pests across the landscape.

Objective 1, action strategies 1, 2

Objective 2, action strategies 1, 2

Objective 3, action strategies 1

Goal G: Educate the public about invasive weeds and agricultural pests.

Objective 1, action strategies 1, 3, 4

Objective 2, action strategies 3

Strategies for completion July 2012- June 2013

Goal A: Prevent the introduction and spread of invasive weeds and agricultural pests.

Objective 2, action strategies 4, 2

Goal B: Establish and enforce sound invasive weeds and agricultural pest regulations and policies.

Objective 1, action strategies 1, 2, 3, 4

Objective 2, action strategies 2

Goal C: Coordinate invasive weeds and agricultural pest management strategies statewide and locally.

Objective 1, action strategies 1, 4

Goal D: Facilitate and implement EDRR for invasive weeds and agricultural pests that are beginning to arrive to Alaska or regions within Alaska.

Objective 1, action strategies 2, 6, 8

Objective 2, action strategies 5

Objective 3, action strategies 1

Goal E: Decrease invasive weeds and agricultural pest presence in Alaska through strategic management using integrated pest management strategies.

Objective 1, action strategies 3, 4

Objective 2, action strategies 3

Goal F: Record the location and movement of invasive weeds and agricultural pests across the landscape.

Objective 1, action strategies 1, 2

Objective 2, action strategies 3

Objective 3, action strategies 2

Goal G: Educate the public about invasive weeds and agricultural pests.

Objective 1, action strategies 2, 3

Objective 2, action strategies 1, 2, 3

Objective 3, action strategies 1, 3

Strategies for completion July 2013- June 2014

Goal A: Prevent the introduction and spread of invasive weeds and agricultural pests

Objective 2, action strategies 2

Goal B: Establish and enforce sound invasive weeds and agricultural pest regulations and policies

Objective 1, action strategies 5

Objective 2, action strategies 2, 5

Goal C: Coordinate invasive weeds and agricultural pest management strategies statewide and locally.

Objective 1, action strategies 1

Goal D: Facilitate and implement EDRR for invasive weeds and agricultural pests that are beginning to arrive to Alaska or regions within Alaska.

Objective 1, action strategies 2

Objective 3, action strategies 1

Goal E: Decrease invasive weeds and agricultural pest presence in Alaska through strategic management using integrated pest management strategies.

Objective 1, action strategies 3, 4

Objective 2, action strategies 3

Goal F: Record the location and movement of invasive weeds and agricultural pests across the landscape.

Objective 1, action strategies 1, 2

Goal G: Educate the public about invasive weeds and agricultural pests.

Objective 1, action strategies 3

Objective 2, action strategies 3

Objective 3, action strategies 2, 3

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

Objective 2, action strategies 3

Strategies for completion July 2014- June 2015

Goal A: Prevent the introduction and spread of invasive weeds and agricultural pests

Objective 2, action strategies 2

Goal B: Establish and enforce sound invasive weeds and agricultural pest regulations and policies

Objective 2, action strategies 2

Goal C: Coordinate invasive weeds and agricultural pest management strategies statewide and locally.

Objective 1, action strategies 1

Goal D: Facilitate and implement EDRR for invasive weeds and agricultural pests that are beginning to arrive to Alaska or regions within Alaska.

Objective 1, action strategies 2

Objective 3, action strategies 1

Goal E: Decrease invasive weeds and agricultural pest presence in Alaska through strategic management using integrated pest management strategies.

Objective 1, action strategies 3, 4

Objective 2, action strategies 3

Goal F: Record the location and movement of invasive weeds and agricultural pests across the landscape.

Objective 1, action strategies 1, 2

Goal G: Educate the public about invasive weeds and agricultural pests.

Objective 1, action strategies 3

Objective 2, action strategies 3

Objective 3, action strategies 3

Strategies for completion July 2015- June 2016

Goal A: Prevent the introduction and spread of invasive weeds and agricultural pests

Objective 2, action strategies 2

Goal B: Establish and enforce sound invasive weeds and agricultural pest regulations and policies

Objective 1, action strategies 5

Objective 2, action strategies 2

Goal C: Coordinate invasive weeds and agricultural pest management strategies statewide and locally.

Objective 1, action strategies 1, 2

Goal D: Facilitate and implement EDRR for invasive weeds and agricultural pests that are beginning to arrive to Alaska or regions within Alaska.

Objective 1, action strategies 1, 2, 4

Objective 2, action strategies 2

Objective 3, action strategies 1

Goal E: Decrease invasive weeds and agricultural pest presence in Alaska through strategic management using integrated pest management strategies.

Objective 1, action strategies 3, 4

Objective 2, action strategies 3

Goal F: Record the location and movement of invasive weeds and agricultural pests across the landscape.

Objective 1, action strategies 1, 2

Goal G: Educate the public about invasive weeds and agricultural pests.

Objective 1, action strategies 3

Objective 2, action strategies 3

Objective 3, action strategies 3

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

Objective 1, action strategies 1, 2, 3, 4

Objective 2, action strategies 1, 2