Forest Health Conditions in Alaska - 2009
A Forest Health Protection Report
2009 Select Projects

“Early Detection Rapid Response (EDRR) Monitoring Update”
Roger Burnside and Mark Schultz

“Northern Spruce Engraver Beetle Management in a Changing Climate – Research and Demonstration Slash Management Projects in Interior Alaska”
Roger Burnside, Christopher Fettig, Christopher Hayes, Mark Schultz, and Jim Kruse

“Firewood Transportation in Alaska”
Jim Kruse

“Yellow-cedar Genetics”
Paul Hennon

“New Book and Leaflet on Hazard Trees”
Paul Hennon

“Alder Disease Update”
Lori Winton

“Preventing the Spread of Invasive Species by Identifying Pathways of Invasion”
Nick Lisuzzo

“Eradicating Spotted Knapweed from Alaska”
Gino Graziano and Michael Rasy

“Invasive Plant Education in Alaskan Schools”
Katie Spellman
Invasive Plant Education in Alaskan Schools

By Katie Spellman

“Pull, mow, call and spray, to make invasives go away, go away!” the Denali Elementary first graders sang to the tune of the classic “Head, shoulders, knees and toes” song. These students were the first of many classrooms throughout Alaska to complete lessons from Weed Wackers: A K-6 Educator’s Guide to Invasive Plants of Alaska. Alaska’s first Alaska-specific elementary curriculum on invasive plants, was written by a mother-daughter team, Katie Spellman, then a graduate student at University of Alaska Fairbanks, and Chris Villano, a teacher in the Fairbanks North Star Borough School District.

The first line of defense and most cost-effective strategy against the spread of invasive plants is preventing them from being introduced and becoming established in Alaska. The prevention of introductions of problematic species in the diverse areas of the state relies heavily on informed and empowered Alaskan citizens. With Katie’s research background on invasive plants in Alaska, and Chris’s outstanding contributions to science education in the state, the two set out to engage Alaska’s largest, most enthusiastic captive audience, elementary students, in the fight against invasive plants.

With support from RIO Forest Health Protection, the Center for Global Change and Arctic Systems Research, Bonanza Creek LTER, Salcha-Delta Soil and Water Conservation District, and other small grants, Katie and Chris were able to write, field test, and publish the Weed Wackers curriculum guide. The Weed Wackers curriculum guide provides teachers with current scientific background to teach about invasive plants. Many lessons and experiments in the guide are adapted from recent studies on invasive plants conducted by Alaskan scientists. Teachers have replicated experiments in their classrooms with species that have not yet been studied in Alaskan habitats, and their students contributed to the ecological understanding of invasive species in Alaska. After conducting these experiments, the Weed Wackers model seeks to facilitate the exchange of information between students and scientists working on the issue around the state.

During the Fairbanks North Star Borough School District science curriculum revision process in 2008, Chris was successfully able to advocate for the inclusion of invasive plants in district-wide mastery core objectives to address Alaska State Science Standards. As a result, all third and sixth graders in the Fairbanks North Star Borough are required to learn about invasive plants. This was a tremendous first step in widespread education on invasive plants in Alaskan schools.

In 2009, FHP offered an even greater opportunity to extend the reach of the Weed Wackers project. With this partnership, Katie and Chris were able to develop a series of teacher-training workshops on the Weed Wackers curriculum in communities throughout the state. After earning her Master’s degree from UAF, Katie became the program director at the Center for Alaskan Coastal Studies (CACS), an environmental education non-profit in Homer, Alaska. With CACS connections to a statewide network of science educators, the Weed Wackers workshops were an instant success. In the first month of workshop offerings alone, the teacher trainings were able to reach teachers and agency educators from 11 different communities throughout Alaska (Figures 50 and 51). Teachers were instructed on the biology of invasive plants, ecological field methods, and how to connect with Alaskan

Figure 50. A transect study inquiry using photos of invasive plants in natural Alaskan habitats. Inclement weather in Juneau prevented an outdoor field study of local invasive plants.
scientists interested in the topic. Workshops also covered how to engage K-6 students in meaningful scientific investigation and how to empower students to educate their own communities on the impacts of invasive plants.

By educating Alaska's teachers and offering them quality teaching resources, the Weed Wackers project is working to help build a statewide awareness about the threat of invasive species in Alaska. The elementary students that these teachers take their newly found knowledge to heart. They not only educate their own families and friends, but create the conservation attitudes of tomorrow.

Figure 51. Ketchikan workshop participants conduct a field survey of invasive plants to learn how to use scientific sampling methods with their students. Photo by Katie Spellman, Center for Alaska Coastal Studies.

2009 Invasive Plant Program

Activities

2009 was a busy year for the R10 FHP invasive plant program. We continued our wide-ranging and effective partnerships with a variety of organizations, and began to work with several new groups. The section below describes some of the year's highlights.

Engaging The Wildlife Society in invasive species issues

Alaska has few invasive species. This positive situation has one significant downside: it can be hard to get people and organizations to mobilize around the cause of prevention. While it may be human nature to respond most emphatically to crises, once an invasive species issue has reached the crisis stage the best opportunity for management has usually been lost. What prevents some Alaskan policy makers and natural resource professionals from enthusiastically adopting prevention and EDRR approaches? Some in Alaska believe the state is immune the problems that invasive species are causing in other places. Some aren't convinced of the threat posed by invaders, while others don't realize the value of prevention. And some, having spent their entire professional careers here, are simply unaware of the extent of the problem in the lower 48 states.

Two important and powerful groups of natural resource professionals in Alaska are wildlife and fishery biologists. In an effort to increase awareness, spur dialogue and gain traction in the first group, R10 FHP sponsored a special session at the 2009 meeting of the Alaska Chapter of the Wildlife Society. The session, "Impacts of invasive plants on wildlife: a growing threat in Alaska," was held in Fairbanks in April. Three wildlife biologists from the lower 48 were sponsored to speak on the spread of invasive plants in their regions, and the associated impacts to wildlife habitat. Tom Toman, Director of Conservation for the Rocky Mountain Elk Foundation, described the long-term impacts of invasive plants on elk habitat at a landscape scale. Shawna Bautista, Region 6 FHP, described impacts of invasive plants in riparian and coastal areas of the Pacific Northwest, considering purple loosestrife, reed canarygrass and Japanese knotweed, all species that are spreading in Alaska. Steve Link, Washington State Extension Ecologist and editor of the Natural Areas Journal, discussed the ecological effects of cheatgrass invasion. Cheatgrass seed is routinely and inadvertently imported to Alaska in bales of straw, and widely dispersed as sled dog bedding. FHP personnel spoke on the current status and distribution of invasive plants in Alaska.

The special session was attended by about 80 members of The Wildlife Society. Numerous FHP-produced invasive plant identification guides and brochures were picked up, and many copies of the NFS-produced DVD "Defending Favorite Places" were taken home. One attendee commented that it had never occurred to him that he could be contributing to the spread of invasive plants when he did field work. A similar session is being discussed for a future American Fisheries Society annual meeting.
Field Guide to Alaska Grasses

In 2009, Alaska FHP joined a project of the US Fish and Wildlife Service and the Alaska Division of Agriculture, Plant Materials Center (PMC) to develop a field guide to Alaska grasses. The guide is a joint effort of Dr. Quentin F. Skinner, Professor Emeritus of the University of Wyoming, and Stoney Wright, of the PMC. Skinner taught grass taxonomy in Wyoming for 25 years and has written guides to the grasses of Wyoming and Nevada. FHP support ensured that a number of non-native grass species that are showing invasive tendencies in Alaska would be included in the guide. The project also included two 3-day short courses on grass identification, which were held in Palmer and Fairbanks in August (Figure 52). Class rosters were filled 24 hours after the registration period opened, indicating the interest and need for this type of training in Alaska. The courses were also sponsored by the Alaska Chapter of the Society of Wetland Scientists, and by the University of Alaska Museum of the North. The Field Guide to Alaska Grasses is expected to be completed in 2011.

Purple loosestrife display removed from Alaska State Fair

When the Alaska State Fair opened in August of 2009, invasive-plant-savvy attendees experienced a shock. Gracing the entryway of the fairgrounds in Palmer, Alaska, was a beautiful bed of perennial flowers, dominated by a carefully tended stand of purple loosestrife in full bloom. FHP cooperators from the Alaska Cooperative Extension Service (CES) immediately contacted the head gardener at the fairgrounds to express their concern about the perennial bed. After some discussion, the gardener agreed to let the CES set up a display explaining the problematic nature of that species (Figure S3).

CES responded rapidly, and within hours hundreds of fairgoers were learning about why most Alaskans want to keep this species out of the state. By midweek, the species had been removed entirely from the flower bed.

Partnering with the US FWS’ Youth Habitat Restoration Corps

In 2009, FHP personnel assisted in the inaugural year of the US FWS Youth Habitat Restoration Corps. Five Fairbanks students ages 14 – 17 participated in the 3-week pilot program. The students worked alongside biologists on local wetland and streambank restoration projects. FHP provided a presentation on invasive plant issues and identification in Interior Alaska. The Corps removed over 100 pounds of invasive weeds from the US FWS equipment storage yards and the Wander Lake Wildlife Refuge.

Alaska invasive species meetings held in Southeast Alaska for first time

The Alaska Committee for Noxious and Invasive Plant Management (CNIPM) has held annual meetings since 1999. The meetings are well attended, and over the years have become the must-attend opportunity for people concerned with invasive plants in Alaska to interact and coordinate their efforts. The meeting location has alternated between Fairbanks and Anchorage, where most of the state’s population resides, and several years ago, the Alaska Invasive Species Working Group (AISWG, an all-taxa group) began to meet in conjunction with CNIPM. In an effort to bring resi-
dents of Southeast Alaska more into the fold of Alaska's invasive species community, in 2009 the CNIPM and AISWG meetings were moved to Ketchikan, the southernmost city of Alaska's panhandle. Many new faces joined us this year, including many folks from the Tongass National Forest and the Forest Service's Alaska Region office. Presentations focused on species of particular concern in Southeast Alaska, including the knotweed complex (Japanese knotweed and other knotweed species), garlic mustard, and spotted knapweed. The latter two species are present in Alaska in extremely limited areas, and have been targeted by a multi-agency consortium for eradication from the state. Alaska FHP was actively involved in the organization of the meetings, and in partnership with the Alaska Center for Coastal Studies, sponsored an Invasive Plant Curriculum Workshop for Southeast Alaska teachers (see Select Project page 57).

Two awards were presented. The annual Alaska CNIPM award was presented to Genelle Winter, landscape manager of Metlakatla Indian Community, for setting up and managing a proactive invasive plant management program on the Annette Island reservation. Two Customs and Border Protection Agents were recognized by the Forest Service for their September, 2008 detection of Asian gypsy moth egg masses on a ship arriving at Leask Cove.

Cooperative Weed Management Areas (CWMAs) Alaska's network of Cooperative Weed Management Areas continues to expand, and FHP is actively involved in many of the groups.

In 2009 the Juneau CWMA was officially formed (Figure 54), replacing a long-standing and active group, Juneau Invasive Plant Action. Paperwork is moving forward in the ratification of a Sitka CWMA as well. Several other CWMAs in the state continue to sponsor innovative and effective projects.

During Alaska Weed Awareness Week, hundreds of people took advantage of Fairbanks CWMA's table at the Fairbanks Farmers' Market, where weed identification services and pocket guides were offered. Temporary tattoos were applied to hundreds of kids (Figure 55). About 20 people attended the Fairbanks CWMA's second annual "Weeds Gone Wild" workshop in late July.

![Figure 54. The logo of the newly established Juneau Cooperative Weed Management Area. Both FHP and National Forest System personnel are active in this group.](image)

![Figure 55. This temporary tattoo refers to *Vicia cracca*, or bird vetch, one of Alaska's most problematic invasive plants.](image)
Viewing Alaska's invasive plant distribution data in Google Maps

Region 10 FHP has long been an active participant in the development of the Alaska Exotic Plant Information Clearinghouse (AKEPIC) database. The database, designed and managed by the Alaska Natural Heritage Program, now has over 80,000 records of invasive plant locations in the state. The database is heavily used by the Alaska invasive plant community, but until recently it could be downloaded only as an enormous spreadsheet.

A collaboration between R10 FHP and the University of Georgia's Center for Invasive Species and Ecosystem Health has lead to the development of an internet portal that allows AKEPIC data to be viewed online in Google Maps (Figure 56). The Early Detection Distribution Mapping System (EDDMapS) allows anyone with internet access to view the distribution of invasive plants in map format (http://www.eddmaps.org/alaska/). This portal makes AKEPIC data easily accessible and viewable to people without GIS skills or software. A related project funded by R10 FHP and conducted by HDR, Inc., makes invasive plant absence data viewable as well, vastly increasing the information content of these online maps.

Figure 56. Two screen captures of the newly developed EDDMapS-Alaska portal for displaying invasive plant distribution data in map format. The screen capture at left shows the known distribution of Japanese knotweed (red markers) around the village of Kake on the northern end of Southeast Alaska's Kupreanof Island. The screen capture at right displays the locations where Japanese knotweed was found (red markers) and the points that were surveyed and no Japanese knotweed found (white markers). Including such "absence data" in invasive plant maps greatly increases their information content, giving managers a more complete understanding of known distributions, and helping them plan new surveys.
The following section highlights invasive plants of concern in subarctic Interior Alaska, the central portion of the state which extends north to the Brooks Range, and encompasses the Alaska Range and the Wrangell Mountains. Interior Alaska is home to the state's longest river, the Yukon, and vast tracts of boreal forest and forest-tundra transitional zones. The climate in the Interior is characterized by seasonal temperature extremes - long, cold winters and short, relatively warm summers. Most of the annual precipitation falls as snow, and the region features pockets of permafrost in the south, transitioning to continuous permafrost in the northern Interior.

The largest city in the Interior is Fairbanks, located in the Fairbanks North Star Borough, which is home to roughly 12 percent of Alaska's 664,000 residents. Other population centers include Delta Junction, Tok and Glenallen. Invasive plants, plant seeds, and propagules are introduced to these population centers via contaminated agricultural seed and livestock feed, roadside seed mixes, nursery, landscaping and greenhouse stock, construction materials and heavy equipment, and on recreational equipment and vehicles. Once established in areas of human disturbance, there is potential for movement into surrounding natural areas: the mountains, river valleys, and forests of Alaska's pristine Interior.

**Bird vetch**

*Vicia cracca* L.  
Non-native

Bird vetch is a climbing, vine-like perennial with three coiling tendrils at the end of each stem (Figure 57). By climbing and covering surrounding vegetation, this species is able to monopolize sunlight, leaving underlying vegetation stunted and chlorotic. Infestations of bird vetch can cause branch dieback on young conifers, suppress understory species and potentially impact forest regeneration.

Intentionally introduced to Interior Alaska as a forage crop in the early 1900s, bird vetch has spread along road corridors from Fairbanks to the Kenai Peninsula. Dense mats of this species can be found overtopping young trees, shrubs, meadow vegetation, and landscaping in the Fairbanks area. Work conducted by the Alaska Plant Materials Center in 2001 mapped the distribution of bird vetch in the Fairbanks area and the Mat-Su Valley. In both cases it appeared to be spreading from the University of Alaska experimental farms. Bird vetch is the invasive species most recognized by the public in the Fairbanks area.

Infestations of bird vetch are rapidly expanding. Work by the Agricultural Research Service in the Fairbanks area has shown that on south-facing slopes, bird vetch is spreading from roadsides and powerline right-of-way into undisturbed forest. This species takes advantage of the longer growing seasons that Interior Alaska has experienced in recent years. It stays green and continues to photosynthesize several weeks after the leaves of native plants turn yellow and fall to the ground. In 2009, a white-flowered specimen of *Vicia cracca* was found and collected on the UAF campus.
Canada thistle  
*Cirsium arvense* (L.) Scop.  
Non-native

This perennial thistle is characterized by spiny stems, sometimes growing to 4' tall, which sit atop an extensive network of horizontal and lateral roots. Canada thistle spreads by seed and root fragments, rapidly colonizing areas of disturbance. Dense patches also move along the forest edge and into meadows. Canada thistle clones can expand up to 6 feet in diameter in a single growing season, creating spiny barriers to human and animal traffic and out-competing seedlings and native grasses and forbs.

While Canada thistle is widespread in Anchorage and the Mat-Su Valley, there is no known Canada thistle in either the Fairbanks or Delta Junction areas. The absence of this species from Delta Junction is one of Alaska’s invasive plant success stories. In the late 1970s, an infestation of Canada thistle was discovered in Delta Junction, distributed over about 160 acres of agricultural land. Agents from Alaska Cooperative Extension, later joined by the Delta Chapter of the Alaska Farm Bureau and the Salcha-Delta Soil and Water Conservation District, treated this infestation with chemicals repeatedly over the next 18 years. As a result, Canada thistle has been completely eradicated from Delta Junction since 1997. The focus of weed control efforts in Delta Junction has now shifted to split-lip hempnettle and perennial sowthistle (see below).

Cheatgrass  
*Bromus tectorum*  
Non-native

Cheatgrass is an annual cool season grass which can be identified by its drooping panicles and soft white hairs on leaves and stems, which give this grass a “downy” appearance. One of the most problematic invasive plants in the western United States, cheatgrass or “downy brome” is well-adapted to harsh climates, limited moisture, and temperature extremes; a species well-suited to establishment and spread in Interior Alaska. Widespread infestations of cheatgrass across the western US have had a devastating influence on landscapes by altering wildfire regimes. A one-acre infestation of cheatgrass was identified in 2006 in an old dog yard near Chena Hot Springs (Lapina et al. 2006). The site was visited in 2009, and no evidence of cheatgrass was found. However, a new population of cheatgrass was identified in a hayfield near the town of Nenana.

European bird cherry  
*Prunus padus* L.  
Non-native

European bird cherry and chokecherry are small ornamental trees that produce cylindrical spikes of showy white flowers in the spring (Figure 58). Long a staple species of nursery and landscape industries, European bird cherry has also spread to parks, greenbelts and riparian areas in Anchorage, and is beginning to exhibit the same behavior in the Fairbanks area. The seeds of this species are dispersed by birds, and birdcherry seedlings are capable of dominating forest understories and competing with native woody vegetation such as alder, willow and birch. The Alaska Chapter of the American Society of Landscape Architects no longer recommends European birdcherry as a landscape tree.

In the Fairbanks area, birdcherry can be seen growing in closed-canopy forests along the Boreal Forest Nature Trail behind the Creamers Field farmhouse. It can be found growing mixed in with native vegetation along the Chena River near the Carlson Center in downtown Fairbanks. Surveys conducted in 2008 of
the University of Alaska Fairbanks campus found European birdcherry spreading in many parts of the campus.

Chokecherry, a related species, has been found growing in greenbelt areas of Anchorage. To date, chokecherry is not known to be spreading in the Fairbanks area.

**Foxtail barley**

*Hordeum jubatum* L.  
Non-native (?)

It is unclear whether foxtail barley is native to Alaska or not: what is known is that it is very widely distributed in the state. Further research will be needed to definitively determine whether the invasive genotypes present in Alaska today are the same as those believed to have been present in eastern Alaska prior to European settlement. In Alaska, foxtail barley spreads rapidly and aggressively in areas of human disturbance.

A perennial bunch grass, the hollow stems of foxtail barley arise from a mass of fibrous roots. The leaf blades of foxtail barley are rough, grey-green, and ribbed. Its nodding open spike inflorescence has long awns, which are green-tinged with pink or purple in early summer, fading to straw color in late summer and fall (Figure S9). While palatable to grazing animals in the early summer, the sharp awns develop backward-pointing barbs which can lodge in the eyes, nose, mouth, ears, and stomachs of animals, causing infection.

Foxtail barley is found all across Interior Alaska, especially in areas where there has been human disturbance. This species is considered a pest in pastures, hay fields, grain crops, and around dog yards and horse corrals. It is expanding into natural areas via logging roads and the trans-Alaska pipeline.

**Hempnettle**

*Galeopsis bifida* Boenn.  
Non-native

An annual in the mint family, hempnettle has square-sided stems with swollen nodes. The entire plant is covered with bristly hairs. Hempnettle leaves are oval to lance-shaped and sharply toothed. Its flowers range in color from white to pink or purple, clustered in the axils of upper stem leaves. Although this species does not spread vegetatively, hempnettle produces enormous amounts of seed. This weedy invader of disturbed areas is a problem in many gardens and other disturbed areas around Fairbanks, but to date we have no indication of it spreading into natural areas. In 2008, FHP staff found dense stands of seed-dispersing hempnettle growing in the shadow of the raspberry plants at a popular Fairbanks u-pick raspberry farm. It’s likely that many berry pickers carried hempnettle seeds home on their shoes.

**Narrowleaf hawkweed**

*Hieracium umbellatum* L.  
Non-native

Considered native to regions of North America, narrowleaf hawkweed is steadily expanding its range in Alaska. This yellow flowered hawkweed species was not historically present in Alaska, but has been spreading aggressively in recent years. Narrowleaf hawkweed is known to have become established in the Matanuska-Susitna Valley, throughout Anchorage and south into the Kenai Peninsula. Several incipient populations were recently detected along roadsides in the vicinity of Delta Junction. One of these populations is located along a powerline right-of-way, which has the potential to function as a corridor for the spread of this species along forest edge and into natural forest openings.

Unlike the other invasive hawkweed species in Alaska, narrowleaf hawkweed does not form a basal rosette of leaves, and has no stolons. Narrowleaf hawkweed is the tallest non-native hawkweed in Alaska, with linear to lance-shaped stem leaves covered in short stiff star-like hairs.
Narrowleaf hawkweed is one of seven hawkweed species now present in Alaska.

**Perennial sowthistle**  
*Sonchus arvensis* spp. *uliginosus* (Bieb.) Nyman  
Non-native

Perennial sowthistle is a deep-rooted plant with loose clusters of yellow, dandelion-like flowers. The leaves of perennial sowthistle vary in shape, and have prickly margins and leaf bases which clasping the stem. This plant has a milky sap-like resin and can grow up to five feet tall. With its extensive horizontal root system, perennial sowthistle is able to monopolize soil moisture and form dense stands. Along with white sweetclover (see below) perennial sowthistle is a colonizer of open, gravelly, early successional areas, and has the potential to spread into riparian areas and glacial outwash plains.

Widespread across Southcentral Alaska, perennial sowthistle has become established in both Fairbanks and Delta Junction. This species can be seen in abundance on roadsides and in vacant lots near the Fairbanks landfill, and along the Alaska Railroad tracks near the University of Alaska Fairbanks. Perennial sowthistle is now the focus of chemical weed control efforts in Delta Junction, the Delta Chapter of the Farm Bureau, and the Salcha-Delta Soil and Water Conservation District.

**Reed canarygrass**  
*Phalaris arundinacea* L.  
Non-native

This species can quickly form a dense mat, excluding all other vegetation. There are concerns that well-established populations of reed canarygrass may interfere with spawning by anadromous fish, such as salmon, by trapping sediment and blocking the flushing action which maintains gravel beds. This species was once a component of a seed mix used to revegetate roadsides and it is moving off the roadways into wet meadows and other natural areas.

While reed canarygrass is common in Southeast Alaska and on the Kenai Peninsula, it was not known to exist in Interior Alaska—until 2009. A single well-developed patch of reed canarygrass was found along Fairbanks’ South Cushman street last summer (Figure 60). The patch is less than half an acre in size. In summer, 2009, FHP cooperators at the Cooperative Extension Service prevented seed production by cutting the panicles off the plants before maturation. The patch has been targeted for control in 2010.

**Siberian pea shrub**  
*Caragana arborescens* Lam.  
Non-native

A shrub or small tree in the pea family, Siberian pea shrub is multi-stemmed with erect to spreading branches originating from a dense, spreading roots system. The leaves of this plant are pinnately compound, with 8 to 12 leaflets. Narrow stipules at the base of leaf petioles persist as sharp spines. Its pea-like yellow flowers are approximately one inch long, and are borne singly or in small groups. The pods of Siberian pea shrub are linear, green, and strongly flattened, becoming more cylindrical and brown at maturity (Figure 61). On warm, sunny days in late summer and fall, Siberian pea shrub pods disperse explosively with an audible “snap.”
This species has been used extensively in Alaska as a hardy landscaping shrub. It can withstand the harsh climate of Interior Alaska with little or no maintenance. In Fairbanks, Siberian peashrub is often planted as a hedge between residential properties.

**White sweetclover**  
*Melilotus alba Medikus*  
Non-native

**Yellow sweetclover**  
*M. officinale* (L.) Lam.  
Non-native

Some of the fastest spreading exotic plants in Alaska, the sweetclovers have infested roadsides throughout the state. The sweetclovers are tall, branching members of the pea family, with fragrant white or yellow flowers. Both white and yellow sweetclover are described as biennial, but have been found to flower and produce seed after one growing season in Alaska, possibly due to the long hours of daylight during summer months. The sweetclovers alter soil chemistry through nitrogen fixation. Improperly stored sweetclover hay may produce coumarin, a chemical that can be toxic to grazing animals and livestock.

Frequently established along roadsides, white sweetclover is now moving from the road system into river corridors and flood plains, via road–river interfaces. Sweetclover seeds float, and are therefore spreading rapidly down river and stream corridors. White sweetclover, more abundant in Alaska than yellow sweetclover, infests riverbanks on the Nenana River in the Interior, the lower sections of the Matanuska River in Southcentral Alaska, and the Stikine River in Southeast Alaska.

**Yellow toadflax**  
*Linaria vulgaris* P. Mill.  
Non-native

Yellow toadflax or “butter and eggs” is a multiple-stemmed perennial, growing to 2 feet, with pale green lanceolate or linear leaves and racemes of bright yellow “snapdragon like” flowers with orange palates (nectar guides) (Figure 62). Producing up to 30,000 seeds per plant and spreading by creeping rhizomes, yellow toadflax forms dense colonies and suppresses surrounding vegetation. Its horizontal roots, which can grow to several feet long, develop adventitious buds which give rise to new plants.

This species is adapted to a wide range of conditions, and has become widespread along Alaska’s rail system, road systems, and in areas of human disturbance. In addition to aggressively colonizing meadows and other natural forest openings, this species contains a glucoside toxic to grazing animals.

Yellow toadflax is one of the more common invasive plant species in population centers throughout the Alaskan Interior. However, 2006 surveys of highway right-of-ways in the Interior detected toadflax in only three locations: in western Fairbanks, outside of Fairbanks near the community of North Pole, and at the end of the Elliot highway. This limited number of sightings only indicates that the survey focused on roadsides, while yellow toadflax is most commonly found in gardens and residential settings.

Figure 62. Yellow toadflax (*Linaria vulgaris*). Photo by National Park Service.