Exotic Plants in Alaska's Parks

by Chris McKee, National Forest Service

Above: Exotic dandelion (Taraxacum officinale officinale)*, growing at the Trail Creek trailhead, mile 29 Nabesna Road, Wrangell-St. Elias National Park and Preserve in 2004. Below: Native Alaska dandelion* (Taraxacum ceratophorum) *in the same park.*

SNRAS alumnus Chris McKee received his master of science degree in natural resource management in 2004 at UAF. McKee's thesis was "Distribution and Ecology of Exotic Plants in Wrangell-St. Elias National Park and Preserve, Alaska." He conducted surveys on Alaska Park Service lands throughout the state, identifying about fifty non-native species. His thesis advisor was professor Patricia Holloway.

The summer of 2004 marked the fifth year of surveys for exotic (non-native) plants on National Park Service (NPS) lands in Alaska. These surveys provide baseline data on exotics in the parks, and help in formulating a long-term monitoring and control plan for exotic plants in Alaska's NPS units. These species are a concern to resource managers because they threaten the genetic integrity of native flora through hybridization, can monopolize limited resources for resident plant species, and can change the structure and function of ecosystems through alterations of geochemical and geophysical processes. Invasive exotic plants cause billions of dollars' worth of economic loss in the lower forty-eight states every year. By 1996, exotic plant species had infested an estimated seven million acres of NPS lands nationally, with 4,600 acres of new infestations occurring daily.

Alaska parks are the only parks in the nation that are still relatively unaffected by exotic plant invasions. Infestations can have profound implications for other aspects of the ecosystems they invade. Some exotic plant species are capable of altering processes such as nutrient cycling and fire frequency and intensity. These effects can be at the small scale (local infestations of a given exotic species altering the nutrient content of the soil, as with sweetclover and nitrogen), and at the large scale (such as cheat grass and its alteration of fire patterns).

Alaska NPS lands have been relatively free from the es-

tablishment of many of the more pernicious exotic plants species found in the lower 48 states. Several factors have contributed to this apparent immunity. The most important is climate. Circumboreal flora are adapted to a range of climatic conditions that many exotic plants cannot tolerate. In addition, park lands in Alaska have remained relatively free of man-made disturbances such as livestock grazing, wildfire suppression, and altered hydrological regimes that encourage the introduction of exotic species, and they still have all of the major floral and faunal ecosystem components. Despite these protective factors, the threat of exotic plant invasion is increasing due to global climate change and increases in disturbance related construction. Fortunately, the NPS has an opportunity to get a head start on exotic plant control in Alaska before it becomes a severe problem, but research and active management must begin now.

The summer of 2004 marked the first year that extensive surveys for exotic plants were conducted using highly accurate Trimble Geo XT GPS units. These units can achieve sub-meter accuracy and can be downloaded with data dictionaries to map infested areas with spatial detail sufficient for year-to-year monitoring of spread. Within the framework of a nationwide database for exotic plants on NPS lands, a data dictionary was customized for Alaska with multiple fields used to describe the composition, size, and severity of exotic plant infestations in a given area (Table 1). A digital photo of each site and species was made in addition to a qualitative description of the area. When exotic species were found in low numbers, they were removed by hand after recording location and other data.

The surveys were opportunistic in nature, being carried out in areas of human use within park lands, including park hiking and ATV trails, roadsides, developed areas such as hotels and other tourist related infrastructure, and administrative and employee housing facilities. More remote areas such as backcountry use cabins and primitive airstrips were also visited in some parks. ArcGIS software was used to generate shapefiles that included all records from the GPS unit, from which a map of surveyed areas was generated. Seven parks were surveyed in 2004: Denali National Park and Preserve (DENA), Glacier Bay National Park and Preserve (GLBA), Kenai Fjords National Park (KEFJ) Klondike Gold Rush National Historical Park (KLGO), Sitka National Historical Park (STHP), Western Arctic National Parklands (WEAR), and Wrangell-St. Elias National Park and Preserve (WRST).

Table 1. Selective fields used in GPS data dictionary and GIS analysis for surveys of exotic plant species within Alaska national parks, summer 2004.

Field Abbreviation	Field Description
Location ID	Location ID
Dstrbncs	Disturbance Type (trampling or mowing)
LctnDscrpt	Location Description (park = inside park boundary)
Taxon	Dominant exotic species
Phenology	Phenology of dominant exotic species (no flower or full flower)
CvrClssPer	Cover class percentage of dominant exotic species (1, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100)
CntrlEffrt	Control effort (low, medium, high)
Action	Inventory or Treatment
Undetermined	Stem count of dominant exotic species
Remarks	Remarks
AssocPark	Associated park (four letter park code)
Recorder	Recorder Initials
Taxon2, Taxon3...	Additional 8 fields for 8 other exotic taxa for each unique site
Treatment	Treatment (only PULL/DIG-MANUAL this year)

Maltese cross (Lychnis chalcedonica)*, a new exotic species for Alaska, growing in Gustavus.*

Table 2. Exotic species list for Alaska national parks, 2004.

Species	Park Unit						
	DENA	GLBA	KEFJ	KLGO	STHP	WEAR	WRST
Achillea millefolium	*			*			*
Allium schoenoprasum							*
Brassica rapa	*						
Bromus inermis	*						*
Capsella bursa-pastoris	*			*			*
Cerastium fontanum		*					
Chenopodium album	*			*			*
Crepis tectorum	*			*			*
Descurania sophia	*						*
Digitalis purpurea					*		
Elymus repens							*
Erysimum cheiranthoides				*			
Eschsholzia californica							*
Euphrasia nemorosa				*			
Galeopsis tetrahit				*			
Lappula squarrosa	*						*
Lepidium densiflorum	*						*
Leucanthemum vulgare	*	*	*	*	*		*
Linaria vulgaris	*		*	*			*
Lolium perenne		*					*
Lupinus polyphyllus	*	*					
Matricaria discoidea	*	*	*	*	*		*
Melilotus alba	*						*
Melilotus officinalis	*						*
Phalaris arundinacea		*					
Phleum pratense	*	*					*
Plantago major	*	*	*	*	*		*
Poa pratensis				*			
Polygonum aviculare	*			*			*
Polygonum convolvulus	*						
Polygonum cuspidatum					*		
Ranunculus acris				*			
Ranunculus repens					*		
Rumex acetosella				*			
Rumex crispus				*			
Senecio vulgaris				*			
Silene cucubalus				*			
Silene noctiflora	*						
Sonchus arvensis	*						
Sorbus aucuparia					*		
Spergula arvensis	*						
Stellaria media	*			*			
Taraxacum officinale	*	*	*	*	*		*
Thlaspi arvense				*			*
Trifolium hybridum	*						*
Trifolium pratense	*	*					*
Trifolium repens	*	*	*	*	*		*
Triticum aestivum		*					
Vicia cracca	*						
Viola tricolor				*			

A total of fifty exotic plant species were found in seven different park units during the summer of 2004 (Table 2). Parks with the highest levels of human use also had the greatest number of exotic plant species. The largest numbers of exotic plant species were identified in Denali, Klondike Gold Rush, and Wrangell-St. Elias parks. Of the species identified during the summer of 2004, nineteen were new records for Alaska park units. All species found were limited to the immediate area of disturbance and no species have been found to be moving into undisturbed native plant communities. The more remote parks of Bering Land Bridge National Preserve and Cape Krusenstern National Monument had no exotic species. Visitation to these parks is limited and expensive, and is usually confined to the winter months. The most common exotic plant species found included oxeeye daisy *(Leucanthemum vulgare)*, pineapple weed *(Matricaria discoidea)*, common plantain *(Plantago major)*, common dandelion *(Taraxacum officinale officinale)*, and white clover *(Trifolium repens)*.

Most of the exotic species found in the Alaska national parks are not invasive to natural ecosystems, and are innocuous in terms of their ecological impacts. However, a few species should be of concern to park managers, particularly white sweetclover *(Melilotus alba)*, bird vetch *(Vicia cracca)* and Japanese knotweed *(Polygonum cuspidatum)*.

White sweetclover is a nitrogen-fixing plant capable of spreading rapidly and developing large infestations. Each plant can produce up to 350,000 seeds that can remain viable in the soil for over eighty years. Large areas of the Stikine River in southeast Alaska, as well as several areas along the Nenana and Matanuska Rivers in the interior region of the state have already been infested by this species. Dispersal of sweetclover seeds along river corridors could provide a vector for the invasion of more remote areas of Alaska's national parks.

Bird vetch is a climbing plant with coiling tendrils at the end of each leaf, and the plants can overgrow herbaceous vegetation and climb over shrubs. This species has a symbiotic relationship with *Rhizobium* bacteria that fixes atmospheric nitrogen. Each plant produces copious amounts of seed that can remain viable for many years.

Japanese knotweed is adapted to southeast Alaska and is capable of forming large monocultural stands, reducing biodiversity and degrading habitat for resident wildlife. The species is also capable of clogging waterways and preventing germination of native plant seed through formation of deep, slowly decomposing organic layers.

Though Alaska parks have yet to witness large infestations of exotic plant species in intact ecosystems, they are by no means immune to invasion. Increases in disturbance related to construction and infrastructure maintenance are creating an environment conducive to the establishment and spread of these species. Ongoing global climate change may result in the northward expansion of some of the more pernicious exotic species from the Lower 48 into northern regions. Once established in large numbers, these species require large investments of time and money in order to control or eradicate their populations. Site and species-specific control efforts should be a priority of park resource management staff. The mantra of the Alaska Exotic Plant Management Team is "early detection and rapid response." Indeed, aggressive control and eradication efforts are needed sooner rather than later before infestations become financially and ecologically untenable.

Chris McKee works for the National Forest Service in Seward.

Sources & Literature

D'Antonio, C., L.A. Meyerson, and J. Denslow. 2001. Exotic species and conservation: research needs. Pages 59-80 in M.E. Soule and G.H. Orians eds. *Conservation Biology: Research priorities for the next decade*. Island Press, London.

Densmore, R.V., P.C. McKee, and C. Roland. 2001. Exotic plants in Alaska National Park Units. Final Report for IA 14431A991000027. USGS, BRD. Digital report and Database.

ESRI. 2002. ArcGIS software. Version 9.0

Gordon, D.R. 1998. Effects of invasive, non-indigenous plant species on ecosystem Processes: Lessons from Florida. *Ecological Applications* 8(4): 975-989.

Klemow, K.M. and D.J. Raynal. 1981. Population ecology of *Melilotus alba* in a limestone quarry. *Journal of Ecology* 69: 33-44.

National Park Service. 1996. A strategic plan for managing invasive nonnative plants on National Park System Lands. U.S. Department of Interior. www.nature.nps.gov/wv/strat.pl.htm. Accessed October 21, 2003.

Royer, F. and R. Dickinson. 1999. *Weeds of the Northern U.S. and Canada*. University of Alberta Press. 434 pp.

Westbrooks, R.G. 1998. *Invasive plants: changing the landscape of America: fact book*. Federal Interagency Committee for the Management of Noxious Weeds. Washington, D.C. 109 pp.

Above: White sweetclover (Melilotus alba) *growing off of a park road, Denali National Park and Preserve. This species is one of particular concern to park managers.*

Below: Common plantain (Plantago major)*, a common exotic plant, growing in Denali National Park and Preserve.*

School of Natural Resources and Agricultural Sciences
Agricultural and Forestry Experiment Station
PO Box 757200 • Fairbanks, AK • 99775-7200
e-mail: fynrpub@uaf.edu
phone: 907.474.5042 or 474.6923 fax: 907.474.6184

This article is reprinted from Agroborealis 37.1