



Science in the Crown

Working Together To Create a Crown of the Continent Invasive Plants Field Guide

A major threat to native plant communities within the Crown of the Continent Ecosystem (CCE) is the invasion, establishment, and spread of invasive non-native plants. In protected areas within the ecosystem, the threat is greatest in the pristine backcountry where a number of invasive plants have visibly increased. Combating invasive plants in the CCE is complicated because it is an international transboundary region managed by more than 20 agencies.

Invasive plants do not recognize political boundaries and CCE managers acknowledge that this is a shared problem that cannot be solved independently. Yet, currently there exists no single reference or common strategy for containing and managing invasive plants in the CCE. To begin to move forward on this issue, managers from throughout the CCE are working together to create a user-friendly, ecosystem-specific field guide on invasive plants.

The Crown of the Continent Research Learning Center and Glacier National Park's Invasive Plant Biologist are designing and developing the field guide in concert with representatives from 20 local, state, provincial, tribal, and federal agencies and organizations, many of whom are members of Crown Invasive Plant Network (CIPN), a working group of invasive plant specialists for the various agencies (including Glacier and Waterton Lakes National Parks) and organizations in the CCE. The CIPN is a subcommittee of the Crown of the Continent Managers Partnership (CMP). The guide will serve as a tool for educating staff, volunteers, and the general public. It will also provide the CIPN a foundation from which to



Orange Hawkweed *Hieracium aurantiacum*
Aster family (Asteraceae)

Distinguishing features:

- Vibrant orange-red flowers
- Milky latex juice when broken
- Hairy leaves mostly found at base of plant
- Stems mostly leafless w/ black bristly hairs

Flowers: Cluster of 5- 30 dandelion-like, showy, red-orange flower heads. Petals have notched tips.

Leaves: Entire, hairy leaves at the base of the plant. Leaves darker green on top than underneath. Few to no leaves on stem.

Seeds: Black seeds with tawny-white plumes.

Roots: Rhizomous. Shallow fibrous roots with a woody stem base.

Growth habit: Perennial from 1 to 3 feet tall. Above ground runners, similar to those of strawberries, create a dense mat that impedes other vegetation.

Dispersal, mode of reproduction: By above ground runner, seeds and roots.

Habitat preferences: Low to mid-elevations. Disturbed areas, meadows, roadsides, grasslands, forest openings and lawns. Will not tolerate heavy shade.

Manual control for small infestations: Hand pull entire plant (including runners and roots), cut below ground or cut flower seed head.

Origin/ Interesting facts: Introduced from Europe as a garden ornamental. Grazed by sheep and goats, occasionally by cattle, horses and native grazing animals.

"Look-alike" native species: Many native hawkweeds exist in the COCE but all have white or yellow flowers. Orange Mountain Dandelion (*Agoseris aurantiaca*) also has milky latex juice but has solitary flowers and is mostly hairless.

A draft of a species account page for the Crown Invasive Plants Field Guide.

build a common strategy for communication, education, and decision support. The guide will highlight detailed accounts on approximately 40 species, including the highest priority species currently present in the CCE and those most likely to invade the CCE, thus promoting early detection of weeds in the backcountry. A digital file will also be created from which partners can create pamphlets and presentations in the future.

The field guide will include an introduction to invasive plant issues in the Crown, detailed information for the 40 weed species, and short profiles for an additional 20 species. The introduction section will include information about the CCE, CMP, and CIPN; about the reason for concern about invasive plants in general; causes and prevention of noxious weed spread;

the importance of early detection and rapid response; other issues (fire, climate change) that may affect weed populations; and how a person can help, monitor, and report infestations. Detailed information for each of the 40 species will include identification characteristics, dispersal, mode of reproduction, habitat preferences (areas at risk), origin of the species, methods for treatment, current distribution of the species in the CCE, and "look-alike" native species.

The guide will be printed in 2008. This project is primarily funded by International Conservation Programs Office of the National Park Service. Several partners and granting agencies have also pledged funding support.

USGS Scientists Study Amphibians in Glacier



Steve Corn, Research Zoologist with USGS Northern Rocky Mountain Science Center in Missoula, Montana.

Dr. Steve Corn, Research Zoologist with the U.S. Geological Survey Northern Rocky Mountain Science Center, is stationed at the Aldo Leopold Wilderness Research Institute in Missoula. He has directed a variety of research projects on amphibians in Glacier NP. Steve has been at the Leopold Institute since 1996, but his involvement with Glacier's herpetofauna began in 1993, when he invited (now retired) park fisheries biologist Leo Marnell to present the results of his amphibian surveys at a symposium, Amphibian Monitoring in Western National Parks.

In 1999, Steve began research on the effects of ultraviolet radiation on amphibian populations, as part of a 2-year multi-park project funded by the Park Service's Park Research & Intensive Monitoring of Ecosystems Network (PRIMENet). This study included collaborators from the Park Service, Environmental Protection Agency, other USGS research centers, and the University of California. Complementary work on amphibians was conducted simultaneously in Glacier, Olympic, King's Canyon, and Sequoia National Parks, and the water chemistry of amphibian breeding habitats was also studied in Acadia,

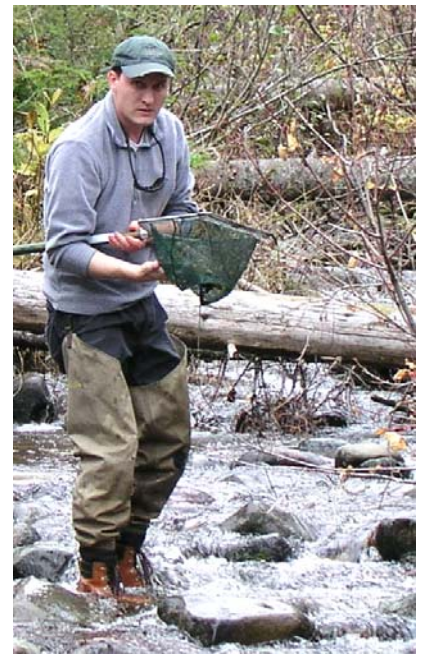
Great Smoky Mountains, and Rocky Mountain National Parks. Steve hired Blake Hossack as the leader for data collection in Glacier, a task Blake continues to perform. The PRIMENet study found little evidence that UV radiation has affected recent distribution or abundance of amphibians in Glacier.

In 2000, Steve and Blake began long-term monitoring of amphibian populations in Glacier as part of the USGS Amphibian Research and Monitoring Initiative (ARMI). This is a national project (<http://armi.usgs.gov>) to determine status and trends of amphibian populations, determine causes of their declines, assist agencies in developing effective ways to combat declines, and develop partnerships by sharing data and encouraging collaborations. Amphibian populations are monitored in Glacier by surveying all known potential breeding sites in a sample of small watersheds, and estimating occupancy, or the proportion of sites where breeding occurs each year. So far, Glacier's amphibians (6 species) appear to have stable populations, and do not appear to have suffered declines, in contrast to species in the southern Rocky Mountains.

The recent wildfires in Glacier have occasionally been a hindrance to completing data collection, but more importantly, have provided a unique opportunity to study the effects of wildfire on amphibians, a topic that has received very little attention until recently. Both the Moose Fire in 2001 and Robert Fire in 2003 burned through areas where Steve and Blake had previously recorded data on amphibian occurrence. Surveys after the fires have revealed a relative reduction in abundance of year-old tadpoles of the stream-dwelling Rocky Mountain Tailed Frog. However, there was little effect on the two most common pond-breeding species (Columbia Spotted Frog, Long-toed Salamander). In contrast, the Boreal Toad, which is of concern because of serious declines in parts of its range, experienced a brief surge in numbers of breeding sites the year after a fire. This surge seems to be short-lived, and

numbers of breeding sites have declined back to pre-fire numbers within 3 years after the fires. The causes of this surge and subsequent retreat are not well understood and are the subject of continued research.

Steve is a graduate of the University of Illinois (B.S.) and Colorado State University (M.S., Ph.D.). He has conducted non-game research since 1983 for the U.S. Fish and Wildlife Service, National Biological Service, and USGS. He received the USGS Central Region Science Excellence Award in 2004. Blake is a graduate of the University of Montana (B.S.) and University of Idaho (M.S.). They continue to monitor Glacier's amphibian populations and study factors, such as climate change and fire, which may influence distribution and abundance. This summer, in addition to their standard surveys, they are surveying potential amphibian sites within the perimeter of the 2006 Red Eagle Fire.



USGS Zoologist Blake Hossack uses a dip net to capture tadpoles of the Rocky Mountain Tailed Frog in Fern Creek on the west side of Glacier National Park.

Glacier Eastside Grassland Ecological Assessment



Photos of Apikuni Falls trailhead and former CCC camp. Taken by George Grant in 1933 (above) and by Dave Shea in 2000 (below). Vegetation on the cliffs has not seemed to change but there has been tree encroachment in the meadow.

During 1999-2001 National Park Service Fee Demonstration Funds provided funding for an Ecological Assessment of Eastside Grasslands in Glacier National Park. The project was undertaken to describe the current ecological baseline condition of eastside grassland communities as a basis for monitoring future changes and to link wildlife use with condition in order to develop a management strategy for these grasslands. The study area consisted of fescue grasslands, dominated by bluebunch wheatgrass, Idaho fescue, and rough fescue east of the Continental Divide between 4,500 -6,500 feet in elevation where precipitation ranges from 26-46 inches annually. Because there is little historical data for these grasslands, we searched the archives for photographs of meadows as an indicator of how they may have changed over the past several decades.

We selected 54 historic photos from park archives featuring eastside meadows originally taken

between approximately 1890 and 1977 for repeat photography. The photo points were replicated as closely as possible during 1999-2001 by Dave Shea, a park biological science technician at the time, who has worked seasonally at the park since about 1965. All photos were digitally scanned and processed to match the views as closely as possible. Dave Shea and Carl Key, of the USGS Glacier Field Station, prepared a document featuring the photo pairs, which includes information on dates, photographers, UTM location, elevation, and a narrative description of the location and changes, fire history, and attributes observed for each photo pair. Increases in conifer and aspen growth are frequently evident, while a number of park developments have changed dramatically or have been returned to a more natural state. This document, entitled "Glacier's Eastside Grasslands: Photographic Comparisons Over Time", was printed during the past year, and a limited number of copies are available by contacting tara_carolin@nps.gov or carl_key@usgs.gov.

Social Science about Sun Road

Dr. Wayne Friemund and graduate student Melissa Baker, both from the University of Montana, returned to the Going-to-the-Sun Road for their third year of social science research in conjunction with the mitigation of the effects of the planned 8-year rehabilitation project. Research in the first 2 years concentrated on pre-shuttle use of existing pullouts, including proposed transit stops and popular pullouts. The information was used to help plan facility development, understand visitor uses and motivations at these areas, and establish baseline conditions to understand the effects of the shuttle system. With the implementation of the shuttle on July first, this year's work will focus on visitor satisfaction and their understanding of the system and its benefits, which will help park managers make improvements to the system to better meet visitor needs. It will also help us understand how effective our messaging and outreach has been.

Glacier NP Associates Internship



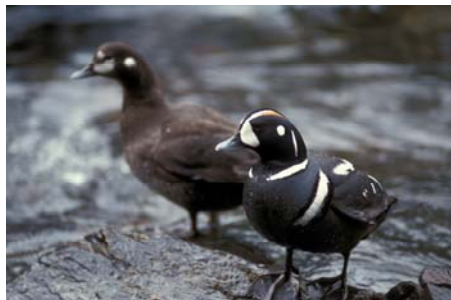
Briana Board, Glacier National Park Associates Intern, looks for Common Loons on Logging Lake.

Glacier National Park Associates (GNPA) is sponsoring a summer intern for the Citizen Science on Common Loons project. The purpose of the internship is to assist in developing and piloting a strategy for making the program sustainable in future years. The primary goal of the loon project is to gather season-long information in order to make a better estimate of population health of Glacier's Common Loons and to identify factors affecting nesting success.

This highly successful, grant-funded, citizen science program was developed in 2005 and 2006, and is continuing in 2007.

Briana Board is the GNPA intern. Some of Briana's responsibilities include coordinating and training volunteers, organizing Summer Loon Day, and creating a training handbook for future interns. She is also entering data about Glacier's loons, creating summary reports, and working in the field. Some of her field work entails verifying loon nest locations and checking remote lakes to determine whether significant loon habitat may have been overlooked in the past. Briana received a B.S. in biology and secondary education from Montana State University. She has been living near Glacier for the past three years, teaching outdoor education. She is excited about and feels fortunate to be working on a field study project and educating volunteers.

Monitoring Harlequin Ducks in Glacier NP



Harlequin Ducks (female on left and male on right) are monitored along one stream each year in Glacier.

Harlequin Ducks (*Histrionicus histrionicus*) are small sea ducks that breed on fast-flowing streams in inland watersheds and coastal estuarine sites in North America from May through August and migrate to coastal rocky shorelines where they remain for the rest of the year. They are able to move swiftly and with great agility in turbulent white water. For a sea duck, they are unusually comfortable on land, resting and preening on rocks, logs, and beaches. The western population in North America breeds from Alaska south through Montana to northwest Wyoming and winters along the Pacific Rim from Alaska to Oregon.

The Harlequin Duck is a “Species of Concern” in Montana, with an estimated 200 breeding pairs in

Montana and perhaps 30-40 pairs in Glacier, including one stream with the highest density of nesting pairs in the state. Surveys in Glacier and elsewhere in Montana have documented limited habitat, low population numbers, and highly variable reproduction.

Banding studies conducted by Glacier staff and volunteers, in cooperation with the Montana Natural Heritage Program, and more intensive monitoring during the 1990s led to several important findings. Harlequins from Glacier have been captured or observed wintering on the coasts of Oregon, Washington, and British Columbia, with most reports from around Vancouver Island. Fidelity to natal streams is high for females but low for males. Age at first return to the breeding stream varies between 2 and 4 or more years, with little successful breeding occurring until 3 or 4 years of age. Movements between nearby breeding streams (separated by <20 km) occurs infrequently, though perhaps routinely; more distant movements have been documented but are probably very rare events.

Harlequin Duck numbers appear to be declining on the one 10-mile section of stream in Glacier that is surveyed annually for pairs and broods. Although it is difficult to draw firm conclusions

about population trend due to variability in survey results, pair counts seem to have declined significantly since the early 1990s. Harlequins have nested on several other park streams but regular surveys are only conducted on one stream, and only about half of the potential nesting streams have been surveyed even once. There is growing concern that harlequins may be declining throughout the park, but lack of reliable survey information prevents an accurate assessment.

Threats to harlequins include recreational activities, construction activities, pollution (heavy metals and pesticides), and climate change effects. Very high or low water can reduce productivity. Likely effects of warming trends in Glacier include earlier timing of spring runoff with bigger pulses of water, and less water later in the season, resulting in some streams becoming ephemeral. Declining stream flows as a result of warming trends or persistent drought could have devastating effects on nesting harlequins.

Key to our ability to protect these unique birds for future generations is continued monitoring. We will continue to seek funding for consistent, park-wide monitoring so that we can be more certain about the status of Harlequin Ducks in Glacier NP.



National Park Service
U.S. Department of the Interior

Crown of the Continent Research Learning Center
Glacier National Park
PO Box 128
West Glacier, MT 59936

Sallie Hejl, Acting Director
and Resource Education Specialist
Billie Thomas, Administrative Assistant

Phone: 406-888-5827
Web address: <http://www.nps.gov/glac/>

Research Learning Centers increase the effectiveness and communication of research and science results in the national parks.

Upcoming Projects & Events

Parks, Peace, and Partnerships Conference 2007

Waterton-Glacier International Peace Park is celebrating 75 years of international cooperation by holding an international science conference from September 9–12 in Waterton Lakes National Park. The conference will be an exciting gathering of international experts on peace parks and transboundary natural resource management. To register, go to www.peaceparks2007.org

Western Airborne Contaminants Assessment

Dixon Landers, US EPA scientist, will present the results from research on airborne pollutants in eight national parks, including Glacier. In October, Dixon will give a brown bag seminar for park staff and an evening presentation for the public emphasizing the results for Glacier.

Astronomy, Light Pollution, and the National Parks

Tyler Nordgren, Associate Professor of Physics at University of Redlands in California, will give a brown bag seminar for park staff and an evening presentation for the public on astronomy, light pollution, and the National Parks in early September in Glacier NP.