National Park Service
U.S. Department of the Interior
Crown of the Continent Research Learning Center

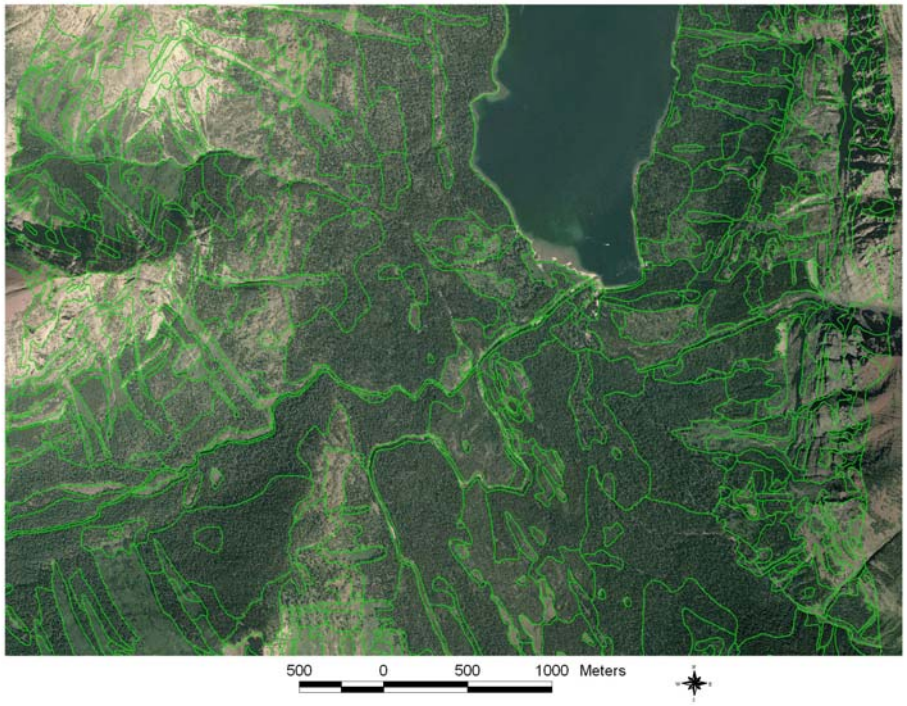
Science in the Crown

Vegetation mapping for Waterton-Glacier

In 1998, Glacier National Park became one of the first National Park Service units to begin its vegetation classification and mapping project under the joint USGS-NPS Vegetation Mapping Program (http://biology.usgs.gov/npsveg/). This program will classify and map the vegetation of approximately 270 NPS units within the next twenty years. Glacier's project began in earnest in 1999, with field crews hitting the east side of Glacier to begin collecting "classification" data –information needed to describe the diversity of vegetation associations found on the ground. Ecological modeling provided the project team and field crews a sense of how this diversity might be distributed geographically, which informed where field crews should focus their sampling.

Waterton Lakes National Park joined the project in 2000, with the goal of creating a seamless vegetation map for Waterton-Glacier International Peace Park**.** Field work to collect classification data continued in Waterton and Glacier through 2001, yielding roughly 1,000 sampling points throughout the Peace Park. Ecologists with NatureServe and the Montana Natural Heritage Program analyzed these data and published the *Vegetation Classification of Waterton-Glacier International Peace Park* in June of 2004. Byproducts of the classification data collection and analysis included a key to field identification of vegetation associations and the geographically-extensive compilation of fuels data valuable to fire management.

A second field component of the project, accuracy assessment (AA), was conducted throughout the Peace Park from 2002 through 2005 and yielded an additional 1,000 or so data points describing vegetation. AA sample points will be used to ensure that the mappers (USGS Upper Midwest Environmental Sciences Center in La Crosse, WI) meet program accuracy requirements. Some additional AA data points will be sampled in 2006 to address geographical holes in the area sampled to date.



This section of the vegetation map being created for Glacier National Park shows an image of the Goathaunt area.

The mapping component of the project continues today, with roughly sixty-five percent of the Peace Park mapped as of May 2006. Mapping is based on a 1999 snapshot in time (color aerial photography) and will provide detailed ecological information useful to fire, wildlife, and general park management and research needs. Current research, including the snowshoe hare and wolverine ecology studies, is applying the draft map products to inform their sampling design and to describe habitat parameters with greater ecological resolution. The Peace Park will receive a final digital map product in fall 2007.

One of the immediate challenges upon receiving the final map will be updating it to reflect the approximately 200,000 acres that have burned in the Peace Park (184,000 in Glacier) that post-dates the mapping source photography.

USGS Scientist Uses Noninvasive Genetic Techniques to Monitor Grizzly Bears

Kate Kendall ties barbed wire to a tree to snag grizzly bear hair samples as part of the Northern Continental Divide Ecosystem DNA study.

Katherine Kendall, a research ecologist at the USGS Northern Rocky Mountain Science Center Glacier Field Station, studies grizzly and black bear populations and their habitats. During her 32 years with the USGS and the NPS, her research has used noninvasive sampling methods and DNA analysis to monitor bear populations and ecology, and whitebark and limber pine communities. In recognition of her research contributions, she received the National Park Service's Natural Resource Research Award in 1998 and Department of Interior's Superior Service (1999) and Meritorious Service (2003) Awards.

Kate currently leads a multi-partner project to identify population size, distribution, and genetic structure of the grizzly bear population in the Northern Continental Divide Ecosystem (NCDE) in northwest Montana, one of the two primary populations of grizzly bears remaining in the lower 48 states. Within the 8 million acres occupied by grizzlies in the NCDE, 85 % is rugged mountains and 50% is roadless, making access for fieldwork a challenge.

The project samples and identifies bears using noninvasive techniques that eliminate the need to capture and handle bears. In 2004, 34,000 bear hair samples were collected from 5,200 natural bear rub trees and 2,560 baited barbed wire hair snag stations systematically distributed throughout the ecosystem. From the DNA extracted from the hair, genetic analysis determines the species, sex, and identity of individual bears. Kate and her team use statistical models to estimate the number of grizzly bears inhabiting the NCDE and to determine if bears are able to freely travel between all parts of the ecosystem despite growing development and other human activity.

Kate is also an important contributor to the management of the International Peace Park. She has worked with Steve Gniadek, wildlife biologist at Glacier NP, to evaluate the efficacy of the bear management program at Glacier. They used comprehensive records of grizzly and black bear activity at Glacier and determined that the rate of grizzly bear/human confrontation has risen in the past several decades.

Whitebark pine is an important source of food for many species, including red squirrels, nutcrackers, and bears. Grizzly bears and black bears raid squirrel middens containing whitebark pine cones to get the large, high and protein-rich whitebark seeds. Due to their importance as bear food and because they have been impacted by an introduced disease, Kate documented the status of whitebark and limber pine communities in national parks in the Rocky Mountains from Wyoming to Alberta and determined the historical distribution of whitebark pine in Glacier NP. In general, whitebark pine trees in the International Peace Park and on the Blackfeet Indian Reservation in Montana had high mortality rates, blister rust infection rates, and crown kill, while populations in Grand Teton and Yellowstone NPs had much lower mortality and blister rust infection rates. To foster restoration of damaged whitebark pine communities, Kate is a founding member and serves on the Board of Directors of the Whitebark Pine Ecosystem Foundation.

Songbird Sampling In Glacier

Songbird distribution was sampled throughout the Park along 24-26 trailside transects during 2004 and 2005. Each transect consisted of 10 sampling points from which birds were identified by sight or song. Between late May and mid-July, biological technicians Will Richards (2004) and Sean Clawson (2005) recorded the birds they detected during 10-minute periods at each point. Over 100 species of birds were detected during this 2-year survey. Among the most common species recorded were the Dark-eyed Junco, Swainson's Thrush, Townsend's Warbler, Red-breasted Nuthatch, Yellow-rumped Warbler, and Pine Siskin. Only three Clark's Nutcrackers and five Cassin's Finches were detected during this park-wide survey. Nine Black-backed Woodpeckers were detected, reflecting the benefits to this fire-dependent species from recent large fires. Perhaps the rarest bird found during transects was the Northern Hawk Owl, also in recently burned forest.

All the data from this project were submitted to the University of Montana Avian Science Center (ASC) for analysis. ASC sampled other areas throughout the region during the same time periods. Analyses will be done at park and regional levels.

While the sampling for this project has been completed, the bird and habitat data gathered will provide a wealth of valuable information on bird distribution, habitat associations, and relative abundance. The results can be used as the basis for long-term trend monitoring of wildlife populations in Glacier.

Male Western Tanagers were among the birds sampled in the park.

Whitebark and Limber Pine Restoration

Whitebark pine and limber pine are ecologically important species that have suffered serious declines due to a non-native pathogen, white pine blister rust. Surveys conducted in 1995 to 1997 showed that 44% of whitebark in Glacier National Park was dead, 78% of the living trees were infected with white pine blister rust, and 26% had crown loss, resulting in decreased reproductive capacity. The impact on limber pine is unknown.

Glacier initiated a whitebark and limber pine restoration program in 1997 by collecting seed from healthy trees in stands with heavy blister rust infection. Between 2000 and 2005, 5,785 whitebark seedlings were planted (most on West Flattop Mountain in the 1998 Kootenai Complex burn perimeter). An additional 5,064 limber seedlings were planted in scattered locations on the park's east side.

Whitebark showed the best results, with 45% survival after one year, 34% survival after 4 years for the 2001 planting, and 47% survival after 3 years for the 2002 planting. Many trees survived the 2003 drought, an excellent result. Most of the seedlings were healthy and many had grown considerably, a positive indication for their long term survival. Overall, the whitebark restoration program shows a good chance for success.

Limber pine results were more mixed. Appropriate microsite placement seems to play a role in enhancing survival for limber pine. While 49% of the limber pine survived their first year, the year old seedlings did not fare well during the dry summer of 2003. 94% of the survivors were barely alive after this season and less than 1% survived into the next year. The drought likely had a greater impact on limber pine because of their placement, which tends to require rocky, exposed, shallow soils.

Limber pine survival was more encouraging for the following wet fall of 2004 and wet spring of 2005. These results were a 54% survival with 87% of the seedlings in good or fair condition. Monitoring in future years will determine the overall success of this program.

Waterton-Glacier Science & History Day

Waterton-Glacier International Peace Park held its 3rd Annual Science and History Day on Thursday, July 27, at the Bayshore Inn Convention Centre at Waterton Lakes National Park, from 8:30 a.m. until 4:30 p.m. More than 125 people attended the free event. Fourteen presentations scientists and historians featured ongoing or recently completed projects in Glacier and Waterton Lakes National Parks. The 20-minute presentations included a variety of topics including vegetation studies (whitebark pine, aspen, and effects of climate change), paleoclimate studies, historical and cultural research projects (on recreational properties and Prince of Wales Hotel), management and human impacts (visitor use and private lands conservation), and wildlife studies (wolves, Black Swifts, bull trout, and bighorn sheep). Science and History Day will continue as an annual event, alternately hosted by Glacier and Waterton Lakes National Parks.

Suppression Can Benefit Bull Trout

After 10,000 years of dominance, Glacier's greatest aquatic predator, the bull trout, is vanishing from beneath the surface of the lakes on the western slopes of the Continental Divide.

In just 30 years, Glacier National Park's native bull trout populations have plummeted to the point that their survival is in jeopardy. In Glacier's west side lakes the primary cause of bull trout (and other native fishes) decline is due to the rapid expansion of non-native lake trout. In 1998, due to population declines throughout its native range, the U.S. Fish and Wildlife Service listed the bull trout as Threatened under the Endangered Species Act.

In 2003, Andy Dux, from Montana State University, began a three-year study on Lake McDonald to create a lake trout suppression protocol in an attempt to prevent further decline of the bull trout population in Glacier's west-side lakes. Andy's work included ultrasonic telemetry to examine the spatial and temporal distribution of lake trout and gill netting to evaluate population characteristics and diet.

Lake trout in Lake McDonald had a broad age structure and a maximum age of 37 years. Males reached maturity earlier (12 years – 18.6 inches) than females (15 years – 21.8 inches), and total annual mortality rate for lake trout ages 8-27 was 13%. Growth rates were slow and relative weight values were among the lowest observed for lake trout throughout their range. The average age of lake trout sampled was 11.2 years. 95% of the diet by weight consisted of fish prey. The largest lake trout sampled weighed 21 pounds.

These results indicate that a substantial reduction of the lake trout population in Lake McDonald is feasible if suppression efforts are focused on specific spawning locations during the fall of the year. It also appears that this type of reduction program would be effective on other west-side lakes being impacted by non-native lake trout.

Saving Large Douglas-firs with Beetle Pheromones

Douglas-fir beetles are a serious threat to park resources.

Douglas-fir beetles attacked and killed 60 large Douglas-fir trees in Logging Creek Campground in Glacier National Park in 2005. Large Douglas-fir trees in Quartz Creek Campground are currently vulnerable. The Douglas fir beetle outbreak occurring in Glacier National Park and throughout western Montana is not a new or unique phenomenon. Douglas fir beetles preferentially attack large (> 14inches dbh), old (> 120 years) trees in dense stands. Douglas fir beetle populations, endemic to Douglas-fir stands throughout their range, have been at epidemic levels in the US Forest Service's Northern Region since before the fires of 2000. The years since 2000 have been generally warmer and drier than normal-- conditions especially conducive to beetle survival and population expansion. Current weather conditions, despite improving over the last few years, suggest outbreaks could continue for a few more years. Beetle-killed trees have the potential to become hazard trees within a few years after being killed.

Glacier NP wants to maintain large old Douglas-fir trees in campgrounds. To that end, they are using an anti-aggregation pheromone, which the beetle regularly produces, to trick the beetle into attacking trees outside the campground. Douglas-fir beetles rely on pheromones to communicate with one another.

The two most important types of beetle pheromones are aggregation and anti-aggregation pheromones. Upon finding a suitable breeding site, the female beetle releases an aggregation pheromone that is attractive to both male and female beetles. As more beetles arrive and mate, the concentration of aggregation pheromone declines while the concentration of anti-aggregation pheromone increases.

The anti-aggregation pheromone, MCH, serves to prevent overcrowding and optimize brood survival. MCH acts as a signal to later arriving beetles that the tree is already occupied causing them to avoid that tree. In the early 1990s, several studies consistently demonstrated that MCH could be used to prevent the infestation of live trees in high risk stands. MCH effectively protects treated stands by preventing beetles from initiating new attacks. Beetles will move through a treated area and continue to disperse until they find suitable habitat elsewhere.

In spring of 2006, MCH packets were applied to healthy Douglas-fir trees in the Quartz Creek Campground in an effort to save the remaining live large trees in the campground. The packets will be removed in October. The plan is to continue treatment for at least a few years. Next year MCH will also be applied to large Douglas-fir trees occurring in the Polebridge Ranger Station area and possibly park headquarters.

Unfortunately, it is too late to save the large dead Douglas-fir trees in the Logging Creek Campground. Dead trees will be treated to create wildlife snags and trees completely removed will be incorporated into the structure of the new Apgar Transit Center.

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Upcoming Projects & Events

Wildlife Biologist Spends Sabbatical in Glacier NP

Dr. Don White, Associate Professor at the University of Arkansas, is on a 6-month sabbatical at Glacier. He is working with wildlife managers on a range of issues including reproduction, disease, and behavior of ungulates and carnivores and their interactions with humans.

New Fire Ecology Nature Trail at Rocky Point

The Research Learning Center is designing and developing a self-guided fire ecology nature trail near Rocky Point at the southern end of Lake McDonald. The trail will provide access to an area of the Robert Fire that burned in 2003.

International Volunteer to Monitor Rare Plants and Wildlife

Alexander Hof, a student at Philipps-University in Marburg, Germany, will volunteer at Glacier during August and September. Alex is studying wildlife and conservation biology and will help park biologists locate and monitor rare plants, harlequin ducks, and wolves.