



## INVESTIGATOR'S ANNUAL REPORT

United States Department of the Interior  
National Park Service

All or some of the information you provide may become available to the public.

OMB # (1024-0236) Exp. Date (6/30/2007) Form No. (10-226)
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<b>Reporting Year:</b> 2006	<b>Park:</b> Glacier NP	<b>Select the type of permit this report addresses:</b> Scientific Study	
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<b>Name:</b> Dr. Karen E. Hodges		<b>Phone:</b> 250-762-5445 ext. 7548	<b>Email:</b> khodges@ouc.bc.ca
<b>Project Title (maximum 300 characters):</b> Evaluating the prey base for lynx: snowshoe hare abundance, habitat use, and population dynamics in Glacier National Park			
<b>Park-assigned Study or Activity #:</b> GLAC-00065	<b>Park-assigned Permit #:</b> GLAC-2005-SCI-0047	<b>Permit Start Date:</b> Apr 01, 2005	<b>Permit Expiration Date:</b> Dec 31, 2008
<b>Scientific Study Starting Date:</b> Apr 01, 2005		<b>Estimated Scientific Study Ending Date:</b> Dec 31, 2008	
<b>For either a Scientific Study or a Science Education Activity, the status is:</b>  Continuing	<b>For a Scientific Study that is completed, please check each of the following that applies:</b>  <input type="checkbox"/> A final report has been provided to the park or will be provided to the park within the next two years <input type="checkbox"/> Copies of field notes, data files, photos, or other study records, as agreed, have been provided to the park <input type="checkbox"/> All collected and retained specimens have been cataloged into the NPS catalog system and NPS has processed loan agreements as needed		
<b>Activity Type:</b> Research			
<b>Subject/Discipline:</b> Ecology (Aquatic, Marine, Terrestrial)			

**Purpose of Scientific Study or Science Education Activity during the reporting year (maximum 4000 characters):**

The overall goal of this project is to provide currently unknown but highly pertinent information that will directly assist Park managers with identifying and managing important habitat for the Federally Threatened Canada lynx (*Lynx canadensis*), a specialist predator of snowshoe hares (*Lepus americanus*). Our research will address: 1) snowshoe hare distribution and abundance in relation to stand structure and fire history; 2) impacts of fragmentation and landscape patterns on hare distribution and abundance; 3) the relationship between lynx space use and snowshoe hare distribution; 4) development of a field methodology for non-invasive monitoring of snowshoe hare populations in Glacier National Park; and 5) implementation of a strong public outreach and education program designed to engage park visitors and the public in our research.

**Findings and status of Scientific Study or accomplishments of Science Education Activity during the reporting year (maximum 4000 characters):**

2006 Research Activities

In May-August 2006 we surveyed snowshoe hare populations and collected vegetation data from 45 study sites throughout Glacier National Park. Of these, 25 sites were randomly located, 11 occurred in 1988 and 1994 burns, and 9 were targeted study sites a priori identified as likely to support high hare densities. Targeted sites were used to test field methods for non-invasive monitoring of hare populations. All sites were 20 ha, contained at least 80% forested habitat, had not burned since 2001, and were located at least 3 km from each other.

At each site we conducted pellet counts on 80 systematically located rectangular (2m X 10m ) Krebs plots and vegetation surveys at a subset of 30 of these plots. Pellet counts were tied to a regression equation to index hare density at each site. At 50% of our random study sites indexed hare densities were <1 hare per 10 ha (functionally absent). At 36% of our sites hare densities were low to moderate (1 hare per 2-10 ha). At 14% of our sites we found higher hare densities of >1 hare per 2 ha. These relatively high hare density sites occurred in the 1988 Red Bench burn, Many Glacier, and Two Medicine areas. We did not find a significant difference in hare densities between the east and west sides of the Park, nor among burn categories.

Our habitat data for each study site included understory and canopy coverage, sapling density by species, dominant canopy species, and downed logs count. Our preliminary data show no clear correlation between these vegetation variables and hare densities.

We conducted pilot tests at six study sites to compare sampling methodologies for non-invasive genetic estimation of hare densities. Our general methodology was to place baited landscape cloth (genotyping plots) at 80 points per site and return after several days to collect a fresh pellets for genotyping. We examined the effectiveness of three baits (apples, oats, alfalfa), two plot sizes (0.5 and 1.0 m<sup>2</sup>), and different sampling durations (1 to 6 days) for capturing fresh hare pellets. Our pilot data suggest the three baits work equally well for attracting hares, but alfalfa baits are easiest to handle. The inner 0.5 m<sup>2</sup> of our 1.0 m<sup>2</sup> genotyping plots captured 70% of all pellets deposited on plots. These smaller plots (0.5 m<sup>2</sup>) were easier to handle in the field, and will therefore be the recommended size for field sampling. Pellets accumulated rapidly on genotyping plots in the first four days after plots were laid out, increasing slowly on subsequent days. These data suggest a minimum sampling duration of four days for mark-recapture density estimation. Our pilot data showed no clear trend in DNA amplification success from pellets that were 0 to 6 days old.

Preliminary Conclusions and Next Steps

Hare densities in Glacier seem to be generally low, with patchy concentrations of higher hare densities in the 1988 Red Bench burn, Many Glacier, and Two Medicine areas. In 2007 we will continue sampling across the Park, with particular focus on the 1988 Red Bench burn area and on vegetation types that may have been underrepresented in study sites so far. We will collaborate with John Squires (Rocky Mountain Research Station) on a GIS-based analysis of how lynx use landscapes in relation to hare densities in the Park. Squires will have lynx habitat use data from 1-2 radio collared lynx in Glacier National Park during May-Sept. 2007.

We have developed a simple field sampling method for obtaining fresh hare pellets for non-invasive genetic density estimation. In 2007 we will 1) assess the relationship between pellet age and genotyping error rates, 2) further optimize laboratory procedures to reduce genotyping costs, 3) compare hare density estimates generated from non-invasive genotyping versus live-trapping, and 4) conduct a cost-benefit analysis comparing hare density estimation methods.

**For Scientific Studies (not Science Education Activities), were any specimens collected and removed from the park but not destroyed during analysis?**

No

**Funding specifically used in this park this reporting year that was provided by NPS (enter dollar amount):**

\$131000

**Funding specifically used in this park this reporting year that was provided by all other sources (enter dollar amount):**

\$0

**List any other U.S. Government Agencies supporting this study or activity and the funding each provided this reporting year:**

**Paperwork Reduction Act Statement:** A federal agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. Public reporting for this collection of information is estimated to average 1.625 hours per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the forms. Direct comments regarding this burden estimate or any aspect of this form to Dr. John G. Dennis, Natural Resources (3127 MIB), National Park Service, 1849 C Street, N.W., Washington, DC 20240.