



## INVESTIGATOR'S ANNUAL REPORT

United States Department of the Interior  
National Park Service

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

<b>Reporting Year:</b> 2007	<b>Park:</b> Glacier NP	<b>Select the type of permit this report addresses:</b> Scientific Study	
<b>Name of principal investigator or responsible official:</b> L. Scott Mills		<b>Office Phone:</b> 406-243-5552	
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<b>Additional investigators or key field assistants (first name, last name, office phone, office email)</b>			
<b>Name:</b> Ellen Cheng		<b>Phone:</b> 406-251-7269	<b>Email:</b> ellen.cheng@umontana.edu
<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 primarily addresses: 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) development of a field methodology for non-invasive monitoring of snowshoe hare populations in Glacier National Park; and 4) implementation of a 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):**

2007 Research Activities

In June-August 2007 we surveyed snowshoe hare densities and collected vegetation data from 72 study sites throughout Glacier National Park. Of these, 13 were randomly located in 1988 burns (Red Bench Fire) and 59 were randomly located in unburned areas (based on available GIS data). All sites were 20 ha, contained at least 80% forested habitat, and were located at least 3 km from each other. At each site we conducted pellet counts on 80 systematically located rectangular Krebs plots and we conducted 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.

Our 2007 data agree with findings from our previous two field seasons that snowshoe hare densities are low in much of Glacier National Park. Among our 2007 unburned sites, 69% were functionally absent of hares (<0.1 hares/ha), 15% had low hare densities (0.1 to <0.3 hares/ha), 8% had moderate hare densities (0.3 to <0.5 hares/ha), and 6% had relatively high hare densities (≥0.5 hares/ha). Hare densities were generally higher and more variable in 1988 burn sites. Among our burn sites, 46% were functionally absent of hares, 15% had low hare densities, 15% had moderate hare densities, and 23% had relatively high hare densities. Hare populations were patchily distributed in Glacier National Park, with highest concentrations occurring in the Many Glacier, Two Medicine, and Polebridge (1988 burn) areas.

Our vegetation data for each study site included understory and canopy coverage, sapling density by species, dominant canopy species, and downed logs count. Our 2005-2006 data showed no clear correlation between these vegetation variables and hare densities. We are currently analyzing 2007 vegetation data.

In summer 2006 we conducted a pilot study of non-invasive genetic vs. live-trapping methods for estimating snowshoe hare densities. We analyzed this data during the 2007-2008 reporting year. We were not able to compare density estimates from the two sampling methods at four of our six pilot study sites due to insufficient recaptures. Preliminary results from the remaining two sites suggested: 1) ~79% genotyping success rate (i.e., producing reliable genotypes across 7 microsatellite loci) from hare fecal pellets up to four days old and 2) non-invasive genetic methods can yield density estimates comparable to live-trapping methods when genotyping at least two pellets per sampling plot. A simulation-based cost-benefit analysis indicated our genetic sampling method may be cheaper than live-trapping at readily accessible backcountry sites (i.e., within three hours hike) with less than 35 hares, but live-trapping may be cheaper at higher hare densities. We have received a grant to extend our comparison of non-invasive genetic vs. live-trapping methods of density estimation to additional study sites (outside of Glacier National Park) in summer 2008.

2007 Outreach and Education

In summer 2007 we hired and trained 10 undergraduates and recent graduates as research technicians for this project. An additional 5 volunteers of various backgrounds assisted with research for up to one week each. We presented our work at the 2007 Glacier National Park interpretive staff training workshop and at two visitor evening programs.

**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):**

\$134000

**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.