Draft

Environmental Assessment for issuance of a 10(a)(1)(B) permit for the incidental take of the Canada lynx (*Lynx canadensis*)

Associated with the Maine Department of Inland Fisheries and Wildlife

Incidental Take Plan for Maine's Trapping Program

Prepared by:
Maine Field Office
U.S. Fish and Wildlife Service
17 Godfrey Drive, Suite 2.
Orono, ME 04473

August, 2011

Summary

This draft Environmental Assessment (EA) addresses the effects of issuing an Incidental Take Permit (Permit) under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA), for incidental taking of Canada lynx during Maine's trapping program (Project). In support of its application for a permit, Maine Department of Inland Fisheries and Wildlife (MDIFW) submitted a draft Incidental Take Plan (draft ITP) (also called a Habitat Conservation Plan (HCP)) in 2008. Minimization measures in the draft ITP include, among other things, educating trappers and implementing measures to reduce take caused by trapping. The draft ITP also includes proposed mitigation measures intended to eventually create 5,000 acres of lynx habitat on public land. The requested term of the permit is fifteen (15) years.

This draft EA was prepared by the U.S. Fish and Wildlife Service in accordance with the National Environmental Policy Act (NEPA) of 1969, the regulations of the Council on Environmental Quality (CEQ) for implementing NEPA (40 CFR 1500) and the U.S. Department of the Interior's implementing regulation (43 CFR Part 46).

The draft EA: 1) identifies the purpose and need for a Permit; 2) describes the aspects of the human environment that would be affected by the proposed Project; 3) discusses alternatives considered; and, 4) identifies possible environmental consequences of the proposed project and mitigation measures. This draft EA considers 5 alternatives, including continuing trapping without a Permit, the measures proposed in the draft ITP, 2 other alternatives comprised of conservation measures intended to further minimize take (lethal and non-lethal) of Canada lynx, and an alternative to discontinuing upland trapping in northern Maine. For each of the 5 alternatives, the draft EA analyzes effects on the Canada lynx, other wildlife, and other resources in the human environment. Under all the alternatives, the draft EA anticipates negligible or no effects to resources such as air quality, geology, soils, water quality, vegetation, federally listed threatened and endangered species (other than lynx), and cultural and economic resources. Most of the alternatives will likely result in continued take of Canada lynx, furbearer species, and incidentally trapped non-target wildlife species. In the 2000 final listing rule (65 FR 16052) and the Remand in 2003 (68 FR 40076), the Service recognized that individual lynx may be lost from local populations as a result of incidental trapping but that there was no evidence that the loss of these individuals had negatively affected the overall ability of the contiguous U.S. population of lynx to persist.

TABLE OF CONTENTS

1. Purpose and Need

1.1 Purpose

The Maine Department of Inland Fisheries and Wildlife (MDIFW) developed a draft Incidental Take Plan for Maine's Trapping Program (hereafter draft ITP). The draft ITP outlines measures to avoid, minimize, and mitigate the incidental take of the federally threatened Canada lynx (*Lynx canadensis*) by trappers licensed by MDIFW in the State's trapping program. The draft ITP accompanies an application by MDIFW to the U.S. Fish and Wildlife Service (Service) for the issuance of an incidental take permit[1] pursuant to section 10(a)(1)(B) of the Federal Endangered Species Act (ESA) of 1973, as amended (87 Stat 884, 16 U.S.C. § 1531 *et seq*.). As required by the National Environmental Policy Act (NEPA), the purpose of this draft Environmental Assessment (EA) is to evaluate potential impacts to the Canada lynx (lynx) and the human environment for a) issuance of an incidental take permit under the proposed action (Maine draft ITP) and b) for other alternatives to the issuance of this permit.

1.2 Need

The Canada lynx was listed in 2000 as a threatened species under authority of the ESA. Take of endangered and threatened species is restricted by section 9 of the ESA. Under the ESA, 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect a federally listed threatened or endangered species or to attempt to engage in any such conduct. "Harm" in the definition of "take" in the ESA means to perform an act which actually injures or kills wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding or sheltering." (50 CFR Sect. 17.3). "Harass" in the definition of "take" in the ESA means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." (50 CFR Sect. 17.3). Take of lynx by trapping may includes "harass, harm, shoot, wound, kill, trap, and capture" as defined by Section 9 of the ESA. The section 9 take prohibitions of the ESA therefore apply to trappers and MDIFW issuing trapping licenses for the state's trapping program[2]. Under certain circumstances, section 10 of the ESA allows exceptions from the restriction on

---

[1] Traditionally, the Service refers to an "incidental take permit" as an ITP. To avoid confusion with the State's "Incidental Take Plan" which uses the same abbreviation, we refer to the incidental take permit as "permit" throughout this draft EA.

[2] Section 9(a) of the ESA states that "it is unlawful for any person subject to the jurisdiction of the United States to…(B) take any such species within the United States…(D) possess, sell, deliver, carry, transport, or ship by any means whatsoever, and such species taken in violation." Section 9(g) of the ESA says that "it is unlawful for any person subject to the jurisdiction of the United States to attempt to commit, solicit another to commit, or cause to be committed, an offense defined in this section. The term "person" is defined in Section 3(12) of the ESA as "an individual, corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the Federal Government, of any State, municipality, or political subdivision of a State; or any other entity subject to the jurisdiction of the United States."

take. An incidental take permit under section 10(a)(1)(B) authorizes incidental take associated with otherwise lawful activity. A Habitat Conservation Plan (or an ITP in this instance), intended to minimize and mitigate the impact of the taking authorized by an incidental take permit, must be submitted with the permit application[3]. Under section 7 of the ESA, the Service cannot issue a permit that would jeopardize the continued existence of a listed species.

Canada lynx occur throughout most of northern Maine and trappers may occasionally incidentally trap, capture, harass, or kill a lynx when legally trapping for other furbearing mammals (e.g. fox, coyote, bobcat, fisher, marten). From 1999-2010, 53 lynx have been reported or determined to be trapped. Of these, four were killed in traps. In consultation with the Service, the MDIFW identified a 10(a)(1)(B) incidental take permit as the most appropriate regulatory instrument to authorize take of lynx while facilitating continuation of a trapping program. The MDIFW is seeking full, statewide coverage of all aspects of take of lynx related to trapping under the terms and limitations of the Department's licenses. The permit requested is only for incidental take of Canada lynx; other currently listed or future listed species are not included.

As required under section 10(a)(2)(A), the draft ITP identifies measures to minimize and mitigate the impacts of incidental take of the Canada lynx during the State's trapping program. If an incidental take permit is granted to the State, licensed trappers conducting otherwise legal trapping activities would be authorized to incidentally take Canada lynx according to limitations prescribed in the draft ITP and incidental take permit.

Some lethal take is anticipated. The draft ITP requests take of 195 lynx over a 15-year period; 5 of which might be "killed" (3 adults and 2 kittens) and 190 "trapped, captured, harmed or harassed" under take definitions in the ESA (draft ITP p. 50-64) and offers means to minimize and mitigate this take. The MDIFW is seeking full, statewide coverage from a Section 10 permit for all aspects of "take" related to trapping under the terms and limitations of the Department's licenses (draft ITP p. 1).

---

[3] Section 10(a) of the ESA enables the Secretary to "permit, under such terms and conditions as he shall prescribe-…(B) any taking otherwise prohibited by section 9(a)(1)(B) if such taking is incidental to, and not the purpose of the carrying out of an otherwise lawful activity. (2)(A) No permit may be issued by the Secretary authorizing any taking referred to in paragraph (1)(B) unless the applicant therefore submits to the Secretary a conservation plan that specifies – (i) the impact which will likely result from such taking; (ii) what steps the applicant will take to minimize and mitigate such impacts, and the funding that will be available to implement such steps; (iii) what alternative actions to such taking the applicant considered and the reasons why such alternatives are to being utilized; and (iv) such other measures that the Secretary may require as being necessary or appropriate for purposes of the plan. (B) If the Secretary finds, after opportunity for public comment, with respect to a permit application and the related conservation plant that- (i) the taking will be incidental; (ii) the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking; (iii) the applicant will ensure that adequate funding for the plan will be provided; (iv) the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and the measures, if any, required under subpargraph (A)(iv) will be met: and he has received such other assurances as he may require tha the plan will be implemented, the Secretary shall issue the permit. The permit shall contain such terms and conditions as the Secretary deems necessary or appropriate to carry out the purposes of this paragraph, including, but not limited to, such reporting requirements as the Secretary deems necessary for determining whether such terms and conditions are being complied with."

State agencies manage furbearer populations for the benefit of a public with diverse opinions. Wildlife managers balance diverse objectives including preserving sustainable populations of furbearing animals. Trapping is an important source of income and recreation and an important component of Maine's wildlife tradition. Like other states in the Northeast, MDIFW conducts a trapping program for furbearing species recognizing the biological, ecological, economic, aesthetic and subsistence values of furbearer species (Northeast Furbearer Technical Committee, http://www.conservewildlife.org). Trapping, in part, is conducted to manage furbearer populations and may be an effective means of controlling local wildlife problems (Northeast Furbearer Technical Committee, http://www.conservewildlife.org/, Armstrong and Rossi 2000). Most state wildlife agencies, including Maine, routinely refer nuisance furbearer complaints to licensed trappers as this is often the most cost-effective way for agencies to address wildlife damage and nuisance problems. Trapping is also an important management tool for capturing furbearers for research purposes and removing predators to enhance the recovery of listed species (Northeast Furbearer Technical Committee, .http://www.conservewildlife.org/). The level and intensity of "avocational or recreational" trapping today is declining and may not be as effective as it once was to regulate or manage furbearer populations across broad geographic areas (Scott 1977, Armstrong and Rossi 2000).

Trapping provides psychological and emotional satisfaction for many of those who participate (Zwick *et al.* 2002). Sale of pelts and wildlife products significantly contribute to the household economies of some participants and as a supplemental source of income to others. The average annual income from trapping-related activities for trappers in the Northeast in 2004 was $1,587 (AFWA 2005). However, according to one study financial gain is often not the primary motivation for trapping. The challenge of trapping animals, escape and relaxation, appreciation of nature, personal achievement, health and fitness, and affiliation with others are greater motivators (Siemer *et al.* 1994).

1.3 NEPA responsibilities

The NEPA requires federal agencies to evaluate and disclose the effects of their proposed actions on the human environment in a written statement as either an Environmental Impact Statement (EIS) or an Environmental Assessment (EA).[4] An EA is a concise public document that briefly analyzes the impacts of a proposed action to determine the significance of the impacts, briefly discusses the need for alternatives to an action, and provides sufficient evidence and analysis to support a finding of no significant impacts or a determination to prepare an EIS. The Service must comply with NEPA when making its decision on the application and implementing the federal action of issuing an ITP. Consequently, the appropriate environmental analyses must be conducted and documented before a Section 10 permit can be issued. The Service has determined that an EA is initially appropriate for this action to determine if there will be significant impacts to the environment.

[4] Under certain circumstances that do not apply here, NEPA also allows an agency to conduct its analysis through a categorical exclusion.

This draft EA was prepared by the Service to analyze the effects of MDIFW's draft ITP and application for an incidental take permit. The preparation of this document follows the guidelines in the Endangered Species Habitat Conservation Planning Handbook (USFWS 1996) and Addendum (65 FR 35242), the Council on Environmental Quality NEPA Regulations (40 CFR 1500), and the Service's NEPA implementing procedures (43 CFR Part 46).

1.4 NEPA decision

In finalizing this document, the Service will review the proposed action (draft ITP and associated avoidance, minimization and mitigation measures) and other alternatives in this draft Environmental Assessment to determine whether they significantly impact the human environment. This draft Environmental Assessment is not outcome determinative. Rather, the Service will first determine whether to finalize the draft EA or undertake further analysis through an EIS. It will then take the final EA or EIS into account in determining whether and how to grant a Permit, consistent with the Service's statutory and regulatory issuance criteria.

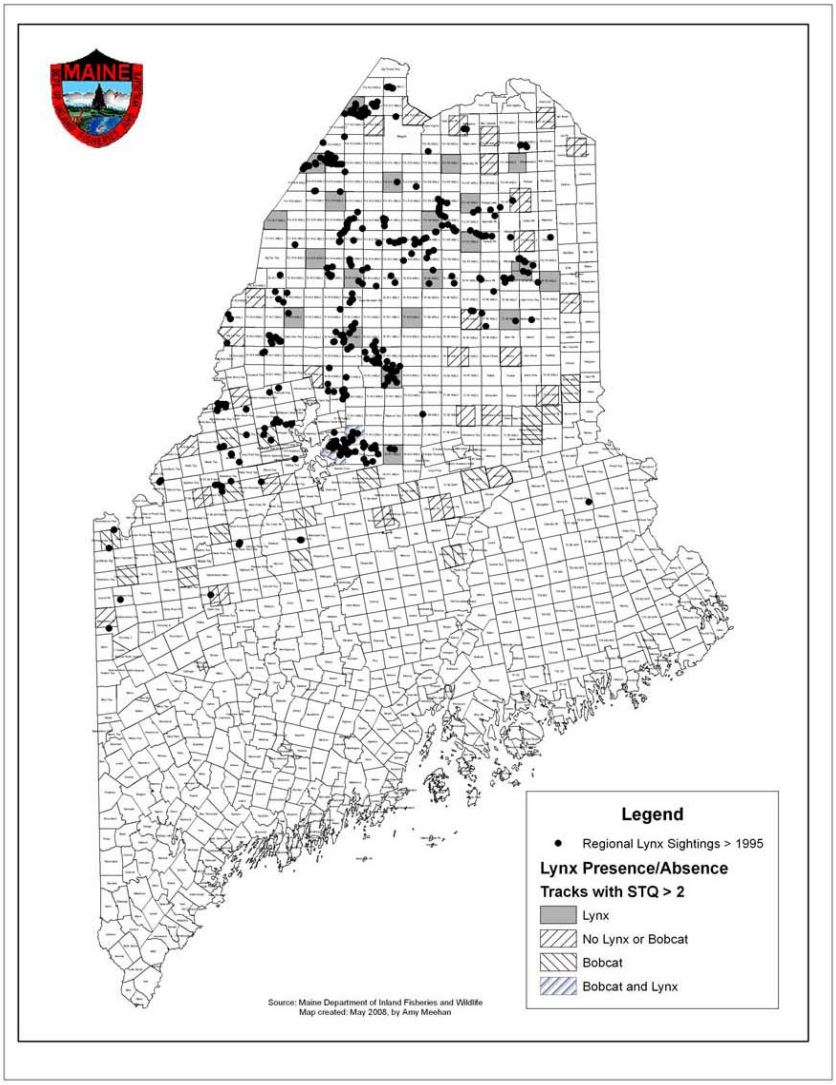
1.5 Background

Considerable background information is provided in the draft ITP concerning the Canada lynx (Section 2.2.1), trapping regulations (Appendix 1 and 2)[5], and trapping in Maine (Sections 3.1 and 3.2). Additional information on lynx natural history, population dynamics, habitat, distribution, status and factors causing the listing of the lynx is found in the Notice of Remanded Determination of Status for the Contiguous U.S. Distinct Population of the Lynx (Remand) (July 3, 2003; 68 FR 40076) and the Final Rule Determining Threatened Status for the Contiguous U.S. Distinct Population Segment of the Lynx (March 24, 2000; 65 FR 16052) and is incorporated by reference here.

Lynx are highly specialized predators of snowshoe hare (*Lepus americanus*) (McCord and Cardoza 1982, Quinn and Parker 1987, Aubry *et al.* 2000). Lynx and snowshoe hares are strongly associated with what is broadly described as boreal forest (Bittner and Rongstad 1982; McCord and Cardoza 1982; Quinn and Parker 1987; Agee 2000; Aubry *et al.* 2000; Hodges 2000a, 2000b; McKelvey *et al.* 2000). The predominant vegetation of boreal forest is conifer trees, primarily species of spruce (*Picea* spp.) and fir (*Abies* spp.) (Elliot-Fisk 1988). In the contiguous U.S., the boreal forest types transition to deciduous temperate forest in the Northeast and Great Lakes and subalpine forest in the West (Agee 2000). The Acadian forest of northern Maine and the Canadian Maritime Provinces is dominated by red spruce (*Picea rubens*) in contrast to the true black spruce (*Picea mariana*) boreal forest to the north. Lynx habitat can generally be described as moist boreal forests that have cold, snowy winters and a snowshoe hare prey base (Quinn and Parker 1987, Agee 2000, Aubry *et al.* 2000, Buskirk *et al.* 2000, Ruggiero *et al.* 2000).

[5] MDIFW has voluntarily instituted several new trapping regulations since submitting their draft ITP in 2008. These new regulations are explained in this draft EA.

Maine's lynx are part of a larger lynx population that includes the Gaspe Peninsula of Quebec and northern New Brunswick areas of Canada (Hoving 2001). Data on the historic and present distribution of lynx in Maine comes from historical records as compiled by Hoving *et al.* (2003), radio-telemetry data from MDIFW (Vashon *et al.* 2008a, b), snow track surveys (Vashon *et al.* 2003), and snow track sightings reported by MDIFW regional biologists (draft ITP Fig. 1.5a, reprinted below). Because lynx are cryptic, largely nocturnal, and live in dense, regenerating spruce-fir habitats, deriving a population estimate with confidence limits is challenging. MDIFW estimated Maine's lynx population by using snow track data to determine the proportion of the range that was occupied, then applied the lynx densities from a telemetry study in northern Maine to the occupied range for a state endangered species analysis (MDIFW unpub. data 2006).



Draft ITP Figure 1.5a. The distribution of Canada lynx in Maine as denoted by ecoregional snow track surveys and sightings of lynx (primarily snow tracks) by MDIFW regional biologists. Data were collected from 1995 until February 15, 2007.

The draft ITP (p. 21) states there are greater than 500 lynx in Maine (the threshold for state listing as threatened). The state listing status of lynx was reviewed in 2006 and because lynx were federally listed but exceeded the population threshold for state listing, lynx were state-listed as a Species of Special Concern. In 2011 while developing a species assessment for lynx, MDIFW estimated between 600 and 1,200 lynx within the critical habitat area (Vashon et al. *in prep*). Using habitat models and lynx density estimates derived from simulated home ranges from Maine lynx snowtracking surveys, Simons (2009) estimated the lynx population in 2007 was approximately 236-355 lynx on a 3.56 million-acre study area, which comprised about half of the 6.8 million acre lynx critical habitat.

Increases in Maine's lynx population in the late 1990s and early 2000s have been credited to regenerating forest conditions created by widespread clearcutting to preemptively cut and salvage softwood forest damaged by the 1973 to 1985 spruce budworm outbreak (Homyack 2003, Hoving *et al.* 2004, Vashon *et al.* 2008a, Fuller 2006). A time-series of forest conditions in a portion of northern Maine indicated that regenerating spruce/fir saplings stands that support snowshoe hare and lynx have been increasing in Maine since 1985 and peaked by 2007 (Simons 2009). Although Maine's historic lynx population was sometimes abundant (Hoving *et al.* 2003), current inventories of spruce/fir sapling forest are at historic high levels (McWilliams *et al.* 2005). As these stands mature, lynx habitat is expected to decline (Simons 2009).

The primary factor that caused the Service to list the lynx in 2000 was the lack of guidance for the conservation of lynx and snowshoe hares on federal lands (March 24, 2000; 65 FR 16052). Of particular concern was degradation of lynx habitat through certain forest management practices on federal lands that comprise a substantial portion of the lynx range (listing Factor A). In the final listing rule (March 24, 2000; 65 FR16052) and Remand (July 3, 2003; 68 FR 40076), the Service concluded that timber harvest and associated activities exert the most influence on lynx forest types in the Northeast.

The extent and influence of current forest practices likely has the greatest influence on lynx recovery in Maine. In contrast to western states, most of Maine's lynx habitat occurs on privately owned woodlands managed for timber production. Lynx are attracted to the regenerating forests that occur on these lands, as the high stem densities of these forests provide snowshoe hare with ideal habitat. Snowshoe hare are associated with regenerating forest (12 to 35 years of age) and are negatively associated with recent clearcuts and mature forest (Litvaitis et al 1985, Monthey 1986, Lachowski 1997, Fuller 1999, Hoving *et al.* 2004, Robinson 2006). Hoving (2001) documented that quality lynx habitat in the Northeast consists of complexes of regenerating forest with relatively few deciduous trees and a high annual snowfall (greater than 105 in. [268 cm]).

In response to widespread clearcutting, the Maine Forest Practices Act was passed in 1989. Although it does not ban clearcutting, the Act greatly reduced the size of clearcuts and frequency of use of this form of silviculture. As a result, landowners have switched to various forms of partial harvesting (e.g., selection cuts, shelterwood, strip or patch

cuts). Current partial harvest practices may or may not produce conifer stands that are capable of supporting hare densities as high as those occurring in stands of regenerating clearcuts (Fuller 2006, Robinson 2006, Homyack *et al.* 2006, 2007, Simons 2009, Scott 2009). Furthermore, partial harvest systems require cutting larger (2 to 3 times) areas to obtain the same quantity of wood as clearcutting (Simons 2009). Clearcutting, shelterwood harvests, and heavy partial harvests may produce high quality hare habitat (Simons 2009, J. Vashon, MDIFW, pers. comm, D. Harrison, UMaine, pers. comm.)

In response to declining habitat, Maine lynx populations will likely decline in the near future from their current historically high levels. Under several silvicultural scenarios, the habitat supply for lynx is expected to decline over the next 5 to 20 years (Simons 2009). The majority of lynx habitat is also projected to shift southward, where lynx experience greater competition with bobcats and fisher and may be at greater risk from declining snowfall as a result of climate change. Lynx density is projected to decline ~65% by 2032 if current silviculture trends continue (prevalent partial harvesting). Even under the best scenarios (maximum clearcutting allowed) lynx density may decline by 55% by 2032 (Simons 2009). However, even under these scenarios, there would still be more habitat present than occurred in Maine in the 1970s and 1980s (Simons 2009).

Habitat trends are compounded by fluctuations in hare populations. From 2005-2010 snowshoe hare populations in Maine declined by 50% or more, even in the optimal regenerating clearcut habitats, but populations began to rebound in 2010-11 (Scott 2009, D. Harrison, UMaine, unpub. data). Whether this represents a stochastic or natural fluctuation, or attenuated hare cycle is unknown. To accommodate hare declines, landscapes needed to support lynx home ranges in Maine may need to be considerably larger in the future, and in some areas landscape hare density may decline to a point no longer able to support lynx (Scott 2009).

Snowshoe hares undergo regular cycles in abundance throughout the northern boreal forest in Canada and Alaska (Keith 1990, Hodges 2000). In response to snowshoe hare cycles, lynx populations typically exhibit a delayed cycle that is synchronous over large areas (Brand and Keith 1979). During periods of high hare densities, lynx have smaller home ranges (Slough and Mowat 1996), lower average age of female reproduction (Quinn and Thompson 1987), larger litters (Brand and Keith 1979, Slough and Mowat 1996), high recruitment and kitten survival (Brand *et al.* 1976, Poole 1994, Slough and Mowat 1996), high emigration of subadults (Slough and Mowat 1996, Poole 1997), and a high proportion of snowshoe hares in the diet (Keith *et al.* 1977). During periods of low hare densities lynx increase their home range size dramatically (Mowat *et al.* 2000), have small litters or forego reproduction (Poole 1994, Slough and Mowat 1996), experience low or no recruitment (Poole 1994, Slough and Mowat 1996, O'Donaghue *et al.* 1997), experience low kitten and adult survival (Mowat *et al.* 2000), increased adult dispersal (Poole 1997), and switch to alternate prey (red squirrels, grouse)(Brand *et al.* 1976, O'Donaghue *et al.* 1998).

Hodges (2000) hypothesized that snowshoe hare populations cycled at the southern edge of their range with 2 to 25-fold population fluctuations and peaks 8 to 11 years apart

close to the turn of each decade. However, cycles had weak synchronicity and occasionally there were times with no apparent peaks. Hare densities at the southern edge of their range were typically 1-2 hares/ha at population peaks. Maine snowshoe hare population remained at relatively high, stable (~2.0 hares/ha in optimal habitat, Robinson 2006, Scott 2009) from 1996 to 2005. From 2005 to 2010, hare densities in Maine and southern Quebec declined to about 50% of their former abundance across all forest stand types (~1.0 hares/ha in optimal habitat, Scott 2009, Assels et al. 2007) and increased to nearly their former abundance (~1.6 hares/ha in optimal habitat) in 2011 (D. Harrison, UMaine, unpub. data).

Typically, lynx populations are tracked using harvest data (e.g. McKelvey *et al.* 2000). Lynx populations or trends are not currently monitored in Maine or elsewhere in the lower 48 states or Maritime provinces because they are not hunted or trapped in these regions, and no survey methods (other than expensive radio-telemetry studies) have been developed to provide population estimates. Lynx harvest records for the Gaspe region of Quebec show evidence of cycles, which is factored into the provinces' fur management program (MEF 1995). Habitat in northern Maine can support lynx densities of 9.2 – 13.0 lynx/100km^2 (Vashon *et al.* 2008) that are substantially higher than some western populations (Koehler 1990) and similar to some northerly populations during the peak of the snowshoe hare cycle (Brand *et al.* 1976, Parker *et al.* 1983, O'Donaghue *et al.* 1997).

During the recent hare decline, Maine lynx exhibited some of the same characteristics of cyclic populations in central Canada and Alaska – limited reproduction on the Clayton Lake study area 2007-2009 (MDIFW 2009 unpub. data). When hare populations began to rebound starting in the summer of 2010 and winter of 2011 (D. Harrison, UMaine, unpub. data), all radio-tagged female lynx produced young in spring 2010, and there was evidence of high survival rates of the kittens 2011 (J. Vashon, MDIFW, unpub. data). The causative factor explaining this sequence of biological events is unknown.

Hare density affects spatial use and movements of lynx. Lynx typically increase their home range size dramatically following the hare declines (Mowat *et al.* 2000). This hypothesis is being evaluated in Maine, but results were not available in time to include in this draft EA (D. Harrison and D. Mallet, UMaine, pers. comm.). In Montana where hare densities are low (0.5 – 0.6 hares/ha in optimal habitat; Griffin 2004), annual lynx home ranges (200 km2 males; 90 km2 females, Squires and Laurion 1999) are four times the size of home ranges in Maine (54 km^2 males; 26 km^2 females, Vashon et al. 2007) where hare densities are four times higher (1-2.4 hares/ha in optimal habitat at peak hare population, Robinson 2006, Scott 2009).

Threats

Threats to Canada lynx are summarized in the final listing rule (65 FR 16052) and Remand (68 FR 40076). In summary, the Service concluded that the lack of Federal land management plan guidance for conservation of lynx, and the potential for forest management plans to allow direct actions that adversely affect lynx, were a significant threat. In Maine, forest practices on private timber lands have the greatest influence on

lynx recovery; changes in silvicultural practices not beneficial to hares and lynx are threats.

In our 2009 lynx critical habitat designation (50 CFR 8616), new information on regional climate changes and potential effects to lynx habitat were considered (e.g., Gonzalez *et al.* 2007; Knowles *et al.* 2006; Danby and Hick 2007). This new information suggests that climate change may be an issue of concern for the future conservation of lynx because lynx distribution, and habitat is likely to shift northward or to higher elevation as temperatures increase (Gonzalez *et al.*2007).

In the 2000 final listing rule (65 FR 16052) and the Remand in 2003 (68 FR 40076), the Service recognized that individual lynx may be lost from local populations as a result of incidental trapping but that there was no evidence that the loss of these individuals had negatively affected the overall ability of the contiguous U.S. population of lynx to persist. In this same rule, we concluded that over-trapping is not a threat to contiguous U.S. lynx populations. We determined that contiguous U.S. lynx occur at naturally low densities, and that the rarity of lynx at the southern portion of the range compared to more northern populations is normal. The rarity of lynx is based largely on limited availability of primary prey, snowshoe hares. At southern latitudes, low snowshoe hare densities are likely a result of the naturally patchy, transitional boreal habitat. Such habitat prevents hare populations from achieving high densities similar to those in the extensive northern boreal forest (Wolff 1980; Buehler and Keith 1982; Koehler 1990; Koehler and Aubry 1994; Hodges 1999a, 1999b; McKelvey *et al.* 2000).

Incidental lynx trapping

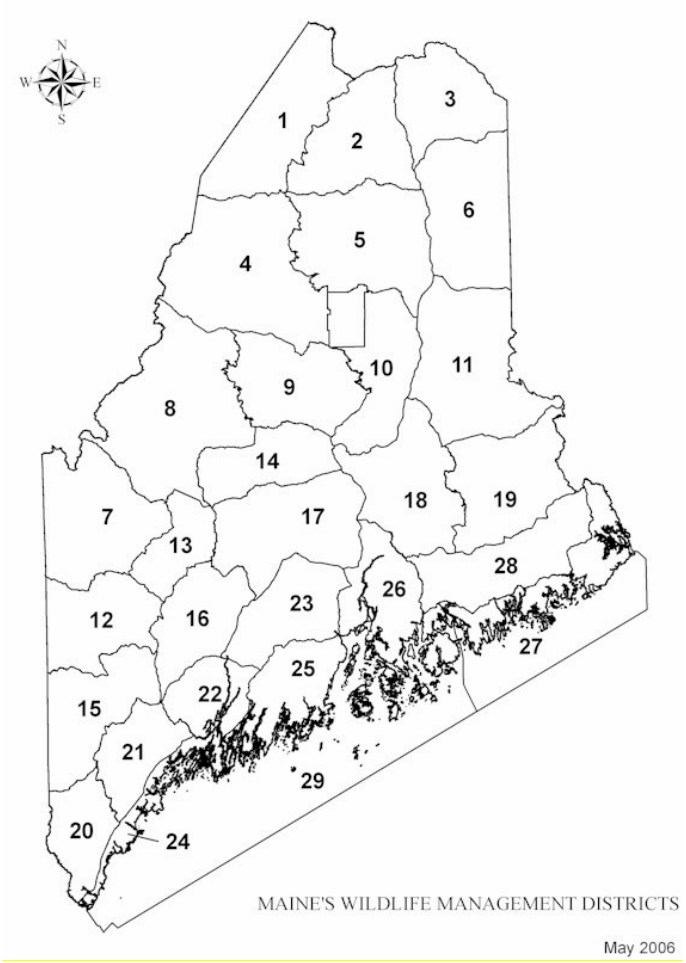
Throughout this draft EA it is important to note the differences between incidental trapping of lynx that results from otherwise legal trapping of furbearer species other than lynx and the intentional (or targeted) programs for trapping of lynx as identified in the proposed and final listing rules. With the exception of its southern range in the contiguous U.S. and the Maritime provinces of Canada, lynx are hunted and trapped as a furbearing animal throughout most of their non-listed range (Bailey *et al.* 1986, Poole 2003, Golden 2004). The results of scientific papers analyzing the effects of a specifically targeted, regulated state or province trapping season on lynx populations cannot be applied to analyzing the effects of incidental take of lynx that occurs during trapping for other species.

The MDIFW was given authority to establish open trapping seasons for furbearing animals in 1973 (Title 12, Chapter 301, § 1960 A). Maine has had no open season on lynx since 1968. Maine's furbearer trapping season generally runs from mid-October through the end of December. Furbearing animals include all mammals harvested primarily for their pelts. In Maine, these include coyote, red fox, bobcat, fisher, marten, beaver and other species. Annually, approximately 50,000 furbearers are trapped. An average of 2,616 individuals acquired Maine trapping licenses (1999-2000 to 2004-2005 trapping seasons). This includes 57 nonresident trappers, 2,078 residents holding a

regular trapping license, 201 junior resident license holders, and approximately 280 complimentary senior citizen license holders who were actively trapping (draft ITP p.32).

Furbearer trapping is governed by the laws and rules promulgated by Maine's legislature and MDIFW, respectively. These laws and rules include stipulations that all new trappers attend a state approved trapping education course, or show proof they have held a trapping license from another jurisdiction, before they can obtain a Maine trapping license. The MDIFW's trapping education program was updated in 2008 and follows recommendations established by the Association of Fish and Wildlife Agencies (AFWA), and is taught by experienced volunteer trappers who follow a predetermined course outline. This course includes materials on how to set traps for specific targeted species. In addition, in 2003, all licensed trappers received the AFWA pamphlet *How to Avoid Incidental Lynx Captures*, which is also posted on MDIFW's website. The website version of this pamphlet is updated annually with current regulation changes.

MDIFW promulgates some trapping regulations and rules according to Wildlife Management Districts (WMDs) (draft ITP Figure 1.5b reprinted below). The majority of lynx occurrences are within WMDs 1-11 (draft ITP Fig. 1.5b), which also corresponds with the recovery area identified in the Recovery Outline for the Canada lynx in Maine (USFWS 2005), modeled lynx habitat (Hoving *et al.* 2004, 2005), and lynx critical habitat. MDIFW has voluntarily expanded special trapping regulations outside the area designated as critical lynx habitat, as consistent observations of lynx in new areas become available. In an emergency rule dated December 10, 2010, the MDIFW recognized recent evidence that lynx are present in WMDs 14, 18, and 19 and extended special trap regulations to these areas.



ITP Figure 1.5b Maine's Wildlife Management Districts (WMDs).

Summary of incidental take of lynx from trapping in Maine

Incidental trapping of lynx could occur in areas where regulated trapping of other species overlaps with lynx habitat. Maine's Wildlife Comprehensive Conservation Strategy (2005, Chapter 5, Table 34) identified incidental take (including trapping), illegal take, edge of range, and habitat loss as threats to lynx. Trapping of lynx constitutes take even if the animal is not killed or injured. Take of lynx by trapping includes "harass, harm, kill, trap, capture, and collect" as defined by Section 9 of the ESA.

From 1999-2007, 42 lynx were incidentally trapped and reported or otherwise documented in Maine as reported in the draft ITP (Table 4.1). Since the draft ITP was submitted in August 2008, 11 additional lynx were incidentally trapped and reported or otherwise documented in Maine during the 2008-2010 trapping seasons. Thus, in total 53 lynx have been incidentally trapped and reported in Maine, 6 were caught in conibear traps (4 of these were killed) and 47 in foothold traps.

New regulations effective in 2008 require that trappers report take of lynx "as soon as possible and prior to removing the animal from the trap" and within 24 hours if the lynx was released (draft ITP p. 84). To encourage reporting, a 24/7 reporting hotline was established and trappers were given commendations by the Commissioner for properly reporting.

The extent of injuries of an animal caught in a trap depends on multiple variables – the animal species trapped, the type of trap used and how it is secured, duration of time the animal is in the trap, weather, and surrounding vegetation. Injuries are believed to be related to the degree of struggling after capture (France *et al.* 2007). Compared to other animals, most lynx remain relatively calm after trapping if undisturbed (J. Vashon, pers. comm. *in* draft ITP p. 92). MDIFW biologists and trappers released most incidentally caught lynx uninjured, however 4 died in conibear traps, 1 was shot in a trap (an illegal action), 1 had a broken leg (foothold with long drag chain), and several others had lacerations, bruising, frozen toes, and other injuries (draft ITP, Table 4.1 p.45).

The MDIFW promulgates regulations that govern the size of the trap that can be used for a particular application (e.g., upland use of conibear "killer-type traps" over 5 inches (in.) is restricted), where traps can be set, and the method by which traps can be set. To minimize trauma of individual animals caught in traps, all trappers must tend restraining-type traps (e.g., foothold traps) within 24 hours. Killer-type traps (e.g., conibears) must be tended every 3 days when set in an organized[6] town and every 5 days when set in an unorganized town. The 5-day tend was instituted to allow trappers more flexibility as to when they had to check their traps. It is also a tending time that is convenient for young trappers that are attending school during the week (draft ITP p. 132). Trappers must identify all traps they set with their name and address.

More than 75% of the incidentally caught lynx in Maine have been taken in fox and coyote sets. Fox and coyote are caught using foothold traps (e.g., #1.75 and #2 coil spring traps), and are primarily attracted to these traps with scent lures or bait (Fig. 1.5c). These traps are commonly attached by chain to stakes driven into the ground, or by chain attached to a drag (typically a large double hook that becomes entangled in vegetation when dragged, thereby preventing the trapped animal from escaping while trapped) (Fig. 1.5d). Foothold traps catch the animal when it steps into the jaws of the hidden trap, and the jaws are intended to close above the digits of the foot. In 2008, Maine trapping regulations were revised to prohibit foothold traps used in upland settings with inside jaw spreads greater than 5 3/8 inches. The intent was to reduce take and injury to lynx because lynx paws are approximately 4 inches in diameter, making it more difficult or unlikely that, if attracted to the trap, the lynx would trigger the trap or be captured by the trap.

[6] Maine towns are organized if they have a system of municipal government. Unorganized towns (such as those throughout much of northern Maine) have few people, if any, living in them and are collectively governed by the Maine Land Use Regulation Commission.

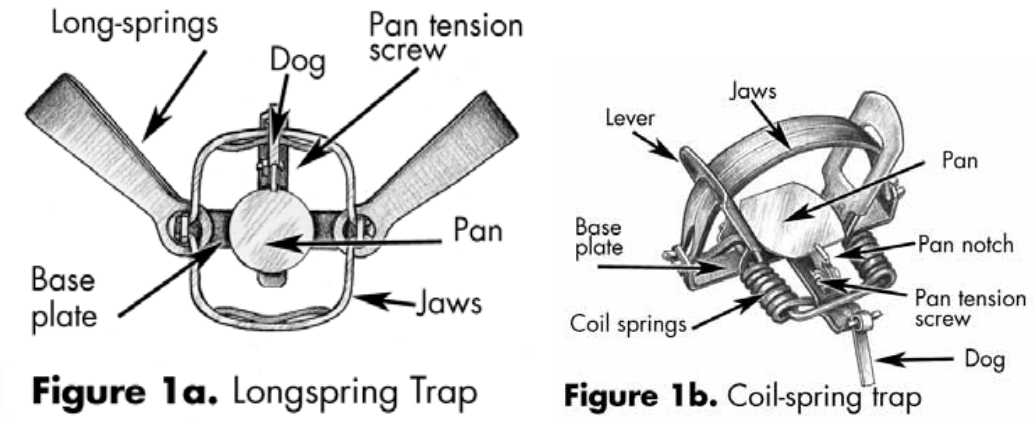


Figure 1.5c. Foothold traps (figures courtesy of AFWA)

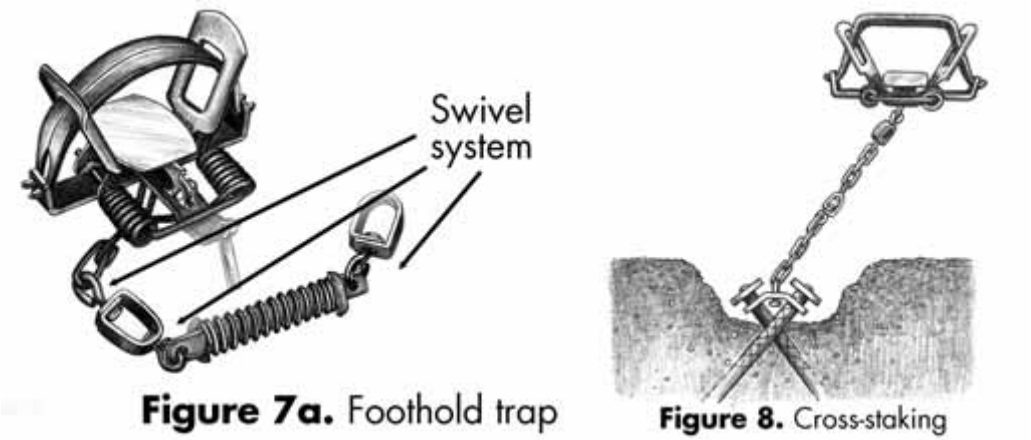


Fig 1.5d. Methods of securing foothold traps showing swivels and inline shock springs (left) and staking (right) (figures courtesy of AFWA).

In Maine, marten and fisher are most often trapped using killing traps, commonly referred to as conibear traps (Fig. 1.5e). These traps are often baited with meat and/or scent lures. It is a widespread practice to hide the trap and bait from plain view by setting them in boxes with an opening at 1 end (e.g., plastic rural newspaper box). Most often, sets made in newspaper boxes use a 120 conibear; however, 220 conibears could be set in larger boxes or buckets. The purpose is to instantly kill the target animal (marten or fisher) that gets its body caught in the trap.

In response the 2007 lawsuit *Animal Protection Institute v. Roland D. Martin* heard in the U. S. District Court in Bangor, Maine, MDIFW and the Animal Protection Institute reached a settlement agreement that imposed further restrictions on trapping activities conducted in WMDs 1-11:

a) limit foothold trap size in northern Maine,
b) limit the size of cage traps,
c) retain regulations concerning the 50 yard distance traps can be set from exposed bait and no exposed bait can be used that is visible from above

d) retain regulations that conibear traps must be set at least 4 feet above the ground except for underwater sets and blind sets
e) regulations requiring conibear traps be set at least 4 feet above the ground and in leaning pole 45 degrees or greater and a pole diameter 4 inches or less
f) no snares (except for beaver and bear) unless an incidental take plan/HCP that covers snaring is in place
g) recommend trappers use foothold traps with offset jaws
h) telephone hotline for calling in lynx take,
i) required to rehabilitate lynx,
j) required to establish a network of qualified veterinarians and wildlife rehabilitators
k) investigate each lynx trapping and advise USFWS and Animal Protection Institute and Intervenors of details, and to
l) prohibit intentional hunting and trapping of lynx.

This court order required that conibears having openings greater than 5 inches used in the region of the state where lynx occur, must be set on small diameter (less than 4 inches) leaning poles (45°), at least 4 feet above the ground (draft ITP pp. 38, 239)(Fig. 1.5f). These regulations were based on recommendations in the USFWS/AFWA publication *How to Avoid Incidental Take of Lynx.* The intent was to limit the chance of a lynx accessing the conibear and being caught.

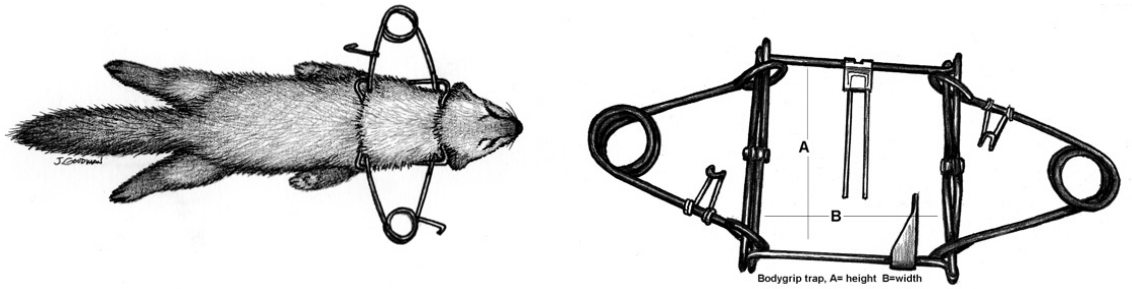


Fig. 1.5e. A body grip or "conibear" trap (figure courtesy of AFWA).

Fig. 1.5f. A leaning pole set with conibear trap (commonly used for marten and fisher) (figure courtesy of AFWA).

The 2007 regulations concerning upland placement of conibear traps in Maine were amended on December 4, 2008 to address the capture and death of 2 lynx in conibear traps during the fall 2008 trapping season. This occurred after MDIFW formally submitted their draft ITP.

> *Chapter 4.01K of the Regulations of the Maine Department of Inland Fisheries and Wildlife regarding "The Location and Preparation of Traps." The regulations provide specifications for use of all conibear or killer-type traps in Wildlife Management Districts 1-11:*
>
> - *The trap must be at least 4 feet away from any bank (**new**);*
> - *The trap must be affixed to a pole or tree that is no greater than 4 inches in diameter at 4 feet above the ground or snow level;*
> - *If a pole is used, the pole must be a natural selection of tree, with or without bark, the sides of which have not been sawed, planed or otherwise altered to create a flat surface (**new**);*
> - *The pole or tree to which the trap is affixed must be at an angle of 45-degrees or greater to the ground (**old**) the entire distance from the ground to the trap (**new**);*
> - *The area within 4 feet of the trap in all directions must be free of trees, poles or other objects greater than 4 inches in diameter and must be free of all trees or poles that are slanted at an angle of less than 45 degrees to the ground at any point between the ground and the height of the trap (**new**)*
>
> The regulations above were extended by MDIFW to include WMDs 14, 18, and 19 by emergency regulation in December, 2010.

Proper installation of conibear traps under the revised 2008 conibear regulations are illustrated in Fig. 1.5g.

Fig. 1.5g. Correct deployment of conibear traps according to Maine regulations (photos courtesy of MDIFW)

Two trapping seasons (2009 and 2010) have elapsed since these new regulations went into effect, and no lynx have been reported caught in leaning pole conibear sets in these years. Further, lynx have not been reported taken in conibear blind sets in Maine (J. Vashon, MDIFW, pers. comm.). These new regulations, however, do not fully eliminate all risk of conibear traps to lynx. Tending times for conibear traps in northern Maine is 5 days, which could affect the trap height above ground when there is snowfall. USFWS law enforcement investigations of lynx mortalities at leaning pole sets have documented that in some instances lynx can ascend poles <4 inches in diameter and at angles $>45^0$, and can ascend vertical trees <4 inches in diameter (R. Rothe, pers. comm. 2009). In WMDs 1-11, 14, 18, and 19, conibear traps with inside jaw spread less than 5 inches set under overhanging stream banks and in "blind sets" are exempt from leaning pole requirements. A blind set is defined as any set designed to catch a wild animal, without the use of bait, lure or visible attractor, by intercepting the animal as it moves naturally through its habitat (typically set for mink in Maine). Bait, lure and visible attractors do not include animal droppings (scat) or urine. Lynx could be attracted to scat or urine associated with blind sets.

MDIFW confirmed that it would accept a permit condition requiring it to implement the 2008 leaning pole regulation, in addition to the regulations already incorporated in its draft ITP (K. Elowe, MDIFW, email, Jan. 28, 2010). This regulation may continue to be adapted in the future as new information becomes available, consistent with any permit issued by the Service or any provisions for changed circumstances or adaptive

management developed for the ITP. We include the 2008 leaning pole conservation measure in our analysis of Alternative B.

Non-lethal take from incidental trapping in the form of "harm" or "harassment" may have short- and long-term effects on the behavior, survival, and breeding of lynx. Most lynx survive a short period of restraint in foothold traps, but there is always a possibility that animals may die after release from exertion, predation, or adverse climate (American Veterinary Medical Association 2008, IAFWA 2003). Trapping-related injuries (even relatively minor injury) could cause some animals released from traps to be more susceptible to predation or to other stressors and cause their deaths weeks or months after capture (Hulland 1993, Seddon et al. 1999). MDIFW reviewed trap-related injury to lynx on their research study area from 1999-2007 (draft ITP p.17). MDIFW biologists used Victor #3 Soft-Catch foothold traps with padded offset jaws and cage traps to capture lynx. In total, 65 lynx were caught a total of 454 times. Lynx were caught in foothold traps 81 times, and were caught in cage traps 267 times.

As evidence that trapping likely has no effect on lynx survival, MDIFW documented that 80% of all radio-tagged lynx were still alive as of the end of 2007 or survived for at least 6 months after capture (draft ITP p. 18). While 20% of lynx died in less than 6 months after capture, they died of causes that may not have been related to the capture event (J. Vashon, MDIFW, pers. comm.). One lynx suffered a broken leg when it was trapped, was rehabilitated, and died of unknown causes several months after release. MDIFW has no evidence that any of these study animals died from factors related to trapping. In addition, 6 additional radio-collared lynx were caught on the study area by trappers – 4 in foothold traps and 2 in conibear traps. These lynx were also equipped with radio collars. One suffered a broken leg when it was trapped, was rehabilitated, released, and lived for 5 years; 1 lived for 20 months; 1 lived for 17 months; and 3 died within a month after release. Of the 3 that died shortly after release, 1 died while trying to cross a swift river swollen from recent heavy rain, and 2 died from unconfirmed causes, although predation is expected based on evidence collected at the mortality sites (draft ITP pp.18-19).

2. ALTERNATIVES AND ASSOCIATED TAKE ACTIONS

The NEPA requires that a range of reasonable alternatives to the proposed action be described. Five alternatives were evaluated by the Service including Alternative A (status quo, continue trapping without a Permit), Alternative B (issue a Permit based solely on the draft ITP plus the 2008 modification of the leaning pole regulation), and 3 additional alternatives, C, D and E, each with a suite of conservation measures. Some of these conservation measures were considered in the draft ITP and some were not. Alternate E posits that the State would discontinue upland trapping in northern Maine. These alternatives were designed to further avoid, minimize, and mitigate take of Canada lynx resulting from trapping. These alternatives were in part derived from:

- discussions with experts in lynx biology and trapping as referenced throughout this document
- Service's expertise and review of best scientific information available

- discussions with MDIFW during development of the draft ITP.

Table 2.2 below contains a summary of the conservation measures included in each of the 5 alternatives so the reader can easily review the measures contained in each alternative.

2.1 Alternatives Not Considered for Detailed Analysis

There are many combinations of conservation measures that could be used to minimize and mitigate incidental take of lynx from trapping. The draft ITP proposed by MDIFW (Alternative B) includes trapper education, procedures for handling incidentally captured lynx, rules for setting and baiting traps, and other measures. Other potential approaches include, for example, limits on the timing, location, and amount of trapping activity; restrictions on the types and sizes of traps; use of lynx exclusion devices; different requirements for tending traps, closing areas to trapping, and enforcement options. Many of these approaches are included in Alternatives C, D and E, but it is not feasible to evaluate every possible variation or combination.

For the purpose of this draft EA, we focused our analysis on measures that would appreciably reduce incidental take of lynx while not significantly curtailing Maine's otherwise lawful trapping program. We did not conduct detailed analysis of measures that would curtail all trapping activities or that would not appreciably reduce take of lynx.

The following examples illustrate our process for eliminating some alternatives from further detailed analysis and provide perspective on the alternatives (A-E below) that were carried forward for detailed analysis.

1. **Discontinue trapping statewide in Maine.** Although this alternative would eliminate incidental take of lynx from legal trapping, it would abolish an otherwise lawful activity outside the core range of lynx in Maine, where few if any benefits to lynx would be realized. It would abolish methods of trapping (e.g. aquatic sets for muskrat and beaver) that have little or no potential to capture or otherwise take lynx. It would also completely prohibit trapping that, with appropriate modifications or restrictions would have little or no potential to cause incidental take of lynx (e.g., some forms of upland trapping). Note, however, that we consider a closure of upland trapping in the core of the lynx range under Alternative E.

2. **Limit the number of furbearers that a trapper could take in a season.** This provision might decrease total trapping effort, especially in the later portions of the trapping season, yet some types of traps and trapping conditions are more prone to causing incidental take of lynx; focusing on trap modifications, types, sizes, and seasons will be more effective in reducing take of lynx than trying to limit the amount of trapping. Although the draft ITP states that MDIFW will consider revisiting trapping quotas if compelling reasons arise (draft ITP p. 130), limiting trapping seems unlikely to substantially curtail overall trapping effort or associated risk of incidental take of lynx.

3. **Limit the number of trappers in Maine or in the core range of lynx in Maine.** Although the draft ITP states that MDIFW will consider revisiting this option if compelling reasons arise (draft ITP pp. 65-66), it is unclear if this provision would affect exposure of lynx to risk of incidental take. If the number of trappers were limited, we believe the most active trappers would continue to seek permits. As with the preceding example, focusing alternatives on trap modifications, types, sizes, and seasons would be more effective in reducing impacts on lynx with less extraneous impact on overall trapping activity.

4. **Institute a foothold trap buy-back program.** We considered a program that would require MDIFW to initiate a voluntary program to buy foothold traps that do not meet Best Management Practices (BMP) standards and replace them with BMP-approved traps (draft ITP 93-97). BMP trap testing identified specific trap designs and components that when incorporated into a foothold trap allowed the trap to meet minimum standards for animal welfare, practicality, selectivity, safety, and efficiency (AFWA, Best Management Practices for Trapping in the United States, www.fishwildlife.org). These standards are species specific; therefore, the BMP standards for foothold traps are for fox, coyote, and bobcat. The program would target trappers who trap in WMDs 1-11, 14, 18, and 19 to provide the maximum benefit for lynx. The effectiveness of the buy-out program would be reported to the Service (e.g., number of trappers participating, number and type of traps purchased, percent of traps in WMDs 1-11, 14, 18, and 19 that were purchased, and an assessment of traps that do not meet BMP standards that are likely in use within the range of the lynx). This measure would enhance the likelihood that trappers would use BMP traps. A foothold trap buy-out program could cost as much as $900,000 (if 1,200 trappers trap in WMDs 1-11, 14, 18, and 19 each have 100 traps, 50% of the traps do not meet BMP standards for foothold traps are non-BMP foothold traps, and traps cost $15 to replace). We did not evaluate this further because of excessive cost.

Measures to mitigate the anticipated incidental take from trapping are limited to variations in the amount and location of habitat management (see conservation measures B.7, C.9, and D.9). We focused on habitat management because it is the most important threat to lynx in Maine that is amenable to management. Although highway signs have potential to reduce take from vehicle collisions, we do not have information to assess the degree of benefit likely to be realized.

2.2 Alternatives

In addition to a status quo action alternative (Alternative A) and the conservation measures outlined in the draft ITP (Alternative B) we considered 3 additional alternatives (C, D and E), each with a suite of conservation measures that would provide additional minimization and mitigation measures (see summary Table 2.2 and narrative below). In the draft ITP, MDIFW considered, but rejected, other measures including shorter tending times for conibear traps, shortening the trapping seasons, MDIFW staffing trapper training courses, foothold trap modifications, prohibiting use of drags on foothold traps, and requiring use of specific traps (including traps meeting BMP standards) (draft ITP

pp. 87-99). We consider some of these conservation measures in Alternatives C, D, and E.

Since the early 1990s, MDIFW has implemented numerous conservation measures and trapping regulations to reduce the incidental take of Canada lynx from trapping. We identify those from the ITP that constitute minimization measures, which are required under our permit issuance criteria. Refer to the draft ITP pages listed below for detailed explanations of these measures:

1991 - Consult with trappers about incidentally caught lynx (pp. 78-79).
1996 - Annual trapper mailing included an offer to help trappers release incidentally caught lynx (draft ITP p. 78).
1997 - Annual trapper mailing included lynx track descriptions (pp. 77).
1999 - Lynx Hot Line established in annual trapper mailing (pp. 79-80).
1999 - Standard operating procedures developed for handling incidentally trapped lynx (draft ITP pp. 80-81).
2000 - Recognition of trappers reporting incidentally trapped lynx (ITP p. 76).
2003 - Distribution of "How to avoid the incidental take of lynx…" USFWS, IAFWA brochure (MDIFW assisted in the writing of this brochure) (p. 77).
2005 - Customization of USFWS, IAFWA brochure for Maine trappers. Brochure distributed to all licensed trappers in Maine (p. 78).
2007 - Restricting use of visible bait used in trapping (Appendix 2 and p. 277 of Appendix 5).
2007 - Requiring conibears to be set on leaning poles within the lynx range (draft ITP p. 85, pp. 277-278 Appendix 5).
2007 - Guidelines for evaluating lynx injuries (pp. 80-81, Appendices 8 and 9).
2007 - Contact list for backup veterinarian care and rehabbers developed (p. 80-81, Appendices 8 and 9).
2008 - New trapper education program emphasis on how to avoid lynx incidental captures (Appendix 3).
2008 - Mandatory reporting of lynx incidental captures (ITP p. 84)
2008 - Revised rules concerning conibears set on leaning poles within lynx range (see below).

Alternatives A-E and their associated conservation measures are summarized in Table 2.2 and fully described in the narratives below in sections 2.2.1 – 2.2.5. The Table is arranged by category: Take Minimization Measures, Measures to Mitigate the Impact of the Taking; Monitoring Measures, and, Other Ongoing Conservation Measures. The draft ITP contains measures that are best categorized as monitoring and other ongoing conservation measures. These activities are not specifically minimization measures, but provide benefits to lynx conservation, inform our general knowledge about lynx and their habitats, and may help with adaptive management implementation. Although these activities may not address specific issuance criteria, it does not minimize the importance of this work.

Table 2.2 Summary of alternative actions table

Conservation measures		Alternatives				
		A	**B**	**C**	**D**	**E**
Take Minimization Measures						
Outreach and education						
A.1	Confer with trappers about lynx caught in traps	✓	✓	✓	✓	
A.2	Periodic trapper mailing with information on how to distinguish between lynx and bobcat, lynx track descriptions, and offer to help trappers release incidentally caught lynx	✓	✓	✓	✓	
A.3	Maintain a lynx hotline for trappers to call if lynx is caught	✓	✓	✓	✓	✓
A.4	Periodic distribution of booklet "How to avoid the incidental take of lynx…" USFWS/IAFWA publication to all trappers	✓	✓	✓	✓	
A.5	Recognize trappers reporting incidentally caught lynx	✓	✓	✓	✓	
B.1	Lynx module in mandatory new trapper education	✓	✓	✓	✓	
B.2	Regularly meet with Maine Trappers Association and participate in other trapper events	✓	✓	✓	✓	✓
C.1	Develop a DVD to explain need to protect lynx, include veterinary guidance on how to recognize injuries to lynx, how to avoid trapping lynx and other non-target species, promoting use of BMP trapping standards for fox, coyote, or bobcat , and handling and reporting requirements. Require the DVD be shown at all trapper training programs and be distributed to all Maine trappers			✓	✓	
D.1	Require periodic retraining of all licensed trappers				✓	
D.2	Require MDIFW staff teach lynx module of trapper training and how to avoid catching non-target species				✓	
Lynx handling procedures and protocols						
A.7	Implement standard operating procedures for handling incidentally caught lynx	✓	✓	✓	✓	✓
A.8	Contact a list of veterinary care and wildlife rehabilitators to handle injured lynx and injured lynx rehabilitation	✓	✓	✓	✓	
B.3	Develop guidelines for evaluating lynx injuries	✓	✓	✓	✓	

C.2	Require that a veterinarian review MDIFW's trap injury protocol and train biologists. Require veterinarian examine the several lynx caught after permit is issued to document the nature and extent of injuries and make recommendations on future field evaluations.			✓		
D.3	Require veterinary evaluation of all lynx caught in traps				✓	
Required trapping practices						
A.9	Restrict use of visible bait for conibear and foothold traps	✓	✓	✓	✓	
A.10	Require conibear traps be set off the ground on leaning poles	✓	✓		✓	
A.11	Restrict the size of foothold traps used in land sets	✓				
A.12	Mandatory reporting of lynx captures	✓	✓	✓	✓	✓
C.3	Require effective lynx-excluding devices for all upland conibear traps in WMD 1-11, 14, 18, and 19 and rescind leaning pole regulations. These regulations are not needed if effective exclusion devices are used			✓		
C.4	Require all trappers phase in foothold traps meeting BMP standards for fox, coyote, and bobcat over the next 5 years and rescind existing foothold trap size regulations once BMP traps are fully implemented			✓		
C.5	Eliminate drags and require short chains, swivels, or in-line springs for foothold traps in WMDs 1-11, 14, 18, and 19			✓	✓	
D.4	Limit conibear traps to size #120 or smaller in WMDs 1-11, 14, 18, and 19				✓	
D.5	Require 24-hour tending of conibear traps in WMDs 1-11, 14, 18, and 19				✓	
D.6	Require trappers immediately use only foothold traps meeting BMP standards for fox, coyote, or bobcat and conibear traps and rescind existing regulations concerning 5 3/8 jaw spread of foothold traps				✓	
D.7	Require pan tension devices on foothold traps in WMDs 1-11, 14, 18 and 19				✓	
D.8	Limit upland foothold trapping season to October and November				✓	
E.1	Close upland trapping in WMDs 1-11, 14, 18, and 19 to avoid take of Canada lynx					✓
Enforcement						
C.7	Increase penalties for non-reporting			✓	✓	

	take of lynx					
C.8	Recommend Maine become a participating member of the Wildlife Violator Compact	✓		✓	✓	
Measures to Mitigate Impacts of Taking						
B.5	Develop forestry BMPs		✓			
B.7	Create 5,000 acres of lynx habitat on Maine Bureau of Parks and Lands		✓			
B.8	Conservation agreements with landowners		✓			
C.9	Create 10,000 acres of lynx habitat on Maine Bureau of Parks and Lands, or another landowner, within 5 years of permit issuance and conduct long-term monitoring			✓		
D.9	Identify 1 ½ to 4 township area currently supporting breeding lynx on private land, develop and implement a management plan that ensures at least 7,000 acres of optimal habitat will be present for the next 70 years				✓	
Monitoring Measures						
B.4	Monitor lynx populations and habitat	✓	✓	✓	✓	
C.6	Conduct an evaluation of compliance with trapping regulations in WMD 1-11, 14, 18 and 19			✓	✓	
D.10	Evaluate compliance with conibear regulations (A.9, A.10 and trap tending). If compliance is <90%, develop new regulations requiring use of conibear excluding devices for all upland conibear traps in WMDs 1-11, 14, 18, and 19				✓ see C.3	
Other Conservation Measures						
A.6	Discuss incidental take of lynx with other states and provinces	✓	✓	✓	✓	✓
A.13	Implement studies to better understand lynx demographics, life history, habitat use, and movements through 2010	✓	✓	✓	✓	✓
A.14	Develop lynx management planning documents	✓	✓	✓	✓	✓
B.6	The ITP considers mitigation to include the outreach, education, lynx handling procedures and protocols, new regulations, research and management outlined above	✓	✓			✓

2.2.1 **Alternative A: Status quo - No Permit is issued and trapping is continued in northern Maine**

- Under Alternative A, MDIFW would not receive a Section 10(a)(1)(B) permit for the incidental take of Canada lynx for the trapping program. MDIFW would continue to conduct a trapping program without incidental take authorization. Take of lynx would not be mitigated. Under Alternative A we assume the procedures and policies described in the draft ITP (pages 74-87), and emergency regulations required by the 2007 settlement agreement resulting from *Animal Protection Institute v. Roland D. Martin* (A.1, A.3, A.7, A.8, A.9, A.10, A.11, A.12 **in bold below**) and 2010 regulations to expand existing trapping regulations protecting lynx from WMDs 1-11 to include WMDs 14, 18, and 19 would remain in place. Measures included under Alternative A and their page reference in the draft ITP include:

Minimization measures:

Outreach and education:

- **A.1 Confer with trappers about lynx caught in traps (pp. 78-79)**
- A.2 Periodic trapper mailing with information on how to distinguish between lynx and bobcat, lynx track descriptions, and offer to help trappers release incidentally caught lynx (p. 77)
- **A.3 Maintain a lynx hotline for trappers to call if lynx is caught (pp. 79-80)**
- A.4 Periodic distribution of booklet "How to avoid the incidental take of lynx…" USFWS/IAFWA publication to all trappers (p. 77)
- A.5 Recognize trappers reporting incidentally caught lynx (p. 76)
- B1 Lynx module in new trapper education (p. 257-270)
- B2 Regularly meet with Maine Trappers Association and participate in other trapper events (MDIFW pers. comm. 2011).

Lynx handling procedures and protocols:

- **A.7 Implement standard operating procedures for handling incidentally caught lynx (pp. 80-81)**
- **A.8 Maintain a list of veterinary care and wildlife rehabilitators to handle injured lynx and injured lynx rehabilitation (pp. 80-81, Appendix 8 and 9)**
- B.3 Develop guidelines for evaluating lynx injuries (p. 287-295)

Enforcement

- C.8 Recommend Maine become a participating member of the Wildlife Violator Compact

Required trapping practices:

- **A.9 Restrict use of visible bait (p. 277, Appendix 2, Appendix 5)**
- **A.10 Require conibear traps be set off the ground on leaning poles (p. 85, pp. 277-278 of Appendix 5) (see 2008 amendment to leaning pole regulations above).**
- **A.11 Prohibit foothold traps >5 3/8 in. in WMDs 1-11, 14, 18, and 19 (pp. 239, 262; 2007 and 2010 emergency regulations)**

- **A.12 Mandatory reporting of lynx captures (p. 84)**

Monitoring measures:

- B.4 Monitor lynx populations and habitat (MDIFW pers. comm. 2011)

Other conservation measures:

- A.6 Discuss incidental take of lynx with other states and provinces (e.g. Northeast Furbearer Technical Committee, phone conversations) (pp. 83-84)
- A.13 Research to better understand lynx demographics, life history, habitat use, and movements (pp. 81-82, 114-115). (Note: MDIFW field research on lynx was discontinued in 2010, but biologists will be analyzing data and collaborating with the University of Maine and other biologists for several years).
- A.14 Develop and implement lynx management planning documents by 2008 (still in progress) (pp. 67, 83, 114, 151)

Although the Service recognizes the important role of research and management efforts in lynx recovery, their contribution to minimizing and mitigating incidental take from trapping is not sufficiently explicit to support analysis at this time. We include them in Alternative A because they were described as ongoing activities in MDIFW's draft ITP.

2.2.2 Alternative B: Permit the draft ITP as submitted

Under Alternative B MDIFW would receive a Section 10(a)(1)(B) permit consistent with measures outlined in the draft ITP with the addition of the 2008 leaning pole regulation. This action would authorize take of Canada lynx as part of Maine's trapping program. Detailed descriptions of the State's proposed minimization and mitigation are interspersed among a larger suite of conservation measures found on pages 74-87 of the draft ITP. Alternative B includes measures found in Alternative A (A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.10, A.11, A.12, A.13, and A.14) and in addition, the following measures would be implemented (Table 2.2):

Minimization measures:

Outreach and education:

- B.1 Include a lynx module in mandatory new trapper education (draft ITP Appendices 3 and 4)
- B.2 Regularly meet with Maine Trappers Association and participate in other trapper events to educate trappers about avoiding incidental take of lynx (draft ITP p. 79)

Lynx handling procedures and protocols:

- B.3 Develop guidelines for evaluating lynx injuries (draft ITP pp. 288-312, Appendices 8 and 9)

Required trapping practices:

- MDIFW would continue to implement regulations described in A.9, A.10, A.11, and A.12. If the USFWS issues a 10(a)(1)(B) permit, trappers will have additional incentives to comply with regulations to avail themselves of the

permit's legal indemnification.

In an emergency rule in October 2007 to comply with a court settlement agreement, MDIFW revised regulations to require that foothold trap must have an inside jaw spread of less than 5 3/8 inches (draft ITP pp. 239, 262). Since the foothold trap size regulations were implemented in 2007, 13 lynx have been documented caught in traps with a jaw spread less than 5 3/8 inches. We did not include the 5 3/8 inch jaw spread measure in Alternative B because MDIFW does not include this measure in the draft ITP. We considered foothold trap BMPs instead of foothold trap size restrictions in Alternative C and D.

Mitigation measures:

- B.5 Develop BMPs for forest landowners (draft ITP pp. 111-112, 114-116)

MDIFW has begun this activity but there is no information in the draft ITP regarding what is contained in the BMPs, how many landowners are likely to use them, and when and where habitat will be created that minimizes or mitigates incidental take of lynx. The Service cannot evaluate benefits of the unspecified BMPs, but we describe them in Alternative B because they were included as part of MDIFW's proposed action in the draft ITP. Although we believe development of BMPs for forestry is valuable, we do not include this measure in Alternatives C, D, and E because we are unsure how BMPs specifically offset the take of lynx from incidental trapping.

- B.7 Provide necessary guidance to Maine Bureau of Parks and Lands (MBPL) to create 5,000 acres of lynx habitat on state land within the next 10 to 15 years or sooner (draft ITP pp. 108-111).

In the draft ITP, MDIFW proposes to mitigate only lynx mortalities by providing guidance to MBPL to create 5,000 acres of lynx habitat on state lands. MDIFW explains (draft ITP p. 102-103) that providing habitat for 1 additional breeding pair of lynx should produce enough young lynx to offset the 5 anticipated trapping-related mortalities over the 15-year life of the incidental take permit. MDIFW estimates that about ¼ of a township of high quality lynx habitat (~5,000 acres) is needed to support and additional pair of lynx (draft ITP p. 102-103) and that habitat should consists of regenerating spruce / fir saplings, that exist in stands with 55,000 stem cover units / ha (draft ITP p. 102-103).

Mitigation measure B.7, as described in the draft ITP (pp. 108-111), lacks sufficient detail and commitments to support analysis of its sufficiency to mitigate the incidental take of lynx. Habitat created on MBPL property could possibly mitigate the incidental take of lynx; the draft ITP would need to specify the location, habitat quality, use restrictions, permanence, enforceability, and binding nature of legal mechanism used to create an area protective of lynx and its habitat. Public land conservation could mitigate the incidental take of lynx if a binding agreement was provided with the draft ITP that specifies the location, condition, size, and timing of lynx habitat is created, using

management described in the Service's *Canada Lynx Habitat Management Guidelines for Maine* (pp. 19-35, McCollough 2007, http://www.fws.gov/mainefieldoffice) as a basis for management, which may be updated, revised based on the best available science.

The final ITP should also demonstrate that an adequate amount of new lynx habitat is created to compensate for all forms of take anticipated from trapping as appropriate. The draft ITP does not propose to mitigate other forms of take of lynx from trapping, for instance harm, harass or wound (see sections 1.2 and 4.11 of this draft EA). However, assessing the extent and effect of the harm, harassment or wounding is difficult. Some animals harmed, harassed our wounded in traps may eventually die or experience reduced productivity.

Creating habitat could address the most pressing, long-term threat to Canada lynx – loss of habitat because of forest management practices that do not provide high quality lynx habitat (see section 1.5 Background, above). MBPL manages greater than 100,000 acres of Public Reserve Land in the core of Maine's lynx range. Some of the largest state-owned lots in northern Maine (WMDs 1-8) include Nahmakanta (43,000 acres), Deboullie (22,000 acres), Round Pond (20,000 acres), Holeb (20,000 acres), Little Moose (15,000 acres), and Scraggly Lake (10,000 acres).

According the MBPL Integrated Resource Policy, *"the Bureau will identify and promote the conservation of all state and federally, listed endangered, threatened, and candidate species of plants and animals and their critical habitats within the boundaries of lands managed by the Bureau."* Furthermore, *"active management programs will be conducted as necessary to perpetuate the natural distribution and abundance of threatened or endangered species and the ecosystems on which they depend"* and *"protection and management of endangered and threatened species and their critical habitats information on these species will be incorporated as it becomes available."* The MBPL manages land for a variety of resource values including recreation, wildlife, ecological reserves and timber, which may limit options for managing for lynx habitat in some units. Although this is their policy, to our knowledge MBPL has not initiated an active management plan for Canada lynx on their lands.

MDIFW calculated that 5,000 acres of habitat would need to be created on state land to support an additional 2 breeding female lynx and their offspring to offset the 5 lynx trapping mortalities estimated to occur over the 15 year duration of the permit (draft ITP pp. 102-103) (B.7). The 5,000 acres of habitat needed to support a pair of lynx and to offset the 5 trapping mortalities was calculated in the draft ITP based on the habitat needs of lynx during a period of high hare density and optimal habitat conditions prevailing in the early 2000s (Vashon *et al.* 2008a, b). The draft ITP should also address the likelihood of deteriorating habitat quality (Simons 2009) or fluctuating hare numbers (Scott 2009). Habitat and landscapes needed to support 2 breeding female lynx may need to be considerably larger when hare populations are low (Scott 2009). On the other hand, less incidental take from trapping may occur when hare populations are low.

Although mitigation via creating new lynx habitat would lag mortality from trapping, it addresses an important factor limiting lynx recovery. Regenerating conifer stands created by clearcuts will not become lynx habitat until about 12 years post-harvest and should support high populations of hares and lynx for 30-35 years post-harvest (Fuller *et al.* 2007). The draft ITP (p. 110) proposes that lynx habitat be created on MBPL during the next 10 to 15 years. Habitat created for mitigation should be created as soon as possible, in softwood-dominated stands that will produce regenerating spruce and fir, and use silvicultural techniques that will produce high quality snowshoe hare habitat.

The MBPL does allow trapping on their lands under their Integrated Resource Policy (http://www.maine.gov/doc/parks/programs/planning/, p. 60):

> ***Trapping*.** The Bureau will allow trapping on lands it manages when such activity:
> - is not specifically precluded by deed, local ordinance, or written management policies;
> - does not create conditions deemed to constitute an unsafe situation or a threat to property or resources; or
> - does not jeopardize other uses of the Resource Allocation System category in which the activity is located.
>
> Consultation between the regional MDIFW biologist and the Bureau's regional manager will occur whenever wildlife resources are potentially jeopardized by trapping.

The probability that a lynx will be incidentally trapped on mitigation areas created on MBPL may be low because trapping would be occurring under the minimization measures required in the ITP. The MBPL has the authority to close some areas to trapping if it causes a threat to resources, in this case the threatened Canada lynx. MDIFW's draft ITP does not contemplate closing trapping on mitigation lands. For the purposes of considering a reasonable range of alternatives in this EA, we assume that the MBPL will not close trapping on public lands used for mitigation under Alternative B. We consider trapping closure or adaptive management in habitat created for mitigation in Alternatives C and D.

- B.8 Conservation agreements with forest landowners (e.g., MDIFW and other state, federal, and private groups developing the Plum Creek conservation easement) (draft ITP pp.111-112, 114-116)

The Service is unable to evaluate the sufficiency of agreements with forest landowners to meet our Section 10 issuance criteria because the nature of the agreements and conservation benefits to lynx are not specified. Private land conservation could mitigate the incidental take of lynx if a binding agreement was provided with the draft ITP that specifies the location, condition, size, and timing of lynx habitat to be created, uses the Service's *Canada Lynx Habitat Management Guidelines for Maine* (McCollough 2007), or a similar document, as a basis for management, and demonstrate that an adequate amount of new lynx habitat is created, adequate to compensate for take anticipated from trapping.

Monitoring Measures

- B.4 Monitoring lynx populations and distribution every 5 years (draft ITP pp. 119-120) and monitoring lynx habitat by participating in the Forest Products Council Lynx Conservation Strategy

Incidental take plans require montioring, and monitoring lynx populations is an important objective of the Service's 2005 recovery outline. The draft ITP (pp.119-120) considers lynx population and habitat monitoring, and commits to participating in an effort to monitor habitat proposed by the Maine Forest Products Council. At the time of submitting the draft ITP in August 2008, The Maine Forest Products Council was in the process of negotiating a draft Lynx Conservation Strategy with MDIFW and USFWS hoping to qualify for an exclusion from proposed critical habitat. The Strategy is referenced several times in the draft ITP (pages 111-112, 122, 146, 147, 153) and is part of the mitigation and monitoring strategy in the draft ITP. It is unlikely that monitoring and other benefits of the Lynx Conservation Strategy will be achieved because the Council annulled the agreement when critical habitat was designated for the Canada lynx in November, 2008 and there has been no further activity on the Strategy. The Service cannot make incidental take Permit findings that rely on unspecified agreements or agreements that may not be redeemed. We describe this measure here because it is included in MDIFW's draft ITP, but do not include it in Alternatives C, D and E.

Other Conservation Measures

- B.6 MDIFW proposed a list of potential mitigation activities including conferring with other jurisdictions, lynx management, and lynx research (draft ITP pp. 99-107 and summarized in Table 5.3.1)

We include conferring with other jurisdictions, lynx management, and lynx research in B.6 as "other conservation measures" because they are important conservation measures, but as described in the draft ITP they do not directly contribut toward minimizing take of lynx and do not mitigate for the take of lynx. We do not include these measures in Alternatives C, D and E.

2.2.3 Alternative C: Modified ITP

Alternative C employs these previously described conservation measures A.1, A.2, A.3, A.4, A.5, A.6, A. 7, A.8, A.9, A.12, B.1, B.2, and B.3 (Table 2.2). In addition, the following minimization and mitigation measures would be implemented. Many of these conservation measures are not discussed in the draft ITP so we provide additional background and justification. Minimization measures C.3, C.4, C.5, C.7, C.8, and C.9 describe more restrictive trapping techniques, which would require changes to Maine statutes or regulations. MDIFW would need to provide the details and wording of any proposed statutory and regulatory amendments, along with timelines. The Service would need this information to evaluate and analyze whether these changes meet the ESA issuance criteria, prior to issuing a final Permit.

Minimization measures:

Outreach and education:

- C.1 Develop a DVD to explain need to protect lynx, how to avoid trapping lynx and other non-target species, veterinary guidance on how to recognize injury to lynx, promoting use of BMP trapping standards for fox, coyote, and bobcat, and other handling and reporting requirements. Require the DVD be shown at all trapper training programs and be distributed to all Maine trappers.

In the draft ITP, MDIFW proposes several trapper outreach and education programs (draft ITP Sect. 5.2, Appendices 3 and 4; measures A.1, A.2, A.3, A.4, A.5, A.6, B.1, B.2). Licensed trappers have been mailed information about lynx and how to avoid capturing a lynx. New trappers are required to complete a trapper education class and pass an exam prior to purchasing a license. Maine's trapper education courses are taught by experienced volunteer trappers using a curriculum outline provided by MDIFW (draft ITP Appendix 3). However, many MDIFW employees may not have the trapping expertise to instruct training sessions (draft ITP p. 91) and teach the lynx/endangered species module. Furthermore, there is no requirement that licensed trappers have to take a periodic refresher course.

Therefore, conservation measure C.1 would require that MDIFW develop a DVD that explains the need to protect lynx, associated regulations, teach trappers how to avoid trapping lynx and other non-target species, explains trapping BMPs (trap selection, selectivity to avoid injury), provides veterinary guidance on how to recognize injuries to lynx, and the need to review handling and reporting requirements. This DVD would demonstrate trapping BMPs and footage of lynx being removed from traps. Showing this DVD would be required at all trapper training programs to ensure that a consistent message is provided to all new trappers (and any experienced trappers and instructors present). By distributing the DVD to all trappers, MDIFW will be able to increase the likelihood that all trappers have the most current information on avoiding and addressing the capture of lynx. This DVD could also be developed in a way to have application in other states to address incidental capture of lynx. In doing so, this could help to minimize incidental take of lynx in Maine via reduced trapping-related take elsewhere.

Andelt *et al.* (1999) encouraged states to consider educational programs including videos to enhance use of trapping BMPs.

Lynx handling procedures and protocols**:**

- C.2 Require a veterinarian review MDIFW's trap injury protocol and provide a written evaluation. MDIFW would need to revise their trapped lynx protocol to address all concerns raised by the veterinarian. This measure would require all wardens and biologists who investigate lynx trapping incidents to be trained by a veterinarian on how to identify and treat injuries. When feasible and not likely to result in additional injury due to delay in release, this measure would require that a veterinarian evaluate several lynx caught in traps after the permit is issued for a specified duration. A veterinarian should evaluate a sufficient number of lynx

> caught in traps so as to allow for a professional opinion on the effectiveness of MDIFW's trap injury protocol. If this were required in a Permit, MDIFW would need to provide protocols for adaptive changes in trapping procedures in an adaptive management plan that addresses uncertainty and describes the decision of whether the type, frequency, or extent of future lynx injury would require additional veterinary involvement.

Capture of animals involves some risk of injury or mortality. Trap-related injuries may cause take of lynx by "harm, harassment, trapping, and wounding" as defined in the ESA. These forms of take may be associated directly or indirectly to the capture and handling of the lynx itself (e.g., trap-related injury, complications from anaesthesia) or may be caused by secondary effects from capture (e.g., stress, myopathy, or trauma) that compromise the physical condition, physiology, or behavior of a lynx and reduce the ability for Canada lynx to capture prey or avoid predation.

A substantial portion of lynx caught in foothold traps can experience minor injuries (Mowat *et al.* 1994). MDIFW examined 16 of 42 lynx that were incidentally trapped in foothold traps by Maine trappers from 1999 to 2007; 8 (50%) had no discernable injury, 8 (50%) had mild injuries (e.g., punctures, lacerations, edema) and 2 (12%) had severe injuries (e.g., broken leg, frozen toes)(draft ITP Table 4.1). These injury rates were comparable to a nationwide study on coyotes and bobcat (AFWA 2003, 2006a, 2006b; draft ITP Tables 5.2.3, 5.2.4). During MDIFW's lynx research project, no lynx caught in padded foothold traps required veterinary attention (draft ITP p. 158).[7] Of 23 Canada lynx trapped in foothold traps under experimental conditions in the Yukon, 5 (22%) experienced minor injuries (= those not likely to endanger the life of the animal; broken, dislocated, and luxated digits, superficial lacerations, and abrasions) and 9 (39%) had frozen toes or feet (4 lynx eventually lost digits). Evidence from a lynx carcass collection conducted in conjunction with this study (Slough and Mowat, unpubl. data, 1993) showed substantial dislocation injury by fur trappers using foothold traps, many of whom used drag poles for anchoring (in Mowat *et al.* 1994). Of 51 lynx trapped in foothold traps in Montana, 8 (16%) had minor injuries ("minor" defined same as above), 1 (2%) experienced a major injury (a fractured ulna), 8 (16%) had foot freezing, and 5 (10%) had edema (pronounced swelling of the foot)(Kolbe *et al.* 2003). A "relatively high frequency of injury" occurred with Eurasian lynx caught in leghold traps for a study in Norway (Nybakk *et al.* 1996).

Other furbearers caught in foothold traps frequently experience injury, much of it minor. Varying rates (e.g., 30-90%) of major injury (e.g., joint dislocation, major laceration, freezing, fractures, major tooth damage, maceration of muscle, amputation) have been documented in research projects using foothold traps for bobcats (Earle *et al.* 2003), red foxes (Englund 1982), wolves (Van Ballenberg 1984, Kuehn *et al.* 1986), and coyotes (Olsen *et al.* 1988, Onderka *et al.* 1990, Phillips *et al.* 1996, Shivik et al. 2005).

[7] A lynx caught in this research study in 2010 broke a leg while in a foothold trap and required veterinary care and rehabilitation (MDIFW unpub. data).

Some trap-related injuries (e.g., luxations, fractures, mild freezing) are difficult to detect in lynx in the field (Mowat *et al.* 1994). Because lynx trapped in the lower 48 states are trapped for research and management purposes only and released, the typical post-mortem method of injury assessment based on necropsy of limbs cannot be used. Necropsy information on injuries sustained by lynx in BMP foothold trap trials in Alaska (where they are not federally-listed) will be available in 2011 (AFWA United States Furbearer Conservation Technical Work Group, www.fishwildlife.org)[8]. Although there is no information on the accuracy of field injury assessments for lynx, a Michigan study evaluated foothold trap injury to bobcats. Earle *et al*.(2003) compared field examination of 22 bobcats caught in foothold traps with necropsy by wildlife pathologists to evaluate accuracy of field-derived injury scores. This study showed injury diagnosis for 20 of 22 captures to be correctly classified. Toe fractures, tendon and ligament lacerations, and joint luxation were the most likely injuries to be missed, sometimes because of swelling of adjacent tissues (Earle *et al.* 2003).

Wildlife pathologists and veterinarians typically classify trap-related injuries in trap BMP studies for furbearer species (e.g. coyotes, fox, raccoons) by doing full-body necropsies (e.g., AFWA 2006, Shivik *et al.* 2005). Trap BMP studies of live animals use injury scores to quantify the extent of injury incurred by a trapped animal. A standard trauma scoring system was developed by the International Organization for Standardization (ISO)(Standard 10990-5:1999, www.iso.org, Harris *et al*. 2006). MDIFW used the ISO injury scoring system to evaluate injury to 17 incidentally-trapped lynx (draft ITP p. 92-97), and found that injury scores for trapped lynx were comparable with injury rates for coyotes and bobcats (draft ITP Table 5.2.5, p. 96). The draft ITP (pg. 93) recognizes there could have been some under-reporting of mild and moderate injuries, and not all lynx incidentally trapped were examined.

Engeman *et al.* (1997) found that inconsistent assessment of trap injury occurred, even among an international panel of veterinary pathologists highly experienced with trap injuries. With training and experience, wildlife biologists may be able to improve their ability to detect, diagnose, and score injuries (Engeman *et al.* 1997). Examination of injuries by a veterinary pathologist to reduce individual bias in trap injury scoring has been advocated by several European authors (Harris et al. 1999, Iossa et al. 2007).

MDIFW developed a lynx investigation protocol in coordination with veterinarian Dr. Stewart Sherburne. Four trapped lynx have been taken to veterinarians after capture in traps to assess injuries – 2 with broken bones and 2 with frozen digits (MDIFW unpub. data). Each of these events provided opportunity for training on how to assess and treat injuries (J. Vashon, MDIFW, pers. comm.).

In North American BMP trap testing, veterinary/wildlife pathologists are typically involved in conducting necropsies. It is believed use of veterinarians to conduct field examination of trapped carnivores for research projects is not widespread, but used in

[8] BMP trap testing in Alaska is only testing variations of the Oneida Victor #3 foothold trap. There are many smaller traps that have BMP-approved characteristics for red fox, coyote, and bobcat that are used in Maine.

some situations. Norway is one of few countries that require veterinarians be present to immobilize wild animals, thus, a veterinarian attends all lynx captured for research (Nybakk *et al.* 1996) and helps diagnose and address frequent injuries to lynx in foothold traps. Alaska Fish and Game's Wildlife Capture and Restraint Manual and Animal Welfare Policy requires a veterinarian to be present at all field wildlife immobilization procedures in the course of research and management activities (Taylor 2000, Beckman 2007).

There are several forms of capture-related injury that are difficult to diagnose in the field, and some may take days to develop into recognizable pathology (Nocturnal Wildlife Research 2008). Post-release survival may be impaired even by relatively minor injuries (Seddon *et al.* 1999, American Veterinary Medical Association 2008). For example, capture or exertional myopathy is a stress-related disease caused by exertion in traps or snares that causes skeletal and cardiac muscle damage, depression, anorexia, and shock and has been documented in some carnivore species (Little *et al.* 1998, Hartup *et al.* 1999, Arnemo *et al.* 2006, Cattet *et al.* 2008). Capture myopathy may influence coyote movements for several weeks after capture (Windberg and Knowlton 1990 as cited in Hulland 1993) and caused death of animals weeks or months after capture (Hulland 1993). Trap pressure may cause occlusion of blood flow, and the sudden return of circulation (after release) may cause necrosis of tissue over a few days – a condition called pressure necrosis (Walker 1991, Stocker 2005). Carnivores are suspected to be less susceptible to capture myopathy than cervids (J. Vashon, pers. comm. 7.20.11).

Finally, chemical immobilization may provide further complications for the health of an animal, particularly an animal that has already experienced stress and injury (Arnemo *et al.* 2006). Trap-related mortality was the greatest source of mortality of Iberian lynx in Spain (64% of carcasses examined), however some lynx that suffered major physical injuries from trapping (broken and lost limbs) were able to survive and even produce offspring (Garcia-Perea 2000). In Norway, 5 of 37 (13%) lynx died as a result of capture-related injuries for a research project (Nybakk *et al.* 1996).

The MDIFW draft ITP provides a protocol for handling incidentally-trapped lynx (draft ITP, Appendices 8 and 9). The protocol explains how an animal with injury will be chemically-immobilized for further evaluation. MDIFW's chemical immobilization program operates under veterinary guidance, but does not require field presence by a veterinarian.

In Maine, captured lynx must be reported to a game warden or biologist of MDIFW as soon as possible and prior to removing the animal from the trap, unless a MDIFW official cannot be reached in time to prevent injury to the lynx. Any lynx released under this provision must be reported to MDIFW within 24 hours from the time it was discovered. Having a veterinarian experienced with wildlife and trapping present could provide useful insights into the extent, number, and type of injuries and whether capture myopathy, chemical immobilization and injuries sustained in traps are a serious problem for trapped lynx.

This conservation measure would require that a veterinarian experienced with trapping-related animal injuries review MDIFW's trap injury protocol and provide written evaluation to the Service and MDIFW. MDIFW will be expected to comply with these recommendations and revise the protocol accordingly. This conservation measure requires that all MDIFW wardens and biologists who investigate lynx trapping incidents to be trained by a veterinarian experienced with trapping-related animal injuries on how to identify and treat injured animals. Finally, to fully understand the nature and extent of trapping injury to trapped lynx, this conservation measure would require a veterinarian experienced with trapping-related animal injuries to accompany MDIFW biologists and wardens to investigate several lynx captures by trappers after the permit is issued (as logistically feasible). This veterinarian should evaluate a sufficient number of lynx caught in traps so as to allow for a professional opinion on the effectiveness of MDIFW's trap injury protocol. Veterinary evaluations of lynx injury would document the extent and nature of injuries. The veterinarian would be required to provide a report outlining their findings and make recommendations as to whether there is a need for future on-site presence of a veterinarian. Decisions of whether to continue veterinary investigation beyond the several lynx would be made through an adaptive management process involving MDIFW and USFWS. Experience from veterinary field investigations would also be used to improve injury evaluation scores and guidelines (B.3) and handling protocols (A.7). This measure has logistical and economic challenges and possible time delays in getting a veterinarian to the trap site. This procedure may delay the release time for animals not requiring veterinary attention, which should be taken into consideration when choosing the trapped lynx to investigate.

<u>New regulations – conibear traps:</u>

- C.3 Require effective lynx-excluding devices for <u>all</u> upland conibear traps in WMD 1-11, 14, 18 and 19 and rescind leaning pole regulations. Leaning pole regulations are not needed if effective exclusion devices are used.

Conibear traps are meant to kill target animals quickly, however, non-target animals caught by toes or limbs may not be killed quickly and may receive severe injury in this type of trap. Six of 53 lynx incidentally caught in Maine were in conibear traps set for fisher and marten (MDIFW draft ITP Table 4.1 and 2008, 2009, 2010 trapping data). Two of these sets were placed illegally, and none of the 6 sets would be considered currently legal in Maine based on trapping regulation changes adopted in 2007 and 2008.

Six lynx have been caught in conibear traps in Maine, 4 of which died. Lynx often explore cubby sets with their paws, being caught by the paw instead of becoming killed by blows from a conibear trap to the head (Proulx *et al.* 1995). Similarly, 3 lynx were incidentally caught in Minnesota in conibear traps – 2 were killed and 1 had a severe injury (P. Delphey, USFWS, pers. comm., 2008). This injury rate is believed to be partly attributed to the trap design, which is not intended to be used as a foothold device.

This conservation measure would require that exclusion devices effective at preventing incidental lynx capture be used in combination with all upland use of conibear traps (including "blind sets") in WMDs 1-11, 14, 18, and 19 (Fig. 2.2.3). If exclusion devices

are required, other restrictive regulations related to conibear trapping would be unnecessary (e.g., restricted use of bait, leaning pole regulations, 5-day conibear tending times).

Diagram on the left and center are courtesy of Natalene Cummings (provided by John Olson, Wisconsin DNR). Diagram on the right courtesy of John Erb, Minnesota DNR; a corrugated plastic cubby from the publication *Trapping restrictions in lynx management zone.*

Two devices to exclude lynx from conibears for potential use in Maine. Photos courtesy of John DePue, MDIFW.

Figure 2.2.3. Examples of excluding devices that exclude lynx from conibear traps.

At least six states (MT, ND, NM, TN, UT, VA, WI, MN) require upland conibear exclusion devices to avoid incidental capture of non-target species (AFWA 2007). Specifically to protect Canada lynx, Minnesota requires all upland conibear traps to be set either in a excluding device that is a box with the trap recessed inside or the trap could be set in trees no larger than 6 inches diameter and greater than 3 feet off the ground (Minnesota DNR Trapping regulations, (www.dnr.state.mn.us/regulations/). No lynx have been reported caught in conibear traps with exclusion devices since these regulations were instituted (J. Erb, MN DNR, pers. comm., November, 2009). Wisconsin (www.dnr.state.wi.us), New Mexico (www.wildlife.state.nm.us), North Dakota (http://gf.nd.gov/regulations/furbearer/), New York (www.dec.ny.gov), Montana (http://fwp.mt.gov/hunting/trapping/), and other states (but not Maine) have similar regulations for exclusion devices to avoid incidental capture of non-target species in conibear traps (AFWA 2007). Trapping BMPs for fisher in the U.S. recommends the use of conibear traps with exclusion devices in some areas to avoid capture of non-target

species (AFWA, Best Management Practices for trapping fisher in the United States). Naylor and Novak (1994) found that use of exclusion boxes with conibear traps for pine marten increased trapper efficiency and reduced take of non-target species.

MDIFW has proposed new regulations for the 2011-12 trapping season that would require excluding devices for 160 and 220 conibear traps set on the ground in WMD 7, 14, 18 and 19 (J. DePue, MDIFW, pers. comm.).

> *In WMDs 7, 14, 18, and 19 killer-type traps with a jaw spread not to exceed 7 ½ inches may be used on the ground level if the trap is placed within a lynx exclusion device. The trap jaws must be completely within the device, the trap springs can be outside of the device. The lynx exclusion device must not have an opening greater than 6 inches by 8 inches, the set trap within the device must be a minimum of 18 inches from the closest edge of the opening to the trap (intended for 160 and 220 conibear traps) or; if the device has a 4 inches by 4 inches or less opening, the trap must be a minimum of 12 inches from the closest edge of the opening to the trap (intended for 120 conibear traps). The opening must not be directly in front of the trap rather on the top or on the side of the device. The back of the device must be secured to withstand heavy pulling; if using wire mesh with a wood box, the wire mesh must wrap around two opposite sides of the box and be secured. There must be at least 2 attachment points for each side of the device were there is a joint or panels come together. The exclusion device can be constructed of wood, or wire mesh that does not exceed 1½ inches openings (side to side). The wire mesh has to be 16 gauge or less (wire diameter of 0.05 or greater). The opening slot in the exclusion device that allows the trap springs to extend outside the device can be no more than7 ½ inches wide and a height of no more than1 ½ inches. The trap must be anchored outside of the exclusion device. Bait must not be visible from above.*

Under conservation measure C.3, MDIFW would be required to promulgate new regulations requiring trappers to use exclusion devices for upland use of all conibear traps in WMDs 1-11, 14, 18, and 19 in northern Maine. MDIFW contemplated the use of conibear excluding devices in the draft ITP (p.138), but did not include them in their preferred alternative. Cost and logistical issues have not been a concern in Minnesota (S. Johnston, MN Trappers Association and J. Erb, MN DNR furbearer biologist, pers. comm., Nov. 2009) where trappers were already accustomed to using cubby (box) sets for fisher and marten and fewer traps are needed to attain the quota of marten and fisher. Some light-weight, collapsible boxes have been developed in Minnesota, but are not yet marketed.

<u>Required trapping practices - foothold traps:</u>

- C.4 Require all trappers to phase in foothold traps meeting BMP standards within 5 years of receiving an incidental take permit and rescind existing foothold trap size regulations once BMP traps are fully implemented.

This conservation measure would require that all Maine trappers phase in foothold traps

meeting BMP standards within 5 years of issuing a Section 10 permit. Currently, MDIFW recommends but does not require the use of foothold traps meeting BMP standards. BMP trapping standards are species specific. Therefore, the traps required by this conservation measure would be traps with standards approved for fox, coyote, and bobcat. These traps may not offer lynx any additional protection. Injuries to trapped lynx were never evaluated for most traps that meet BMP standards for fox, coyote, or bobcat. Injury scores for incidentally caught lynx in Maine were similar to other carnivores captured during BMP trap testing (draft ITP p.96).

Lynx are frequently injured in foothold traps, although many injuries are classified as minor (see discussion in C.2).

In 1997, Canada, the European Union, and Russia committed to an Agreement of International Humane Trapping Standards (AIHTS). This agreement established set internationally agreed humane trapping standards for traps for harvesting 19 furbearer species (including lynx). A list of traps meeting these standards for some Maine furbearers is found in the draft ITP Table 5.2.3 (for coyotes) and 5.2.4 (for bobcats). BMP trap testing identified specific trap designs and components that when incorporated into a foothold trap allowed the trap to meet minimum standards for animal welfare, selectivity, safety, and efficiency. Certain trap characteristics are selected through extensive field trials, and certain characteristics are provided in BMP manuals so trappers can modify these traps to meet BMP standards (Best Management Practices for Trapping in the United States, AFWA, www.fishwildlif.org). .

Some BMP-approved foothold traps have no modifications to the jaws. However, the most common BMP foothold trap modifications include (Fig. 2.2.4):

- Padded foothold traps – These traps have rubber pads attached to the jaws that may reduce injury and improve animal welfare.
- Offset foothold traps – Offset jaws contain a space between the gripping surfaces on the closed jaws of a foothold trap. Offset jaws have less clamping pressure, which may allow small animals to escape and reduces trap injuries and improves animal welfare in larger animals.
- Laminated foothold traps – These traps are standard foothold traps with a strip of rolled steel attached to the trap jaws. The wider jaw is intended to increase the surface area of the jaw on the trapped animal's foot and may reduce animal injury.

Conibear traps have also been field tested. Some characteristics of traps have proven more efficient and quick at killing than others and have been designated BMP traps.

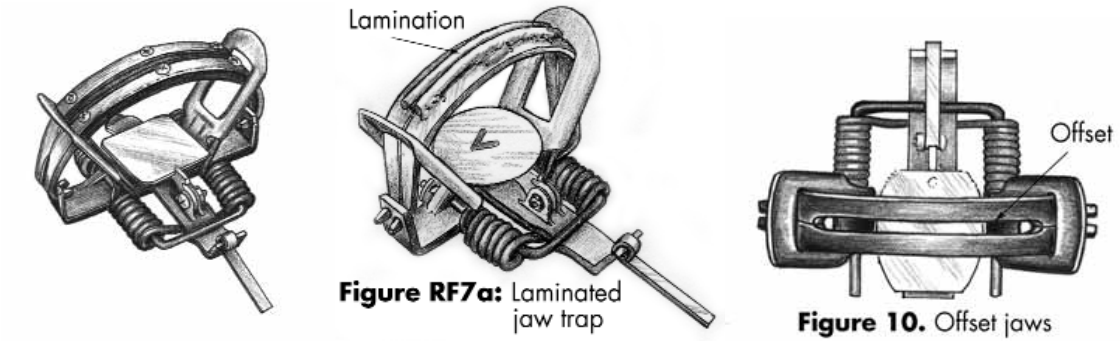


Fig. 2.2.4. Padded jaw coil spring trap (left), laminated jaw trap (middle), and offset jaw trap (right)(figures courtesy of AFWA).

BMP recommendations incorporate these and other modifications (AFWA Best Management Practices for Trapping in the United States, www.fishwildlife.org/Furbearer). The AFWA produces publications on BMP trapping recommendations for North American furbearer species and promotes their use, but they are not mandatory in most states (www.fishwildlife.org/Furbearer). The Fur Institute of Canada conducted their own trap testing program to meet their obligations under the Agreement on International Humane Trapping Standards (AIHTS). Canadian provinces are phasing in BMP trap regulations to meet obligations of AIHTS within the next 6 to 8 years. For instance, British Columbia, New Brunswick and Newfoundland-Labrador now require approved traps for nearly all species. Prince Edward Island and Nova Scotia require padding, laminating, or off-set jaws for foothold traps for coyotes. As of 2008, Quebec requires approved foothold traps for lynx.

Foothold traps meeting BMP standards may not reduce the number of lynx and other non-target species captured in foothold traps. We do not know whether the majority of BMP traps for fox, coyote, or bobcat could reduce the degree of injury to lynx (harm and harassment under the ESA), because lynx catches have not been evaluated in traps with these characteristics. Current BMP trap testing for lynx in Alaska is being conducted with variations of the Oneida Victor #3 traps. While some traps with similar characteristics have BMP approval for coyotes and bobcat, few traps of that size have approval for red fox. Injury scores from the Alaska BMP study are not available for comparison to Maine incidental take data at this time.

Half of Northeast trappers have heard of BMP traps and 82% were interested in receiving more information on these traps (AFWA 2005). Sixty-six percent supported BMP traps, and 53% stated they currently use and plan to continue to use BMP traps (AFWA 2005).

Trap size and jaw spread affects the incidence of non-target captures and may limit capture of some non-target species (Nocturnal Wildlife Research 2008), but BMP studies also illustrate that the size of foothold traps (measured across the open jaws) is not always a good indicator of the risk of injury (AFWA, www.fishwildlife.org). In an October 2007 settlement agreement with the Federal District Court for the District of Maine, in Bangor, MDIFW adopted new regulations that required that foothold traps used in WMDs 1-6 and 8-11 must have a jaw spread less than 5 3/8 inches. This effectively

limits use to No. 1, 1 ½, 1.75, and most No.2 foothold traps and removed No. 3 foothold traps, including some BMP traps, from use. However, lynx continued to be captured in foothold traps despite the size restrictions. In 2007, 8 lynx were caught; in 2008, 2 lynx were caught; and, in 2009, 3 lynx were caught in these smaller foothold traps. Regulations requiring only BMP-approved foothold traps would replace the 2007 regulations requiring certain jaw spread.

Under this Alternative, MDIFW would require traps meeting BMP standards to be phased in over 5 years because they may be, but not always, more expensive than regular traps. Sometimes, a trapper can modify existing traps to meet BMP standards, which would be less expensive than purchasing new traps. Foothold traps cost $10-15 each and softcatch (padded) footholds cost $12-20. The average trapper owns about 111 foothold traps (Duda *et al.* 2005), thus it would be considerable expense of time and money to re-outfit in a single year. Furthermore, requiring trappers to use BMP approved traps would break a promise made to trappers by MDIFW. When trappers were asked to participate in the BMP trap testing program, MDIFW promised not to require these traps be used. Requiring BMP traps may affect trapper cooperation (W. Jakubas, MDIFW, pers. comm.)

Only 10% of Northeast trappers opposed BMPs (AFWA 2005). Of the 10% who opposed, 28% believed they were unnecessary, 28% thought BMPs were too much regulation, and 13% disagreed with the testing methods (AFWA 2005). Andelt *et al.* (1999) encouraged all state wildlife agencies and trapper organizations to adopt BMP practices and incorporate them into trapper education and furbearer management programs. Currently, at least 28 states, including Maine, offer BMP training in trapper education programs (AFWA 2005, 2007).

<u>Required trapping practices – eliminate drags:</u>

- C.5 Require new regulation that prohibit drags, and require foothold traps in WMDs 1-11, 14, 18 and 19 be anchored with chains not more than 9 ½ inches long with at least 2 swivel points and optional in-line springs.

This conservation measure would prohibit the use of drags in WMDs 1-11, 14, 18 and 19 to anchor foothold traps. Instead, chains not more than 9 ½ inches long with at least 2 swivels would be required to anchor all foothold traps. Optional in-line springs would be recommended.

Two systems are typically used to anchor foothold traps – drags and staked chains. "Drags" are a long chain attached to the trap at 1 end and to a grapple, weight, log, or board at the other. Drags are sometimes used in Maine with foothold traps to allow an animal trapped in the open (e.g. field or road edge) to escape to cover. The trapped animal drags the chain and grapple/board until it becomes entangled. The trapped animal is typically out of view of the public and perhaps under less stress than if it were exposed in the open. Foothold traps may be secured with short chain(s) attached to the trap and anchored with long, metal stakes. Trappers clear the brush around chained foothold traps so the animal and trap cannot become entangled. To further minimize injury, trappers

often attach swivels (typically 1 to 3) to the anchor chain to allow the trap to rotate. They may also employ springs to allow the chain the ability to stretch when an animal struggles in the trap. Swivels and springs have been demonstrated to reduce injury to animals trapped in foothold traps (Tullar 1984, Olsen *et al.* 1988, Houben *et al.* 1993, Warburton and Poutu 2008).

The method of anchoring traps could exacerbate injuries to animals, and no method functions properly all of the time. Lynx have weaker leg bones than coyotes so are more likely to be injured in sets that are not anchored or have long chains without swivels (Mowat *et al.* 1994). There is no control of where animals caught in a drag set will become tangled in vegetation. If caught in thick brush where the animal cannot struggle it may experience little injury. However, in other instances the animal may become twisted in the drag set or get the set tangled in brush and dislocate or break bones, which has happened in Maine (draft ITP, Table 4.1). Evidence from a lynx carcass collection conducted in the Yukon (Slough and Mowat, unpub. data in Mowat *et al.* 1994) showed dislocation injury to lynx caught in foothold traps. When a drag with a long chain is used, the trapped animal has room to run and lunge, potentially increasing the chance of dislocation or fracture. One researcher associated with a Maine lynx study did not recommend drags because of the risk of injury to lynx (A. Vashon, pers. comm., Oct. 28, 2002). One of 8 Maine lynx caught in drag sets had a serious injury – a fractured leg (draft ITP, Table 4.1). Nybakk *et al.* (1996) also recommended that lynx traps be anchored tightly because of the potential for injury of animals tangled in vegetation.

A lynx in a drag set in Minnesota escaped detection from a trapper and was found dead (P. Delphey, USFWS, pers. comm., 2008). For this reason, drags were discontinued in northern Minnesota in 2008 (J. Erb, MN DNR furbearer biologist pers. comm., Nov., 2009 and www.dnr.state.mn.us/regulations). Minnesota has implemented regulations requiring 18 inch chains to protect injury to lynx: "All foothold traps except those set as water sets, must be staked or otherwise secured by tethering chains or cables not more than 18 inches long with at least 2 swivel points. Traps must be secured in a manner that prevents captured animals from removing the trap site (no drags allowed)." (Minnesota DNR, www.dnr.state.mn.us/regulations/).

To prevent injury to lynx, MDIFW's version of *How to Avoid Incidental Take of Lynx* publication distributed to Maine trappers advises against using drags. Specifically the guidelines suggest staking traps so that lynx cannot get tangled around a solid object and to keep the area around the trap clear of solid objects. The guidelines further recommend that attachment chains should be less than 9 ½ inches, be equipped with at least 2 swivels, and attached at the center of the foothold trap frame.

Sometimes (but rarely), animals caught in drags escape detection by the trapper and ultimately die in a trap. A lynx in a drag set in Minnesota escaped detection from a trapper and was found dead (P. Delphey, USFWS, pers. comm., 2008). For this reason, drags were discontinued in northern Minnesota in 2008 (J. Erb, MN DNR furbearer biologist pers. comm., Nov., 2009 and www.dnr.state.mn.us/regulations). Minnesota has implemented regulations requiring 18 inch chains to protect injury to lynx: "All foothold traps except those set as water sets, must be staked or otherwise secured by tethering

chains or cables not more than 18 inches long with at least 2 swivel points. Traps must be secured in a manner that prevents captured animals from removing the trap site (no drags allowed)." (Minnesota DNR, www.dnr.state.mn.us/regulations/).

Nationally, 86-89% of coyote trappers and 90-92% of red fox trappers secured their foothold traps by stakes and chain (AFWA 2005). Many Northeast trappers (43%) modify foothold traps or purchase traps that are pre-modified (11%). The most common foothold trap modification for coyote and fox trappers was adding additional swivels to the chain (AFWA 2005).

MDIFW captured lynx for research purposes in Victor No. 3 Softcatch coil spring foothold traps anchored by a short chain with swivels at the terminal end and base plate of the trap and with an in-line swivel (A. Vashon, pers. comm., Oct. 28, 2002). During this research study, trapped lynx had a low rate of injury. One lynx was severely injured in a foothold trap of this configuration in Maine in 2008 when a stick became wedged in a swivel and the animal twisted and broke its leg.

Alternative C would require new regulations prohibiting drags.

- C.7 Require MDIFW to develop the necessary statutes or regulations for a mandatory $1,000 fine for non-reporting take of lynx, to include mandatory seizure of equipment, and revoke trapping license for 5 years.

Advanced attempts to manage exploited fish and wildlife populations may be confounded without estimates of illegal harvest (Smith *et al.* 1989), but such information is difficult to obtain. Fines, penalties, loss of personal freedoms, or confiscation of personal belongings is a central theory of deterrence in our criminal justice and penal system (Hahn 1998). Likewise, fear of penalties and associated adverse publicity or social stigma form a conceptual framework for wildlife law enforcement (Musgrave *et al.* 1993, Sigler 1995). Unlawful activities, such as the illegal killing of wildlife, are thought to be worthy of stiff fines and possible jail sentences by 87% of the public surveyed (Kellert 1979). First offenses of wildlife crimes in all states are punished at least as a misdemeanor, and fines, forfeiture of property, and license revocations are often associated with more serious convictions. Penalties are often determined by a judge, although some offenses (e.g., selling illegally obtained wildlife parts, killing deer out of season) have mandatory fines and sentences and in some states are felonies (Musgrave *et al.* 1993).

The severity of penalties, to a certain extent, determines the effectiveness of wildlife laws (Musgrave *et al.* 1993). Penalties can range from small civil fines to criminal misdemeanors and their varying punishments, to felonies to forfeiture of property and mandatory license revocations. Mandatory fines and sentences are believed to be an effective form of deterrence from wildlife crime (Musgrave *et al.* 1993). Fines need to be steep enough to act as a deterrent to future violations and to convey the seriousness of the violation. License revocation and mandatory court appearances, in particular, are feared penalties (Musgrave *et al.* 1993). Trappers interviewed by the Service for this EA

recommended stiff, mandatory penalties for failure to report the incidental take of a lynx to ensure that take was being quantified accurately (S. Loch, Minnesota, pers. comm., November, 2009; C. Niemeyer, Idaho, pers. comm. November, 2009).

This conservation measure would require creating a mandatory $1,000 fine, seizure of equipment, and hunting and trapping license revocation for failure to report the take of a Canada lynx. This may require statutory change and legislative approval. Currently, failure to report take of a lynx is punishable as a Class E crime (12 MSRA Part 10 Chapters 701-811. Chapter 721 Enforcement), which carries a penalty of *up to* $1,000 and *up to* 6 months in prison, but penalties are at the discretion of a judge. Some wildlife infractions (e.g., illegal hunting of deer) in Maine carry mandatory fines of $1,000. MDIFW revokes hunting licenses for several infractions, for example, 10 years for conviction of assault while hunting, 5 years for shooting a domestic animal and hunting under the influence, 3 years for disturbing a trap, 2 years for stealing a trapped animal, and 1 year for a variety of different wildlife and trapping infractions. Therefore, it is practical for MDIFW to increase penalties for the non-reporting of the take of a Canada lynx. It is unknown what fraction of lynx incidentally caught are reported. Without a high level of reporting, it will be impossible to assess take in the ITP. There is currently no information available to know whether reporting is high (>90%) or low (<10%).

Mitigation measures:

- C.9 Prior to issuing an incidental take permit, MDIFW must complete a binding agreement with the MBPL, or another landowner, identifying a land unit to manage habitat for lynx. The agreement will specify the location (it must be within the designated Canada lynx critical habitat area), habitat quality, use restrictions, permanence, enforceability, binding nature of legal mechanism used to create an area protective of lynx and its habitat. The agreement will require a lynx forest management plan that specifies the timing and location of creating lynx habitat and use management consistent with the Service's *Canada Lynx Habitat Management Guidelines for Maine* (pp. 19-35, McCollough 2007, http://www.fws.gov/mainefieldoffice/) and create 10,000 acres of habitat within 5 years of receiving a Permit. The lynx forest management plan must include a program to monitor lynx, hare densities, and habitat to ensure mitigation is achieved. The lynx forest management plan document must be submitted with the final ITP or submitted and approved by the Service within 1 year of receiving a Permit and all silvicultural prescriptions contained in the approved plan must be implemented on the ground within five years. Absent failure to attain these milestones, the Permit would be suspended.

This mitigation measure is similar to mitigation offered in the draft ITP (B.7, draft ITP pp. 108-111) except that it would require: a) MDIFW to identify a suitable area for lynx habitat management on MBPL, or another owner's, land in the final ITP, b) submit a long-term management plan with the final ITP or a Service-approved plan within 1 year, c) require a long-term hare and lynx monitoring plan to assure anticipated results are achieved, and d) shorten the time period to implement from 10 to 15 years in the draft ITP to 5 years to ensure habitat mitigation occurred during the 15 year life of the Permit.

Habitat created on MBPL, or another landowner's, property could possibly mitigate the incidental take of lynx if the draft ITP specified the location (it must be within the designated Canada lynx critical habitat area), habitat quality, use restrictions, permanence, enforceability, binding nature of legal mechanism use to create an area protective of lynx and its habitat. The draft ITP should also specify the timing of when lynx habitat is created and use forest management described in the Service's *Canada Lynx Habitat Management Guidelines for Maine* (pp. 19-35, McCollough 2007, http://www.fws.gov/mainefieldoffice/), which may be updated or revised based on the best available science. The final ITP should also demonstrate that an adequate amount of new lynx habitat is created, above the current baseline, to compensate for all forms of take anticipated from trapping.

Maine hare densities have recently undergone a significant fluctuation or cycle (Scott 2009; see discussion on pages 7 and 8 of this EA). Hare density affects spatial use and movements of lynx. Lynx typically increase their home range size dramatically following the hare declines (Mowat *et al.* 2000). We conclude that lynx populations and home ranges will fluctuate with hare densities in Maine as they do in Canada, but it is possible that the magnitude of the fluctuation is less because the magnitude in fluctuation of hare populations are less than occur in Canada. Long term lynx populations in Maine may likely decline because of diminishing habitat (Simons 2009, draft ITP p. 53). Thus, for this alternative we doubled the size of the mitigation from 5,000 acres (draft ITP, B.7) to 10,000 acres to ensure lynx take from incidental trapping is adequately mitigated in times of low hare densities. MDIFW has identified changes in lynx home range as an area of uncertainty. A University of Maine Masters student, David Mallett, is evaluating home ranges of lynx in Maine during times of high and low hare density. We will incorporate these analyses in our final EA. Uncertainty can be addressed in HCPs through a precautionary approach (e.g., creating surplus habitat to ensure mitigation of lynx occurs in time when hare densities drop) or through adaptive management (e.g., radio-telemetry to ensure lynx home ranges are not fluctuating in size).

The probability that a lynx will be incidentally trapped on mitigation areas created on MBPL is low because trapping would be occurring under the minimization measures required in the Permit. However, there is still a chance that take could occur and offset the intended mitigation. Rather than require state mitigation lands be closed to trapping, we suggest MDIFW develop an adaptive management plan that requires monitoring of trapping on mitigation lands. If take occurs, then the mitigation areas should be closed until such time that new measures are implemented to avoid further take. The Bureau has the authority to close some areas to trapping if it causes a threat to resources, in this case the threatened Canada lynx.

Monitoring measures:

- C.6 Within one year of receiving a permit, design, obtain Service approval, and implement an evaluation of compliance with trapping laws and regulations in with a goal of checking at least 1/3 of active trappers and their traplines in WMDs 1-11, 14, 18 and 19. The purpose of increased enforcement is to assess and ensure

compliance with new regulations protecting lynx.

The protection of the wildlife resources is materially affected by the degree of compliance with state statutes, laws, ordinances, regulations, and administrative rules relating to the management of such resources (Interstate Wildlife Violator Compact, http://www.dnr.state.oh.us/Home/tabid/20979/Default.aspx). Compliance monitoring is critical to ensuring regulations are being met (Musgrave *et al.* 1993, Sigler 1995). In a survey, state wildlife agencies responded the most effective law enforcement programs (ranked highest to lowest) were increased compliance monitoring, education, peer-group pressure, increased penalties, and rewards (Nelson and Verbyla 1984). Education alone is believed to be insufficient to ensure compliance with wildlife laws (Heberlein 1991). Only about half of conservation officers believed education was an effective form of deterring wildlife violations (Kessler 2005).

This conservation measure would require MDIFW to document compliance with new trapping regulations and take appropriate actions for improvement. This would be done by developing a study design (e.g., Beattie 1975, Cowles *et al.* 1979) that specifies the behaviors that will be considered violations and the role of officer discretion, design and implement random and representative sampling, an assessment of findings and their application (i.e., adaptive management), and recommendations for repeating such studies and refining techniques. After 5 years, the need for increased compliance monitoring would be reassessed[9].

The study should be initiated within one year of receiving an incidental take permit, the results compiled, and findings reviewed, and approved by the Service. Law enforcement details would be increased in northern Maine and assigned to gather information on compliance with existing and new regulations protecting lynx (e.g. use of traps meeting BMP standards), prohibit use of drags, use of conibear exclusion devices) according to study protocols. For example, wardens would collect data on the number of trappers and traps checked, number that are in compliance, nature of non-compliance, non-target animals caught, and number and nature of citations given. In 2007, the Maine Warden Service made a concentrated effort to increase trapping enforcement. In that year, 947 trappers were checked (about 1/3 of Maine's trappers), 2,770 trapping sets (traps) were examined, and there were 267 violations. The most frequent violations were failure to label traps, trapping without landowner permission, and failure to check traps (MDIFW memo, 2007 Fall Theme Enforcement Data and Survey: Statewide Data Summary). Thus, it appears practical for similar efforts (i.e., check 1/3 of Maine's trappers) in a periodic study to evaluate compliance with trapping regulations designed to protect lynx.

Other conservation measures

- C.8 Recommend Maine become a participating member of the Interstate Wildlife Violator Compact

This conservation measure would provide additional deterrent for individuals who fail to follow trapping regulations in Maine. The Interstate Wildlife Violator Compact is a

[9] This process would be identified using an adaptive management process outlined in MDIFW's final ITP.

cooperative interstate effort to enhance a member state's ability to protect and manage wildlife resources (www.dnr.state.oh.us/Home/tabid/20979). The Compact is an agreement that recognizes suspension of hunting, fishing, and trapping licenses in member states. This means that illegal activities in 1 state could affect a person's hunting or fishing privileges in all participating states. Any person whose license privileges or rights are suspended in a member state would be suspended in Maine if Maine were a member of the Compact. If a person's hunting, fishing, or trapping license were suspended in Maine, they would be suspended in member states as well.

The Interstate Wildlife Violator Compact also establishes a process whereby wildlife law violations by a non-resident from a member state are handled as if the person were a resident, meaning they could be served a ticket rather than being arrested, booked, and bonded. This process is a convenience for hunters, fishermen, and trappers of member states, and increases efficiency of game wardens by allowing more time for enforcement duties rather than violator processing procedures.

Thirty-two states are currently members, and 5 others have passed state legislation and are in the process of becoming members. MDIFW has received legislative approval to become a member of the Interstate Wildlife Violator Compact, this approval becomes effective September 28, 2011 and MDIFW will initiate the process to become a member after this date (M. Stadler, pers. comm.. 7.20.2011).

2.2.4 Alternative D: Modified ITP

Alternative D employs these previously described conservation measures A.1, A.2, A.3, A.4, A.5, A.6, B.1, B.2, C.1, A.7, B.3, A.8, A.9, A.10, A.12, C.5, C.6, C.7, and C.8 (Table 2.2). In addition, the following minimization and mitigation measures would be implemented. Many of these conservation measures are not discussed in the draft ITP so we provide additional background and justification. Minimization measures D.1, D.4, D.5, D.6, D.7, and D.8 describe more restrictive trapping techniques, which would require changes to Maine statutes or regulations. MDIFW would need to provide the details and wording of any proposed statutory and regulatory amendments, along with timelines for their enactment or approval. The Service would need this information to evaluate and analyze whether these changes meet the ESA issuance criteria, prior to issuing a final Permit.

Minimization measures:
Outreach and education:

- D.1 Require periodic retraining of all licensed trappers

Many values have been attributed to hunter and trapper education, including improved safety, hunting skills, landowner relations, ethics, and knowledge of basic wildlife management (Decker and Connolly 1990). Hunter education classes are required in all 50 states (International Hunter Education Association (IHEA), http://www.ihea.com/). At least 6 states, including Maine, require mandatory training for all adult trappers (AFWA 2007). However, once a trapper is certified (or shows proof of having a previous

trapping license), there is currently no requirement in Maine for periodic refresher courses or training. Trapper education courses have been cited as a primary means to improve public perception of trapping, although there is a need for states to evaluate the effectiveness of the program and make appropriate modifications (Armstrong and Rossi 2000). Decker and Connelly (1990) believed an aggressive continuing education program was warranted to educate hunters about their role in response to changing management conditions, including new regulations, changing wildlife populations, new hunting techniques in urban areas, land access, and growing anti-hunting sentiment, although they stopped short of requiring mandatory retraining.

In 2010, the AFWA Furbearer Conservation Technical Work Group and the Northeastern Fur Resources Technical Committee launched a web-based Trapper Education Program based on Best Management Practices for Trapping in the United States and the AFWA National Trapper Education Program. The goal of the web-based program is to provide an online method for trapper education in the United States that will instruct students in consistent content standards and learning objectives. The program will provide a mechanism for all state agencies to certify trappers. Trappers will simply be directed to the website by state agencies and be allowed to take the course online. Students who review the 17 modules and pass the associated quizzes by answering at least 80% of the questions correctly will be issued a voucher that they have successfully completed the course. Students will then be required to attend a field day, hosted by the state agency, to get "hands-on" instruction from agency trapper/hunter education instructors.

This conservation measure would require retraining of all licensed trappers once every 5 years (possibly the National Trapper Education Program described above). A trapper certification system could be instituted, which would require periodic re-training. Certification would have to be maintained to purchase a trapping license.

- D.2 Require qualified MDIFW staff teach lynx module of trapper training and how to avoid catching non-target species

This conservation measure would require that MDIFW staff (game wardens or biologists) with trapping expertise teach the lynx and endangered species module at trapper education classes. MDIFW staff would use the DVD (measure C.1) and be present to provide additional demonstrations, explanation of policy and procedures, and answer questions. Wildlife biologists and game wardens with trapping expertise are credible sources of information for trappers and would provide consistent information on how to avoid take and injury of lynx, explain laws and regulations, and answer trapper's questions. There are 16 trapper education classes posted on MDIFW's website for 2010, thus it would require about 40-60 hours of MDIFW staff time annually (1 hour for lecture and time for preparation and travel).

<u>Lynx handling procedures and protocols:</u>

- D.3 Require veterinary evaluation of all lynx caught in traps when feasible and not likely to result in additional injury due to delay in release

See conservation measure C.2 above for discussion of implementing this action for 10 lynx.

This conservation measure would require veterinary evaluation of all lynx caught in traps when it is logistically feasible to do so. This would be costly, but would likely result in diminished injury to lynx. Improved veterinary examination would inform future actions to adapt traps and methods to further avoid injury, improve injury evaluation procedures, and train MDIFW staff. This measure has logistical challenges. Current protocol requires that incidentally-trapped lynx be held in traps (usually for 3-8 hours after they are discovered) until MDIFW biologists, wardens, and USFWS law enforcement arrive at the scene. Including a veterinarian in the investigation may delay release of animals not needing veterinary attention. The value of this conservation measure is that a veterinarian would provide advice on the protocol and revisions needed to minimize injury to lynx (see C.2). However, these benefits could be offset by causing further injury to lynx that must wait in traps until a veterinarian arrives.

<u>New regulations – conibear traps:</u>

- D.4 Limit conibear traps to size #120 or smaller in WMDs 1-11, 14, 18 and 19 and require that they be set at least 5 feet above the ground and snow level in trees

This conservation measure would limit conibear traps in northern Maine WMDs 1-11, 14, 18, and 19 to #120 or smaller to further reduce incidental captures and injury to lynx. Although only 6 of 53 lynx incidentally trapped in Maine have been caught in conibear traps, these types of traps have been a significant source of mortality and injury. Three lynx were caught in #120 conibears set on the ground with no visible bait. Two were caught in #160 conibear traps set in leaning pole sets in trees, and 1 was caught in #220 conibear trap set in leaning pole set. (See details of these trapping incidents in section 2.2.3 measure C.3 in this draft EA).

Conibear traps are used in upland settings primarily for fisher and marten trapping. Although it is unlikely that smaller #110 and #120 conibear traps would capture fewer lynx, smaller traps would exert less force and may reduce trap injury to incidentally caught lynx (J. Erb, MN DNR, pers. comm., Nov., 2009, S. Loch, pers. comm., Nov., 2009). The effectiveness of conibear in killing target species has been extensively tested, yet injury due to incidental capture of non-target species has received almost no attention (Iossa *et al.* 2007). Some trappers believe that large conibears (#160 and larger) are not needed to capture and humanely kill marten and fisher. In Canada, #120, #160, and #220 conibear traps are approved traps for marten and fisher. In the U.S., 4 configurations of #120 conibear traps pass BMP standards for pine marten (AFWA, Best Management Practices for Marten in the United States), and several configurations of #120, #160, #220 and larger (up to 7 inch opening) pass BMP standardsfor fisher (AFWA, Best Management Practices for Trapping Fisher in the United States). MDIFW biologists have recommended that only #120 conibear traps be used within lynx range to reduce the risk of mortality and injury to lynx (MDIFW, J. Vashon memo to W. Jakubas October, 2, 2006). Maine's version of *How to Avoid Incidental Take of Lynx* provides no recommendations on the size of conibear traps. MDIFW considered eliminating use of

#220 conibear traps in the draft ITP (p. 131), but did not choose this measure because they believed leaning pole sets as described in *How to Avoid Incidental Take of Lynx* would prevent take of lynx.

This conservation measure would require trappers to use only #110 and #120 conibear traps to be set in trees (not leaning poles) at least 5 feet above the ground. Lynx have ability to climb (Iwaniuk *et al.* 1999), but there is little information concerning how well they climb and what diameter trees and leaning poles lynx can ascend. Investigations of lynx trapping incidents in Maine document that in some situations lynx ascended leaning poles less than 4 inches in diameter, at angles greater than 70^{o}, and climbed vertically 8 feet in trees less than 4 inch in diameter with foothold trap and drags attached (R. Rothe, USFWS Law Enforcement, pers. comm., Nov., 2009). An adult male lynx from Maine measured 4 feet from hind to front foot, thus lynx may be able to reach into traps set 4 feet off the ground (R. Rothe, USFWS Law Enforcement, pers. comm., January, 2010).

Some trappers believe that although lynx may be able to climb trees, they are not behaviorally motivated to do so (S. Loch, Minnesota, pers. comm., 2009). In Minnesota, lynx tracks have been observed approaching baited trap sets in trees, but the lynx did not climb the tree (S. Loch, Minnesota, pers. comm., 2009). Therefore, placing traps higher in trees would be a further deterrent to a lynx, but would not affect the ability to trap marten and fisher that readily climb trees (S. Loch, Minnesota, pers. comm., 2009).

In this conservation measure, traps would be required to be set at least 5 feet off the ground to a) further reduce the behavioral motivation for lynx to explore traps, b) further reduce the likelihood that a lynx can reach the trap, and c) further reduce the likelihood that snow will reduce the height of traps in remote areas of northern Maine. This conservation measure is untested, and some lynx may still be caught and injured in small conibear traps. For this reason, long chains or cables would be used to secure the conibear trap so that a lynx would not be suspended from a foot and tending times would need to be reduced to 24 hours (see D.5 below). Trappers usually secure conibears in sets in trees with short chains so the trapped fisher or marten is suspended high above the ground and away from scavengers that could ruin the fur.

- D.5 Require 24-hour tending of conibear traps in WMDs 1-11, 14, 18 and 19

This conservation measure would require changing the trap check frequency for conibear traps in WMDs 1-11, 14, 18 and 19 from 5 days to 24 hours. Greater lynx injury and mortality rates in conibear traps can be attributed to a trap designed to instantly kill, not hold, target animals and the long period of time that lynx may be suspended off the ground if caught in this type of set by the foot.

Animals held in traps for longer periods of time receive more severe injuries and experience greater stress (Powell and Proulx 2003, Proulx *et al.* 1994, Nocturnal Wildlife Research 2008). Thirty-six states require a daily or 24-hour trap check time for all traps set on land (Fox and Papouchis 2004), and at least 19 states require 24-hour tending specifically for body-gripping traps set on land (AFWA 2007). Maine's version of *How*

to Avoid Incidental Take of Lynx recommends that conibear traps be checked frequently. Maine has a 24-hour trap check requirement for foothold traps state-wide, however, conibear traps must be checked every 3 days in organized towns and 5 days in unorganized towns. These longer tending times for conibears are allowed because conibear traps are intended to kill the target animals quickly and because of the difficult logistics of checking traps in remote areas of northern Maine.

Well-designed conibear traps if set properly usually result in rapid death of target furbearers (e.g., Parker 1983), but sometimes do not cause instant death as intended (e.g., Proulx 1999). All or most non-target animals are usually killed (Iossa *et al.* 2007). Sometimes target furbearers and non-target species are not well-positioned in traps for a killing blow, the trap is the wrong size for the animal that is caught, or the trap does not have sufficient energy to kill the animal (e.g., Proulx and Barrett 1989, 1993). In Maine, marten and fisher conibear sets are required to be set on leaning poles, and after capture the trapped animal hangs from the pole suspended off the ground by a short chain to prevent damage of the fur by other predators. Four of the 6 lynx killed in conibear traps in Maine were caught by the paw and two by the head (see discussion of conservation measure C.3). Shorter tending times may reduce harm or injury to those lynx incidentally caught in conibear traps. States that require 24-hour tend of conibear land sets have done so to improve humane treatment for wild animals caught and not immediately killed and to reduce injury to pets incidentally caught in conibear traps.

In northern Maine, snowfall is likely to start in mid-November, which corresponds to the trapping season. A trap must be 4 feet off the ground or snow level when set. If snowfall accumulates a trapper is required, per Maine regulations, to adjust the trap level to 4 feet above snow level.

In the draft ITP (p.131), MDIFW considered instituting a 24-hour trap tending requirement for conibear traps, but did not choose this alternative because it inconvenienced trappers and they believed leaning pole regulations in *How to Avoid Incidental Take of Lynx* would be more effective.

<u>New regulations:</u>

- D.6 MDIFW is required to adopt regulations that require trappers immediately use only traps that meet BMP standards, and rescind existing regulations concerning 5 3/8 in. jaw spread of foothold traps

These conservation measures would require that trappers immediately shift to foothold and conibear traps that meet BMP standards and rescind existing regulations concerning 5 3/8 in. jaw spread of foothold traps. (See conservation measure C.4 above for discussion of this action if phased in over 5 years).

- D.7 MDIFW is required to adopt regulations that require pan tension devices be used with foothold traps in WMDs 1-11, 14, 18 and 19

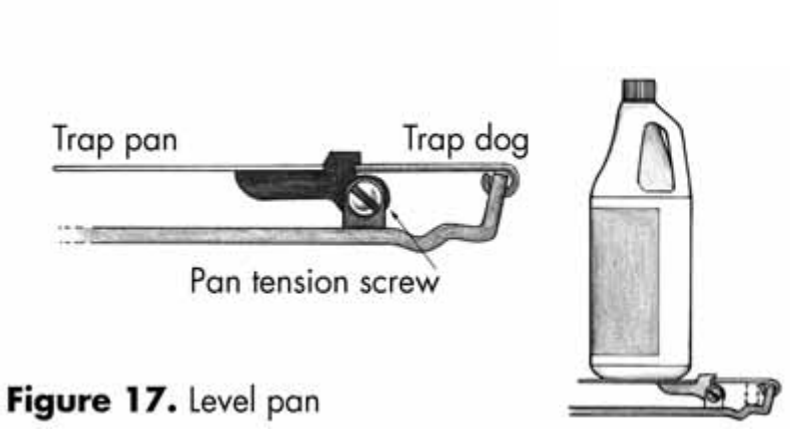


Figure 2.2.4. Pan tension device (figures courtesy of AFWA).

One method to increase trap selectivity is to increase the force required to trigger the foothold trap so that smaller species are excluded. Pan tension devices (Fig. 2.2.4) are a particular type of BMP recommendation that improves selectivity of traps by adjusting the amount of weight needed to trigger a foothold trap (AFWA Trapping BMPs for the United States). For example, pan tension devices in California are effective at excluding endangered swift foxes from foothold traps set for coyotes (Turkowski *et al.* 1984, Kamler *et al.* 2002). Pan tension devices provide an added benefit in avoiding incidental take of small non-target birds and mammals (Kamler *et al.* 2002). In one study, pan tension devices excluded 97% of 826 small, non-target animals, whereas unmodified traps excluded only 6% (Turkowski *et al.* 1984). To avoid incidental capture of nontarget species, AFWA trapping BMPs recommend setting pan tension at 4 pounds for eastern coyotes, 2 to 4 pounds for bobcats, and 2 pounds for foxes.

Pan tension devices may be able to exclude lynx from some coyote traps, but lynx would trigger foothold traps set for bobcat and fox traps. Adult male lynx in Maine weigh between 28-32 pounds and females weigh up to 22 pounds (J. Vashon, MDIFW, unpub. data), thus pan tension would need to be greater than 8 pounds to exclude lynx. The average weight of Maine coyotes is 30-35 pounds (individuals up to 48 pounds) (Jakubas MDIFW 1999 coyote assessment). Therefore, foothold traps with pan tension devices set at a minimum of 8 pounds should avoid incidental capture of lynx. However, 8-pound pan tension would reduce or eliminate trapper's ability to trap red fox and small coyotes in the same sets.

- D.8 Limit upland trapping season to October and November to prevent freezing injury

This conservation measure would be implemented to reduce freezing injury to Canada lynx incidentally trapped in foothold and conibear traps. Maine's upland trapping season typically begins in mid-October with a two-week fox and coyote season and continues with a statewide season for all upland furbearers in November and December. Trapping seasons occur in the cold weather months because the quality of the fur increases as

temperatures become colder and typically peaks from mid-November to January for many species.

Although Alternative D contains measures to restrict sizes of conibear traps (D.5), requires 24-hour tending of all traps (D.6), and requires immediate use of traps meeting BMP standards (foothold and conibear) (D.7), incidental take of lynx in conibear traps in December, although reduced, would still be likely to occur.

Freezing is an important factor during fur trapping seasons at northern latitudes. Foothold and conibear traps could create a tourniquet effect, cutting off blood flow to a trapped appendage that could cause freezing and eventual loss of the toes or foot (Onderka *et al.* 1990, Mowat *et al.* 1994, Kolbe *et al.* 2003). For example, 9 of 23 lynx caught during the winter in foothold traps had frozen feet or digits, particularly when temperatures were less than 18 degrees °F (Mowatt *et al.* 1994). Similarly, Kolbe *et al.* (2003) documented foot freezing in 18% of 39 lynx captures in padded foothold traps in Montana, even when traps were checked every 12 hours and traps were closed when temperatures were <18 °F. Complete freezing causes severe injuries and gangrene, which results in loss of function and eventual loss of the limb. Even partial freezing could initiate cell necrosis, which could debilitate incidentally-trapped animals (Robbins and Cotran 1979, Onderka *et al.* 1990).

Freezing temperatures become prevalent in Maine in November and December. In November, the average high daily temperatures for Caribou Maine is 37.6 °F and lows are 23.7 °F and in December are 24.0 °F and 5.5 °F, respectively (National Weather Service data). Thus, freezing of digits may occur for lynx held overnight in foothold traps, especially in late November and December. Risk is assumed to be higher for lynx held in conibear traps, where trap tending times could be up to 5 days (see discussion for D.6 above).

Lynx with frozen digits may require rehabilitation. For instance, Mowat *et al.* 1994 recaptured 2 lynx that had frozen digits and could not detect an injury. A Maine lynx caught in a conibear trap on November 19 had 4 frozen toes and was taken to a veterinarian for assessment and held for observation as a precaution. This animal was released within a week after a veterinarian verified the toes were uninjured (J. Vashon, MDIFW, pers. comm., draft ITP, Table 4.1). Eliminating trapping in December could reduce harm or harassment due to freezing.

Because of the high value of marten and fisher furs, competition between trappers, and increased access before snowfall, most trappers concentrate their effort in the early weeks of the season (November) for these furbearers (W. Jakubas, MDIFW, pers. comm.). Many trappers attain their quota of marten (25 animals) in November, thus the majority of the marten harvest occurs during the first 2 weeks of the season (Hodgman *et al.* 1994). Shortening the trapping season to October and November likely would not affect most marten trappers and would not reduce marten and fisher harvest significantly (W. Jakubas, MDIFW, pers. comm.). To reduce harvest in 2008, MDIFW reduced marten

and fisher seasons to just 4 weeks in November, but resumed the longer trapping season in 2009.

Most incidentally-trapped lynx (26 of 42, draft ITP Table 4.1) are caught in the early coyote and fox season in October. Fewer lynx are caught in November (15 of 42 lynx, J. Vashon, MDIFW, pers. comm.) and December (1 of 42 lynx caught in Maine, draft ITP Table 4.1).

Mitigation measures:

- D.9 Prior to issuing an incidental take permit, MDIFW must complete a binding agreement with a private forest landowner identifying an area to manage habitat for lynx. The agreement will specify the location (it must be within the designated Canada lynx critical habitat area), habitat quality, use restrictions, permanence, enforceability, binding nature of legal mechanism use to create an area protective of lynx and its habitat. The agreement will require a lynx forest management plan that specifies the timing and location of creating lynx habitat and use management consistent with the Service's *Canada Lynx Habitat Management Guidelines for Maine* (pp. 19-35, McCollough 2007, http://www.fws.gov/mainefieldoffice/) and create at least 7,000 acres of habitat within 5 years of receiving a Permit. The lynx forest management plan must monitor lynx, hare densities, and habitat to ensure mitigation is achieved. The lynx forest management plan document must be submitted with the final ITP or submitted and approved by the Service within 1 year of receiving a Permit and all silvilcultural prescriptions contained in the approved plan must be implemented on the ground within 5 years. The lynx forest management plan must be approved by the Service, contain provisions for monitoring lynx, hare densities and habitat conditions, and allow rights of access by a 3rd party beneficiary to enforce the terms of the agreement and plans. Absent failure to attain these milestones, the Permit would be suspended.

This mitigation measure is similar to B.7 and C.9 and addresses the most pressing, long-term threat to Canada lynx – loss of habitat because of current trends in forest management practices that may not benefit lynx. Although mitigation on private forest lands was not presented as an alternative in the draft ITP, we consider it in this draft EA because MDIFW indicated this is an activity it wishes to pursue (draft ITP pp. 82, 114, 115, 116, and 149).

Habitat created on private forestlands could possibly mitigate the incidental take of lynx if the draft ITP specified the location (it must be within the designated Canada lynx critical habitat area), habitat quality, use restrictions, permanence, enforceability, and binding nature of legal mechanism use to create an area protective of lynx and its habitat. The final ITP should demonstrate that an adequate amount of new lynx habitat is created, to compensate for all forms of take anticipated from trapping.

The Service and Natural Resource Conservation Service currently have 5 northern Maine landowners enrolled in management agreements meeting these criteria in the Healthy

Forest Reserve Program (HFRP). Substantial financial incentives ($1 to $1.50/acre) were provided through the HFRP to pay for developing lynx habitat management plans and initial implementation.

The anticipated decline in lynx habitat because of changing forest management offers opportunity for mitigating lynx killed, harmed, and harassed in traps. As explained in B.7, MDIFW developed habitat mitigation goals assuming high, stable lynx densities and did not contemplate declining habitat or fluctuating hare numbers. Prompt, intensive, and sustained silvicultural treatments (clearcutting and some shelterwood cuts) of adequate size and juxtaposition focused on a 1 ½ to 4 township landscape could support 3 to 4 adult lynx at times of lower hare densities and 7 to 8 adult lynx at higher hare densities (McCollough 2007), which would have a higher probability of compensating for incidental take of lynx than 5,000 acres of habitat proposed in Alternative B.

As explained in B.7, regenerating conifer stands created by clearcuts would become lynx habitat about 12 years post-harvest and would support high populations of hares and lynx for 30-35 years post-harvest (Fuller *et al.* 2007). Habitat created for mitigation should be created as soon as possible to offset hare and lynx habitat declines anticipated after 2012 (Simons 2009, Scott 2009).

The probability that a lynx will be incidentally trapped on mitigation areas created on private forestlands is low because trapping would be occurring under the minimization measures required in the Permit. However, take could occur and offset mitigation. Rather than require that private mitigation lands be closed to trapping, we suggest that MDIFW develop an adaptive management plan that requires monitoring of trapping on mitigation lands. If take occurs, then the mitigation areas should be closed until such time that new measures are implemented to avoid further take.

Closing private forestlands to trapping is practicable. The MDIFW has the authority to close areas to trapping and typically implements trapping closures for beaver on a township basis. Therefore it would be practicable for MDIFW and the Bureau to close a township to trapping by regulations and posting logging roads entering a township.

There are several obstacles to securing this form of mitigation on private forest lands. Industrial forest landowners may have little incentive to manage their lands for Canada lynx. Long-term management agreements are often difficult to negotiate and may be expensive (e.g., staff time to develop, legal costs). Also, private forest landowners may not want to encourage federally-listed species on their property without incidental take authorization.

Monitoring measures

- D.10 Annually, for the first 3 years after the section 10 permit is issued, MDIFW will evaluate compliance with conibear leaning pole trapping regulations (A.9, A.10 and trap tending), inspecting at least 30 trappers. If compliance is less than 90% in any 1 year, MDIFW would require use of conibear excluding devices for

all upland conibear traps in WMDs 1-11, 14, 18 and 19 (C.3) that minimize the potential for lynx to be taken in conibear traps.

There has been no assessment of existing conibear/leaning pole regulations to determine their practicability (i.e., do trappers interpret and implement the regulations correctly and consistently) and effectiveness. MDIFW anticipated that new rules (2007) concerning use of leaning poles with conibear traps, if followed, would eliminate mortality and reduce major injury from conibear traps (draft ITP p.58).

Annually, for the first 3 years after the section 10 permit is issued, MDIFW will evaluate the compliance of the new leaning pole regulations by conducting an evaluation of baited conibear sets on leaning poles in WMDs 1-11, 14, 18 and 19. The objective of the study is to document conformance with regulations concerning the leaning pole, bait placement, and document trap tending frequency. (In 2002, MDIFW conducted a similar evaluation of snaring compliance by checking 30 snare lines consisting of an average 19 snares/line.) A sample of at least 30 trappers will be selected at random each year; evaluations will occur throughout the trapping season (including when there is fresh snow); the entire trap line for each trapper will be evaluated. Reports on the compliance as well as enforcement actions taken will be compiled and provided by MDIFW to USFWS. If compliance is less than 90% within any year: MDIFW will require use of conibear trap excluding devices for all upland conibear traps in WMDs 1-11, 14, 18 and 19, as in conservation measure C.3, prior to the start of the next trapping season. This measure would address the uncertainty of compliance with and the effectiveness of the current conibear regulations. The requirement for conibear excluding devices would remain in effect until MDIFW could assure the USFWS their regulations are practicable and effective.

MDIFW considered independent inspection to monitor incidental take would not be practicable (draft ITP p.134) because there are thousands of trappers, few lynx are caught considering the number of traps set, trappers are not obliged to have observers accompany them, and it would be highly inflammatory to trappers. MDIFW did not consider independent inspections to evaluate compliance with trapping regulations in the draft ITP.

2.2.5 Alternative E: No Permit is issued and MDIFW discontinues trapping where lynx occur regularly in Maine

Alternative E employs conservation measures A.3, B.2, A.7, A.12, B.6, A.6, A.13, and A.14 (Table 2.2). In addition, the State would close upland trapping in WMDs 1-11, 14, 18 and 19 to avoid take of lynx. This conservation measures is not fully evaluated in the draft ITP so we provide additional background and justification. Closing upland trapping in these WMDs would require changes to Maine statutes or regulations.

- E.1 Discontinue upland trapping in WMDs 1-11, 14, 18 and 19.

For the purposes of evaluating a complete suite of alternatives in this draft EA, we

assume that without incidental take authorization the State would discontinue upland trapping for fox, coyote, bobcat, marten, fisher, weasel, mink, skunk, and raccoon in WMDs 1-11, 14, 18 and 19 to protect lynx from incidental take. MDIFW considered closing trapping in portions of the lynx range as a measure to address increased lynx take if fur prices increase (draft ITP pp. 65-66), but does not consider this option in their preferred alternatives. MDIFW has the regulatory authority to close trapping and employs closures of certain geographic areas to protect or manage populations of beaver (draft ITP p. 31) and marten (draft ITP p. 235). MDIFW would likely close only upland trapping. Submerged aquatic sets would be very unlikely to take lynx.

Few of the conservation measures in Alternatives A, B, C, and D would be necessary if upland trapping were permanently discontinued in WMDs 1-11, 14, 18 and 19. MDIFW would likely rescind some or all of the of the court imposed regulations adopted in 2007 and other regulations restricting trapping to protect lynx including regulations addressing exposed bait, placing conibear traps on leaning poles, and size of foothold traps. MDIFW could reduce outreach to trappers and maintain minimal handling and reporting protocols to address the slight probability that lynx may be incidentally caught in traps in other WMDs. Incidental take of lynx may be minimized to an insignificant level and an ITP and associated mitigation may not be required. MDIFW would maintain contact with other states and provinces concerning lynx take, continue lynx studies, and planning documents. Discontinuing upland trapping may be extended to other WMDs if MDIFW believes Canada lynx are present in other areas.

3. AFFECTED ENVIRONMENT

MDIFW submitted an incidental take plan requesting state-wide coverage for incidental take of Canada lynx for all types of trapping. Areas affected by the proposed action include, but are not limited to, private and public property; state, county, municipal lands, including park lands; historic sites; state and interstate highways and roads; railroads and their right-of-ways; property areas in or adjacent to human development; timberlands; croplands and pastures; and, federally-owned or -managed lands, but only to the extent that trapping is permitted, approved, authorized, or conditioned, consistent with applicable federal statutes, regulations and policy. Maine's Native American's control trapping activities on trust and reservation lands, and the alternatives considered in this draft EA would not pertain to these lands.

3.1. Environmental Setting

Maine's environmental setting, climate, topography and geology, and hydrology are described in detail in the draft ITP (pp. 6-10).

3.2 Biological Environment

3.2.1 Habitat and Vegetation

Maine's vegetation is described in the draft ITP (pp.10-11).

3.2.2 Federally-listed, Proposed and Candidate Species

Canada lynx – The federally threatened Canada lynx is associated with dense boreal and subalpine conifer forests, regenerating forests and occurs throughout much of northern Maine (Fig. 2.1). Life history information and threats are covered in Section 1.5 of this draft EA. Critical habitat for the Canada lynx was designated in northwestern Maine (74 FR 8616: February 25, 2009) (Fig. 3.2.2a).

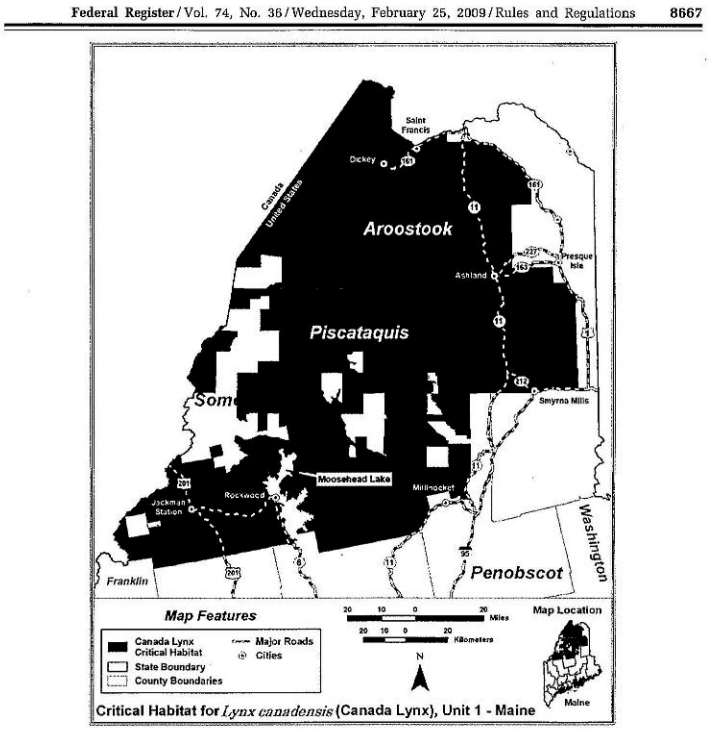


Fig. 3.2.2a. Critical habitat for the Canada lynx.

Atlantic salmon – The federally endangered Atlantic salmon is an anadromous fish that spends most of its adult life in the ocean but returns to freshwater to reproduce. Atlantic salmon have a complex life history that includes adults returning to spawning rivers, eggs, parr, and smolt stages in freshwater, migration back into the ocean and extensive feeding migrations on the high seas.

The Gulf of Maine Distinct Population Segment (GOM DPS) includes all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment (74 FR 29344; June 19, 2009). The marine range of the GOM DPS extends from the Gulf of Maine, throughout the Northwest Atlantic Ocean, to the coast of Greenland

Critical habitat is designated for the GOM DPS of Atlantic salmon (74 FR 29300; June 19, 2009) and includes much the range of the salmon in Maine (see Fig.3.2.2b). Atlantic

salmon critical habitat includes about 2/3 of the state of Maine and intersects with a large portion of WMDs 1-11, 14, 18 and 19 where incidental take of lynx from trapping is most likely to occur.

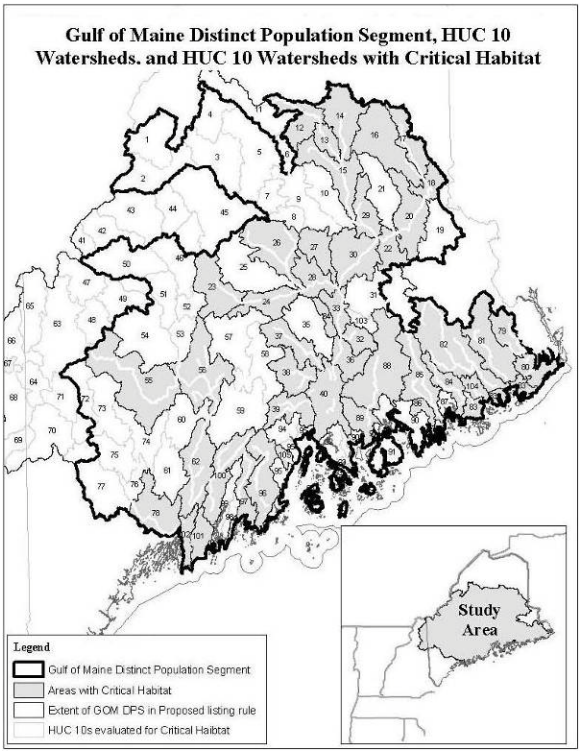


Figure 3.2.2b. HUC 10 watersheds designated as Atlantic salmon critical habitat within the GOM DPS.

Furbish's lousewort - The Furbish lousewort (*Pedicularis furbishiae*) was listed as endangered on April 26, 1978 (43 FR 17910-17916). A member of the snapdragon family, the Furbish lousewort is endemic to the St. John River valley in Aroostook County. It occurs only in small pockets along the riverbank along 160 miles of the river from the confluence of the Big Black River downstream to Andover, New Brunswick. The MDIFW draft ITP does not affect the lousewort because it is dormant during the trapping season, and therefore will not be discussed further in this draft EA.

Eastern prairie fringed orchid - The threatened Eastern prairie fringed orchid (*Plantanthera leucopehaea*) occurs at a single location in a bog in Aroostook County in northeastern Maine. This orchid is a perennial herb that grows from an underground tuber. Flowering begins from late June to early July, and lasts for 7 to 10 days. The MDIFW draft ITP does not affect the eastern prairie fringed orchid because it is dormant during the trapping season and therefore will not be discussed further in this draft EA.

Gray wolf – The gray wolf (*Canis lupus*) is the largest North American canid, and is primarily a predator of medium and large animals (deer, moose, beaver). The gray wolf once ranged throughout most of North America, but was extirpated by humans from over

95% of its historic range, including from Maine in about the 1890s. Recovery has been successful in the northern Rockies and Great Lakes States. The gray wolf remains an endangered species in the Northeast, including Maine.

Although several wolves were found in Maine and elsewhere in the Northeast during the last 20 years, a breeding population is not known to exist south of the St. Lawrence River. A wolf was shot in Maine in the 1993 and another trapped and killed in 1996 (draft ITP p. 5), and a wolf was trapped and killed in southern Quebec near the Maine border in 2002 (Villemure and Jolicoeur 2004). The closest wolf population to Maine occurs in southern Quebec on the north shore of the St. Lawrence.

Eastern cougar – The eastern cougar (*Puma concolor couguar*) once occurred throughout eastern North America. This large felid was a predator of ungulates (deer, moose) and other small mammals (porcupines, snowshoe hare, beaver). The last known eastern cougar in eastern North America was trapped and killed in Somerset County, Maine in 1938 (Parker 1998). The Service believes the eastern cougar is extinct from eastern North America and plans to delist this subspecies (McCollough 2010, USFWS Five-year Review of the Status of the Eastern Cougar). Although cougars have been documented in recent years in Maine, New Brunswick, Quebec, and elsewhere in eastern North America, the evidence suggests that these are of captive origin and are not the eastern cougar subspecies. The eastern cougar will not be considered further in this draft EA.

New England cottontail – The New England cottontail (*Sylvilagus transitionalis*) is a medium to large-sized rabbit that occurs in early successional habitats or thickets in York and Cumberland County Maine. The New England cottontail is listed by Maine as endangered and is a candidate for federal listing. The primary threat is loss of habitat, and there are substantial efforts to create habitat for this species in southern Maine and elsewhere throughout its range. Rabbits and hares are commonly caught incidental to trapping for other animals (Barrett *et al.* 1989, Proulx *et al.* 1989, Mowat *et al.* 1994, Naylor and Novak 1994, Nocturnal Research 2008), therefore we considered effects on this candidate species.

Other federally-listed species – Other federally-listed species occurring in Maine include the threatened piping plover (*Charadrius melodus*), endangered roseate tern (*Sterna dougallii dougallii*), threatened shortnose sturgeon (*Acipenser brevirostrum*), threatened small whorled pagonia (*Isotrea medeoloides*), several sea turtles and whales.

3.2.3 Bald and golden eagles

Bald eagle – Maine is a primary breeding area for bald eagles (*Haliaeetus leucocephalus*) in eastern North America, and in 2005 supported over 90% of the bald eagle pairs nesting in New England. Bald eagles currently breed in all of Maine's 16 counties. More than 60% of the population still resides and overwinters in Maine (Todd 2004). Currently, there are greater than 500 nesting pairs in Maine, and the population is increasing approximately 8% annually.

In all seasons, bald eagles usually associate with seacoasts, rivers, or lakes, although they may also be found congregated at some inland settings near food sources (especially carrion in winter). Proximity to open water with adequate prey, mature trees in shoreland zones, and limited human activity are fundamental habitat requirements for breeding eagles. Coastlines and major rivers that remain ice-free are Maine's primary winter habitats, thus winter distribution is skewed toward the coast. Adults are usually sedentary and shift locally only to acquire food (Todd 1979). Eagle numbers in Maine probably peak in spring and summer when all adults and most subadults native to the state are in residence. In addition, there is an influx of southern eagles from Florida (Broley 1947) which disperse northward along the Atlantic seaboard as far north as the Canadian Maritime provinces. Eagle numbers begin to decline in late summer as eagles from southern states depart from Maine. Peak fall migration occurs from mid-September through early October (Northeast Hawkwatch http://www.battaly.com/nehw/). Migrant eagles continue to diminish in late October and November (coinciding with the beginning of trapping season) as some resident birds move south and winter in southern New England or in the Mid-Atlantic States. It is difficult to predict the number of eagles that over-winter in Maine from year-to-year as numbers vary with the severity of ice cover and winter conditions. Severe winter conditions could limit food availability and, in turn, the birds' winter range. Fish are preferred eagle foods over most of their range in Maine and North America, but regularly eat carrion (scavenging) and will consume, for example, dead deer, livestock, and seal pups. Most wintering eagles subsist in part by scavenging, and can be attracted to uncovered bait in traps.

The bald eagle was removed from the federal threatened list on August 8, 2007 (72 FR 37345) and is now protected from take under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA). Bald eagles were removed from Maine's endangered species list in September 2009. Under BGEPA "take" means to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. The term "disturb" under the BGEPA was defined as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle; 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior (June 5, 2007; 72 FR 31332).

Golden eagle – The golden eagle (*Aquila chrysaetos*) is protected under the BGEPA and MBTA and is an endangered species under the Maine Endangered Species Act. Golden eagle populations have declined in the East throughout the last century, and were extirpated 20-40 years ago in other eastern states. Golden eagles have always been rare in Maine. Only 10 nesting territories have been documented in Maine historically, but at least 18 other localities are suspected (Todd 2000). The last known nesting pair lingered in Maine until 1999, then disappeared from an eyrie that had probably been occupied by successive generations of eagles for hundreds of years. In recent years, sporadic observations of golden eagles have been documented during the nesting season, raising hope that individuals from Canada may reoccupy former eyries. Populations in eastern Canada are poorly documented, but may number 100 or more pairs. There are

approximately, 10 territories in the Gaspe region of Quebec, immediately adjacent to Maine, and these birds migrate through and sometimes winter in Maine (T. Katzner, West Virginia State Univ., pers. comm.). Counts of migrating golden eagles at hawk watch sites in the East indicate that the Eastern population is slowly increasing. Peak migration occurs from mid-September through November (Northeast Hawkwatch http://www.battaly.com/nehw/), which overlaps with the beginning of the trapping season.

In Maine, golden eagles have typically associated with mountainous areas in the western and northwestern portions of the state. Golden eagles are most numerous in Maine during September through November and April when birds migrate through the state. Wintering areas are from Maine and the Maritime Provinces to the southeastern states, depending on the availability of food. In Maine, food remains at the nest have consisted entirely of wading birds (bitterns and herons). Normal diets elsewhere include ground squirrels, marmots, ptarmigan, and seabirds (at coastal eyries).

Marginal habitat conditions (lack of food, open space for hunting prey) limit golden eagles in the East. Historically, shooting, trapping, and poisoning reduced golden eagle numbers. Five dead golden eagles have been recovered in Maine since 1985: 2 died of natural causes, 1 was trapped, 1 was shot, and another was killed on a logging road (Todd 2000).

3.2.4 State-protected species

State-listed species are enumerated in Appendix 1 of the draft ITP. The Maine Natural Areas Program tracks 352 species of plants that are rare in Maine and maintains unofficial state endangered, threatened, and special concern lists. The Maine Department of Marine Resources maintains a state list of endangered and threatened marine mammals, turtles, and fish. The MDIFW draft ITP does not affect state-listed plants because they are dormant during the trapping season. The draft ITP does not affect marine mammals, turtles, or fish because trapping activities occur inland. The draft ITP does not affect most state-listed wildlife because listed migratory birds, amphibians, reptiles, and invertebrates have migrated or are dormant during the trapping season. The bog lemming (state-threatened) occurs usually at high elevations in northern Maine and is not likely to be affected by trapping. The bald eagle (formerly state-threatened now special concern) and golden eagle (state-endangered) are discussed in the previous section. The goshawk is a state-listed species of special concern. The New England cottontail (state endangered) is discussed as a federal candidate species.

3.2.5 Other Wildlife Species

Maine's wildlife is reviewed in the draft ITP (pp. 11-13). The Maine Comprehensive Wildlife Strategy (2005, www.maine.gov/ifw/wildlife/groups_programs/comprehensive_strategy) further addresses the full array of wildlife and their habitats in Maine including vertebrates and invertebrates in aquatic (freshwater, estuarine, and marine) and terrestrial habitats.

3.3 Land Use

3.3.1 Statewide land use

Statewide land use is briefly summarized in the draft ITP (p. 13).

The following is derived from the report *The Cost of Sprawl* (MSPO, www.maine.gov/spo/landuse/docs/sprawlandsmartgrowth/costofsprawl.pdf).

Since the 1970s, Maine has undergone increasing development pressures; much of this centered in southern and coastal sections. Real estate sales and development of rural land led to concern about urban sprawl in some areas of central and southern Maine in the early 2000s. Developed land is most prevalent in south-coastal regions where 12 to 26% of the landscape to be developed. Northwestern Maine, the primary range of the Canada lynx, is totally undeveloped with the exception of logging activities, recreational camps, and sporting camps.

Continued development pressures is converting forested and agricultural habitat to dispersed housing and more intensive development. Wildlife habitat is being lost as is outdoor recreation opportunities (including hunting and trapping). These problems will likely remain greatest in southern and coastal Maine.

3.3.2 Northern Maine land use

This EA focuses on the unique land use in northern Maine (WMDs 1-11, 14, 18 and 19) because it is the focus of alternatives considered in this draft EA, it is where lynx occur, and it has substantially different land use and ownership than other portions of the state. The commercial forestry is the predominant land use in WMDs 1-11, 14, 18 and 19 with some agriculture occurring in northeastern Maine (WMDs 3, 6, and 11).

Approximately 55% of Maine is owned by forest management companies, timber investment companies, and industrial forest landowners. These forestlands, located in the eastern, northern, and western portions of the state, are inhabited by few people, generally do not have town governments, and at 10 million acres comprises the largest tract of undeveloped forest in the eastern United States. Land use, including forestry practices, in these so-called “unorganized” townships is managed by a state agency, the Maine Land Use Regulation Commission.

Companies that own paper mills, sawmills and other wood processing facilities own 5 million acres of Maine forest, including large tracts in northern and eastern Maine. A handful of large, corporate landowners (>100,000 acres) own approximately 2.5 million acres of Maine’s forest. Owners of large tracts of non-industrial forest include individuals, families and public and private companies. Investment institutions, such as banks, insurance companies, mutual and pension funds and university endowment funds, own about 2.6 million acres

Between 1980 and 2005, approximately 23.8 million acres changed ownership in northern Maine, representing a shift from industrial ownership to a variety of financial investors, real estate development trusts, private individuals, and conservation organizations. In 1994, forest industry owned about 60% (4.6 million acres) of the large tracts (>5,000 acres) of timberland and investors owned about 3%. By May, 2005, financial investors owned about 33% of the large forest tracts and industry owned only 15.5% (1.8 million acres, mostly in a single ownership) (Hagan *et al.* 2005). Most forest blocks have remained intact; however, there is a trend toward subdivision and smaller parcel sizes. While forest industry had long ownership tenure, the new investor-owners typically plan to sell land in 10-15 years. Furthermore, they are looking for much higher rates of return (sometimes several times that based on the actual growth rate of the forest) than was sought by the previous generation of owners. One implication is that interest in long-term biodiversity practices has declined (Hagan *et al.* 2005).

The public owns roughly 6% (1 million acres) of Maine forestland. Of that, the state of Maine owns Baxter State Park (235,000 acres), 55 State Wildlife Management Areas, 29 Public Reserve Lands (482,000 acres), and 32 State Parks (from 500 to 43,000 acres in size). In total, the state owns more than 800,000 acres of public land. The federal government owns the other 200,000 acres of forest, including the part of the White Mountain National Forest located in western Maine, Acadia National Park, and 5 National Wildlife Refuges scattered across the state (Maine Tree Foundation (www.mainetreefoundation.org/forestfacts).

Ninety-six land trusts and conservation organizations in the state own nearly 1.4% of the forested area of the state (1 million acres). The Maine Chapter of The Nature Conservancy owns the largest parcel, approximately 180,000 acres along the St. John River in northwestern Maine.

Native American tribes own roughly 1% (approximately 184,000 acres) of the Maine forest. The Penobscot Tribe owns 124,000 acres of land, most of which is forested. The Passamaquoddy Tribe owns 144,000 acres overall, including 60,000 acres of forest.

In undeveloped areas of northern Maine, wildlife habitat is not affected by sprawl but is affected by forestry activity. Forestry activities can have positive and negative benefits for wildlife. Wildlife inhabiting northern Maine may be affected positively by some forms of forest management. Wide-scale clear cutting in the 1970s created much of the habitat used by Canada lynx today and greatly expanded lynx, moose, and bear populations. In some instances, forestry may negatively affect some species like the pine marten and deer wintering habitat, which require mature forest conditions. Some forest management can also result in habitat fragmentation, loss of large habitat blocks, and connectivity between habitat blocks. Wildfire is infrequent in Maine's northern forest (Lorimer 1977). Disturbances such as insect outbreaks (e.g., spruce budworm), disease, and wind-throw also influence forest ecology.

The quantity of forestland in Maine has remained virtually unchanged, as gains in some regions were offset by losses in others (Griffith and Alerich 1996). Development,

climate change, invasive species, and adverse forest practices are recognized as the greatest threat to forest in the region (Wildlands and Woodland report, http://www.wildlandsandwoodlands.org/home)

3.4 Cultural, historical, and paleontological resources

The area that now comprises the state of Maine was populated before European settlement by various Native American tribes belonging to the Wabanaki cultural group. The Penobscot, Passamaquoddy, Micmac, and Maliseet were the most prevalent Wabanaki tribes in what is now Maine. All 4 tribes are federally-recognized and hold lands in northern Maine purchased after the Maine Indian Lands Claims Settlement Act in the 1970s.

Maine was settled by several European ethnicities over the course of the 17th and 18th centuries. Maine became a state in 1820, but much of the Aroostook region did not join the United States until 1842.

Numerous archeological and historical sites have been documented throughout the state. Locations of archeological and historical sites are maintained by the Maine Historic Preservation Officers (SHPO) and are too extensive to provide in this draft EA (see www.state.me.us/mhpc).

3.5 Socio-economic conditions

Demographics

The 2000 United States census estimated Maine's human population at 1.32 million. The population is densest in the southern part of the state and becomes less populated in the north. The overall population density for Maine is 41 persons per square mile, ranging from a high of 318 persons per square mile in Cumberland County to a low of 4 persons per square mile in Piscataquis County.

Maine's population increased 3.8% from 1990-2000 (0.4% annually) compared to a 13.2% increase for the U.S. Maine's population growth has occurred in central and southern portions of the state. From 1990-2000 northern Maine counties experienced population decline including a 15% decline in Aroostook County. Over the next 2 and one-half decades from 2000 to 2025, Maine's population is expected to grow by 11.6% (0.5% annually) to 1.42 million (MSPO Figure 13), primarily through immigration (both interstate and international) rather than from natural increase ((http://www.state.me.us/spo/economics/census).

Maine people are moving out of urban centers in central and southern Maine to suburban and rural settings (*The Cost of Sprawl* Maine State Planning Office, www.maine.gov/spo/landuse/docs/sprawlandsmartgrowth/costofsprawl.pdf).

Maine has the highest median age of any state in the United States and can reasonably expect the pattern of aging to continue. In 2000, people 55 years and older accounted for 24% of the Maine population, which is projected to almost double between 2000 and

2030, while the number of Mainers of traditional working-age will essentially remain unchanged.

Economically, Maine has a higher proportion of people in the labor force; a higher proportion employed in education, health, and social services and retail trade; a lower proportion employed in professional, scientific, management administrative services; a lower percentage of private wage and salary workers and a higher percentage self-employed in their own businesses than other states. Maine's median household and family incomes and its per capita income are all below national levels.

Maine Economy

Information on the history of Maine's economy, Maine's current economic conditions, and economic forecasts are available at the Maine State Planning Office web site: http://www.maine.gov/spo/economics/docs/publications.

Economic contribution of hunting, fishing, trapping, and wildlife viewing

Except where noted, the following summary is from the 2005 Maine Comprehensive Wildlife Strategy (www.maine.gov/ifw/wildlife/groups_programs/comprehensive_strategy) and the 2006 Survey of Fishing, Hunting, and Wildlife-Associated Recreation (http://library.fws.gov/nat_survey2006.pdf).

Wildlife plays an important role in the lives of Maine people. Maine ranks sixth nationally when comparing the percentage of people who participate in hunting, fishing, trapping, and wildlife related outdoor recreation. Although trapping is not specifically addressed, the surveys portray trends in wildlife-associated recreational activities. Of the total number of participants, 351,000 fished, 175,000 hunted, and 801,000 participated in wildlife watching activities, which include observing, feeding, and photographing wildlife. Many individuals engaged in more than 1 wildlife-related activity.

In 1998, fish and wildlife related recreation in Maine contributed over 1 billion dollars in economic output: $342 million in payroll, 17,680 jobs, and $67 million in sales and income tax revenue (Teisl and Boyle 1998). The $1.1 billion in economic output from upland hunting, fishing and wildlife sightseeing combined with the economic contribution from salt-water recreational fishing, totals $1.4 billion, representing 4.9% of Maine's economy. Maine wildlife-related economy ranks fifth in the U.S. in terms of the percentage of the state's gross state product and generates over 4 times the economic output of the ski and snowboard industry (Ski Maine Association, http://www.skimaine.com/) in the State and more than 3 times the combined sales of Maine's potato and blueberry industries (Maine Department of Agriculture http://www.maine.gov/agriculture/). In 2006, state residents and nonresidents spent $1.5 billion on wildlife recreation in Maine. Of that total, trip related expenditures were $355 million and equipment purchases totaled $951 million. The remaining $192 million was spent on licenses, contributions, land ownership and leasing, and other items.

In 2006, the number of anglers continued to decline and the number of hunters was stable. Declining trends in Maine hunting and fishing participation and increasing trends in non-consumptive wildlife watching activities mirror national trends. Declining consumptive wildlife use is reflected in declining hunting and fishing license sales.

Trapping trends

Participation in trapping has diminished throughout the U.S. in recent years (Southwick 1993, Armstrong and Rossi 2000, AFWA 2005, 2007). Reasons for this decline include the loss of habitat, changing demographics and public interests, declines in pelt prices, loss of access, and increasing political pressure from the animal rights movement. The estimated number of trappers in the United States was 142,287 in 2003-2004, down from 158,752 in 1989-1990 (AFWA 2005) and 300,000 in 1987 (IAFWA Fur Resources Committee 1993). The AFWA (2005) report also documented that trappers were older and had higher average household incomes in 2004 than in 1992. Almost all trappers were male. Trappers in 2004 averaged fewer days trapping and used fewer traps than they did in 1992. Trapping related expenditures were lower in 2004 than in 1992.

Participation in trapping in Maine mirrors national trends. Maine trapping license sales were below 1,700 from 1955 to the mid-1970s, when increasing values of upland furbearer pelts apparently caused an increase in the number of trappers. Trapping licenses sold rose from 3,345 in 1976 to a peak of 5,612 in 1980. Since then, sale of trapping licenses has declined reflecting demographic and societal trends and outdoor recreation trends summarized above. Annually, an average of 2,616 individuals acquired Maine trapping licenses (1999-2005 trapping seasons). The MDIFW anticipates that participation in trapping will continue to decline in the future (MDIFW pine marten, fisher, coyote, fox, furbearer assessments; www.maine.gov/ifw/wildlife/species/plans/index.htm).

About 2,600 trappers buy licenses annually, which generates over $100,000 annually to support MDIFW. Total annual household income derived from trapping in 2004 averaged $1,587 for Northeast trappers, and average trapping-related expenditures of Northeast trappers was $924 (AFWA 2005). On average, Northeast trappers earn about $600. Armstrong and Rossi (2000) classified “avocational” trappers (trapping for recreation) into 2 groups; those who will trap regardless of fur prices and those whose participation is dictated by the fur market. Seventy-eight percent of Northeast trappers said that trapping was “not at all important” as a source of income (AFWA 2005). However, to many trappers selling furs is an important source of income and is an important part of the trapping experience.

A socio-cultural study of trapping in the northeastern states included Maine (Daigle *et al.* 1998). The authors found participants in trapping are predominantly white (98%), males (98%), with a mean average age of 45. Sixty-nine percent reported gross annual household incomes between $10,000-50,000 (early 1990s dollars). Forty percent of Maine trappers belonged to other sportsmen’s organizations. The study found that participation in trapping, similar to hunting and fishing, is motivated by many needs

including tradition, outdoor recreation, and economic gain. Trapping takes place in a round of seasonal activities that often includes hunting, fishing, gathering wild edible plants, cutting firewood, and planting a vegetable garden.

Trapping, especially the use of foothold traps, has come under increased scrutiny by the public (Novak 1987, Andelt *et al.* 1999). The foothold trap was banned in Great Britain in 1958 and is now banned in at least 80 countries (Nocturnal Wildlife Research 2008). Ballot or legislative initiatives to ban or limit trapping have passed in 8 states (Fox and Papouchis 2004). A survey of wildlife professionals documented 46% believed the foothold trap should be outlawed (Muth *et al.* 2006). Public opposition to foothold traps has been consistently high – 78% opposed foothold traps in a 1978 survey (Kellert 1979) and 74% opposed in 1996 (Fox and Papoulchis 2004). Although trapping will likely remain vulnerable to legislative attacks (Minnis 1998), wildlife professionals are optimistic that animals-rights and anti-trapping issues can be resolved (Novak 1987, Todd and Boggess 1987).

Trapping has become an increasingly regulated activity with regulations relating to training of trappers, trap size, trap placement, tending times, use of bait, bag limits and a number of different topics incorporated into state furbearer programs (IAFWA 1995). Batchelder *et al.* (2000) believed that that trappers need to adapt to meet societal needs if trapping is to continue. Novak (1987) also proposed that the future of trapping is dependent on substantial and swift change by trappers and wildlife management agencies to adapt to changing sociocultural conditions.

4. ENVIRONMENTAL CONSEQUENCES

Environmental consequences provide a reasoned analysis of the known and predicted effects of the alternatives considered on ecological, aesthetic, historical, cultural, economic, or social resources. This section is organized to analyze the direct and indirect effects of Alternatives A - E for each of the following resources: geology and soils; hydrology and water quality; vegetation and native plants; air quality; wetlands and jurisdictional waters; land use; aesthetic and scenic resources; cultural, historic and paleontological resources, climate; non-federally listed wildlife (both trapped and non-target wildlife); and federally-listed proposed, and candidate species. For each resource, the effects of trapping and mitigation are analyzed separately. Cumulative effects are analyzed in Section 4.14.

The environmental consequences focus on upland trapping because the alternatives considered focus on conservation measures that minimize or mitigate trapping of lynx. In the draft ITP, MDIFW requests statewide incidental take coverage for all forms of trapping. Thus, this draft EA addresses aquatic wildlife and their habitats when appropriate, even though aquatic trapping poses minimal risk to lynx.

4.1 Effects on geology and soils

Trapping

Trappers routinely alter soils around traps to create conditions conducive to capturing an animal or as part of BMP practices to reduce likelihood of injury to animals. For example, trappers make dirt hole sets to bury bait under a foothold trap hidden in loose dirt. Dirt hole sets become difficult to make once the soil freezes in November. An average trapper may set 100 foothold traps, each affecting less than 0.50 square foot area to a depth of 6 inches. If each trapper moves his/her traps twice to a new location they would disturb 100 square feet of soil. Assuming 2,700 trappers in Maine, made such soil disturbance, about 6 acres of soil would be disturbed in a state 20.4 million acres in size. Thus, effects of trapping activities on soils are minor, limited to the immediate location, and are of very short duration.

Alternatives E would have the least effect on geology and soils because upland trapping would be closed in WMDs 1-11, 14, 18 and 19 in northern Maine. Alternatives A, B, C, and D are similar in that trapping activity would produce about 6 acres of soil disturbance statewide as described above. Soil disturbance under Alternative D would not diminish if the trapping season were reduced to October and November, because trappers do not disturb soil in December when the ground is frozen and covered by snow.

Mitigation

Alternatives B, C, and D mitigate incidental take of lynx by managing 5,000, 10,000, and at least 7,000 acres of new lynx habitat, respectively. There is no habitat mitigation associated with Alternatives A and E. Habitat mitigation would require clearcutting (or heavy partial harvesting) these acreages of relatively mature forest to create early successional habitat.

Forestry activities affect geology and soils by creating permanent logging roads and temporary skid trails. Although northern Maine is heavily-roaded with forestry roads, it is likely that new permanent and temporary roads will be built to harvest mitigation areas. The number and distribution of road required to be constructed is unknown because mitigation areas have not been identified.

For purposes of this analysis, we assume heavily-roaded townships (indicative of heavily-clearcut areas) have 100 km (60 mi.) of permanent logging roads/100 km^2 (24,710 acre) area, and lightly-roaded townships have 60 km (36 mi.) of permanent logging roads. Each mile of road eliminates about 10 acres of habitat (Noss 1995). We also assume to harvest 5,000 acres, ½ of a township would be converted from light to heavy harvest creating 12 miles (120 acres) of new roads. To harvest 10,000 acres, 1 township would be converted from light to heavy harvest creating 24 miles of new roads (240 acres). To harvest 7,000 acres, 1 township would be converted from light to heavy harvest creating 17 miles of new roads (170 acres). Thus, Alternative B would have 50% less impact than Alternative C and 30% less impact than Alternative D. These effects are moderate at the township scale (0.4%-0.5% of the area of a typical 36 $mi.^2$ township), but are negligible at a state-wide scale.

Skid trails are created to remove wood from forest harvests. Puettmann *et al.* (2008) documented 13.7% of clearcut areas were skid trails in northern Minnesota and that soil disturbance persisted in stands up to 11 years post-harvest. Using these estimates, Alternatives B, C, and D, would create 685 acres, 1,370, and 959 acres of soil disturbance, respectively. This is a moderate impact at the township scale (Alt. B=2.7%, Alt. C=5.5%, and Alt. D=3.9% of a typical 36 $mi.^2$ township), but a negligible impact at the state scale. Forest harvests done in deep snow and frozen ground conditions would further reduce impacts from skid trails.

To achieve mitigation under Alternatives B and C, permanent road building and skid trails may be built on state lands, which are managed under sustainable forestry standards (Sustainable Forestry Initiative (SFI) http://www.sfiprogram.org/ or Forest Stewardship Council (FSC) http://www.fscus.org/) and BMPs for water quality written by the Department of Conservation (Maine Forest Service 2004). Forestry certification and water quality BMPs should reduce effects of forest management on soil erosion, sedimentation of streams and wetlands, and stream crossings. The forest certification standards reduce soil erosion, stream sedimentation, and other adverse effects because they require soil conservation measures to be employed. The Department of Conservation BMPs include conservation measures for stream and wetland crossings, road construction, planning log landings and skid trails.

Mitigation areas for Alternative D, and maybe for Alternatives B and C, would occur on private forest lands. Many northern Maine forest landowners, but not all, are certified under SFI or FSC. If MDIFW selected a certified landowner, then the requirements of certification would help minimize effects to soils and geology.

Alternative A and E do not employ habitat mitigation, and from a mitigation perspective would have no effect on geology and soils.

4.2 Effects on hydrology and water quality

Trapping

Trapping does not pollute or impound waters. Alternatives A, B, C, and D employ conservation measures that would affect upland trapping and would not affect aquatic trapping. Alternative E would close upland trapping in WMDs 1-11, 14, 18 and 19, but not aquatic trapping. Thus, aquatic trapping would be similar under all alternatives. Trapping activities associated with Alternatives A, B, C, D, and E are similar in that they each would produce either no effects or negligible effects on hydrology and water quality.

Mitigation

The effects of mitigation activities on hydrology and water quality would vary by Alternative. Alternative A and E do not employ habitat mitigation and would have no effect on hydrology and water quality. Alternatives B, C, and D mitigate incidental take

of lynx by creating 5,000, 10,000, and at least 7,000 acres of new lynx habitat, respectively. This would require clearcutting, shelterwood harvesting, or heavy partial harvesting these amounts of mature forest to create early successional habitat and creating roads and skid trails (see previous section).

Forestry operations and associated roads have been identified as nonpoint sources of pollution. On a national level, silviculture contributes approximately 3 to 9 percent of nonpoint source pollution to the Nation's waters (USEPA 1992). Local impacts of timber harvesting and road construction on water quality can be severe, especially in smaller headwater streams (Brown, 1985). Megahan (1986) reviewed several studies on forest land erosion and concluded that surface erosion rates on roads often equaled or exceeded erosion reported for severely eroding agricultural lands. These effects are of greatest concern where silvicultural activity occurs in high-quality watershed areas that provide municipal water supplies or support cold-water fisheries (Whitman, 1989; Neary *et al.*, 1989; USEPA, 1984; Coats and Miller, 1981). Silvicultural nonpoint sources of pollution impacts depend on site characteristics, climate conditions, and the forest practices employed. Sediment concentrations can increase because of accelerated erosion; water temperatures can increase due to removal of overstory riparian shade; slash and other organic debris can accumulate in water bodies, depleting dissolved oxygen; and organic and inorganic chemical concentrations can increase due to harvesting and fertilizer and pesticide applications (Brown, 1985). These potential increases in water quality contaminants are usually proportional to the severity of site disturbance (Riekerk, 1983, 1985; Riekerk *et al.*, 1989).

Mitigation for Alternatives B and C may occur on state lands, which are under sustainable forestry standards (Sustainable Forestry Initiative (SFI) http://www.sfiprogram.org/ or Forest Stewardship Council (FSC) http://www.fscus.org/) and BMPs for water quality written by the Department of Conservation (Maine Forest Service 2004). Forestry certification and water quality BMPs should reduce effects of forest management, described above, on water quality and hydrology, because BMPs reduce soil erosion, stream sedimentation, and other adverse effects because they require soil conservation measures to be employed. Maine's BMPs include conservation measures for soil, stream and wetland crossings, road construction, planning log landings and skid trails. Many states have conducted studies to assess whether BMPs are effective in protecting water quality. A growing body of literature strongly suggests that properly implemented BMPs protect water quality (Shepard 2006).

Despite forest certification and BMPs there will be unavoidable, but minor, impact to water quality. Comparisons between alternatives are difficult to make because mitigation sites are unknown. Some sites may have many perennial and permanent streams, whereas another site may have almost none. Assuming all being equal, mitigation associated for Alternative C (10,000 acres of cutting) may have twice the impact on water quality as Alternatives B (5,000 acres of cutting). However, given the certification standards and BMPs discussed above, the overall effects of these mitigation sites on state waters is expected to be minimal.

Mitigation areas on private lands under Alternative D, and maybe for Alternatives B and C, would may be certified under SFI or FSC. However, forest certification does not require that private forest landowners employ Maine Department of Conservations BMPs for water quality. Impact to water quality under Alternative D would likely be greater than the other alternatives. However, the extent or degree of impacts from Alternative D are impossible to predict without further details on the location, type of silviculture, ability of the logging contractor to minimize effects, and land management practiced by the private forest landowner.

4.3 Effects on vegetation and native plants

Trapping

Effects of trapping are most likely to woody vegetation (trees and shrubs). In general, most herbaceous plants and aquatic vegetation are dormant or under snow during trapping season. Trappers routinely alter vegetation around traps to create conditions conducive to capturing an animal or as part of BMP practices to reduce likelihood of injury to animals. For example, limbs and small saplings may be cleared to create a leaning pole set to comply with Maine's new regulations. Vegetation is typically cleared around traps anchored with stakes to avoid chains and swivels from tangling in brush. Vegetation may be manipulated to funnel animals through certain areas, and vegetation may be manipulated to create a cubby set. Saplings may be cut to make aquatic sets for beavers and otters. Nails are used to secure traps, chains, and cables to trees. On rare occasions downed trees over logging roads may be cut to gain access to trapping sites. Trappers may collect vegetation and bark to boil with their traps to treat them and eliminate human scent. Vegetation may be slightly disturbed when releasing animals from a trap. See also section 4.10.1 for discussion of possible indirect effects on vegetation from beaver and muskrat trapping.

It is difficult to quantify trapping effects on plants, but the relative effects of the alternatives can be compared. All 5 alternatives would have similar effects on aquatic vegetation because trapping effort for aquatic furbearers is similar. Trapping activities associated with Alternatives E would have the least effect on upland vegetation because upland trapping would be closed in WMDs 1-11, 14, 18 and 19 in northern Maine. Trapping activities associated with Alternatives A, B, C, and D are similar in that they all would produce minimal, temporary effects on vegetation and native plants. This is because many species of hardwood vegetation resprout after cutting. Softwood trees (e.g., cedar, spruce, hemlock, fir) would be killed if the main stem is cut. Assuming 2,700 trappers in Maine set 100 traps each in uplands and one softwood sapling were cut for every 5 traps set, about 54,000 softwood trees would be cut. Lynx and snowshoe hares require about 7,000 - 11,000 stems per acre. Thus, the equivalent of 4.9 - 7.7 acres of softwood would be cut in a state 20.4 million acres in size. Most of these small softwood saplings would die as part of the self-thinning, maturation process of a forest stand. Thus, effects of trapping activities on woody vegetation are minor, limited to the immediate location, and are of very short duration.

Mitigation

The effects of mitigation activities on vegetation and native plants would vary by alternative. Alternatives A and E do not employ habitat mitigation and would have no effect on vegetation and native plants. Alternatives B, C, and D mitigate incidental take of lynx by managing 5,000, 10,000, and at least 7,000 acres of new lynx habitat, respectively. This would require clearcutting, shelterwood harvesting, or heavy partial harvesting these amounts of mature forest to create early successional habitat and creating roads and skid trails (see previous sections), and would result in substantial vegetative changes to the areas cut. In response to logging, the resulting plant communities would change substantially in species composition, age, and structure. Silviculture, and possibly herbicide treatments, may be used to favor regenerating spruce-fir. Effects on vegetation would be temporary as forested conditions quickly return after clearcutting.

The areas harvested for mitigation under Alternative B, C, and D would comprise 20%, 40%, and 28-40% of a typical mi.^{2} township respectively, thus having a substantial effect on vegetation at the township scale. However, the acreage harvested represents only about 0.01-0.02% of the 500,000 acres of forest harvested in Maine in a year. The annual area clearcut in Maine is about 10,000 acres (Maine Forest Service, http://www.maine.gov/doc/mfs/pubs/annpubs), thus mitigation (if clearcuting was employed and completed in 1 year) would increase the annual acreage clearcut by 50-100%.

Under Alternatives B and C, mitigation activities would not occur within rare or exemplary natural communities on state land (as prescribed in state land management policy), and logging in rare or exemplary natural communities is unlikely to occur on private lands (Alternative D) managed under certified forestry standards.

4.4 Effects on air quality

Trapping

Trapping affects air quality because trappers drive gas-powered vehicles to check their traplines. There is no information available on the number of miles driven by approximately 2,700 Maine trappers, but the number of miles driven and emissions produced would be miniscule compared to daily commuter traffic in Maine. In 2007 Maine's annual greenhouse gas emissions from transportation was 8.96 million metric tons (24,547 tons/day) (EPA 2009, http://www.epa.gov/climatechange/emissions/state_energyco2inv.html). Under current conditions, if each Maine trapper drove 100 miles daily for 60 days (at 20 miles/gallon), total emissions would be approximately 7,200 metric tons, or .08% of the greenhouse gasses produced in Maine annually (ATV and snowmobile emissions are included in this estimate). Alternative E would produce the least emissions because upland trapping would be discontinued in northern Maine, which would reduce statewide trapper mileage by at least 1/3. Alternative D would likely create the greatest emissions because it would

require 24-hour tending of conibear traps in unorganized townships, requiring long daily commutes (often >100 miles) from communities surrounding the unorganized townships. However, additional driving for more frequent trap-tending may be offset by reduced trapper activity. Alternatives B and C would likely produce similar amounts of air emissions.

Mitigation

Alternative A and E do not employ habitat mitigation and would have no effect on air emissions. Logging activities associated with mitigation (cutting and hauling wood to mills) would create emissions. The location of mitigation areas have not been identified so the distance that logging trucks would drive and the effects on air quality cannot be quantified. As indicated above, the acreage harvested would represent 0.01-0.02% of the total 500,000 acres of forest harvested in Maine annually. Emissions from vehicle use associated with the mitigation harvests would be expected to contribute a tiny fraction of the emissions created statewide from forest harvesting, and a much smaller fraction of total statewide vehicle emissions. Forest harvesting mitigation in Alternatives B, C, and D are likely to have effects on air quality.

4.5 Effects on wetlands and jurisdictional waters of the U.S.

Trapping

Intensive trapping, in some instances, may affect local beaver populations. If all beavers are trapped (a rare event) from an area, trapping could cause the temporary loss of beaver-created wetlands. Some measures in Alternatives A - E may cause some trappers to discontinue trapping altogether and thus affect participation in beaver trapping. However, the number of trappers who may discontinue trapping is unknown and some trappers are likely to discontinue trapping for other reasons. Because conservation measures in Alternatives A - E address upland trapping, these alternatives are similar in that trapping activity would produce negligible effects on wetlands.

Mitigation

Alternative A and E do not employ habitat mitigation and would have no effect on wetlands and jurisdictional waters. Logging activity associated with mitigation in Alternatives B, C, and D would not occur in wetlands or jurisdictional waters of the U. S. Maine Land Use Regulation Commission regulations (http://www.maine.gov/doc/lurc/), MBPL Integrated Resource Policy (http://www.maine.gov/doc/parks/programs/planning/irp.pdf) and SFI and FSC sustainable forestry standards require forested buffers between harvested areas and these resources. Because of these regulations, mitigation in Alternatives B, C, and D are similar in that mitigation activity would produce negligible effects on wetlands.

4.6 Effects on land use

Trapping

Trappers usually trap in rural settings (forest, fields, wetlands, rivers). Trappers may build or rent camps from which to operate, which have a minimal effect on land use. Trappers may operate gas-powered vehicles to reach trapping locations, but they typically use existing roads. Alternatives A, B, C, and D are similar in that trapping activity would produce negligible effects on land use. Alternative E would have an even smaller effect on land use because upland trapping would be discontinued in a large area of northern Maine.

Mitigation

Alternative A and E do not employ habitat mitigation and would have no effect on land use. Logging activity associated with mitigation measures in Alternatives B, C, and D would affect 5,000, 10,000, and at least 7,000 acres, respectively. Mitigation on Maine public lands (possibly in Alternatives B, C) would be done according to an integrated land use policy (Maine Department of Conservation, http://www.maine.gov/doc/parks/programs/planning/index.html) and would not change state conservation land use, which is primarily for silviculture and outdoor recreation. Land use on private, industrial forest land (possibly Alternative B, C, and D) is regulated by the Maine Land Use Regulation Commission. Logging is a widespread, existing activity on both state and private lands in northern Maine. The relatively small acreages affected by these Alternatives would not change forestry-related land use in the unorganized townships in northern Maine. Alternatives B, C, and D are similar in that mitigation activity would produce negligible effects on land use.

4.7 Effects on aesthetic or scenic resources

Trapping

Encounters with trappers, traps, or trapped animals may affect an aesthetic experience for some people. Trapping activities are discrete and do not affect landscapes or vistas. None of the alternatives would have a measurable effect on aesthetic and scenic resources in Maine. Alternatives A, B, C, and D are similar in that trapping activity would produce negligible effects on aesthetic or scenic resources. Alternative E would have an even smaller effect on aesthetic or scenic resources because trapping would be discontinued throughout a large area of northern Maine.

Mitigation

Alternative A and E do not employ habitat mitigation and would have no effect on aesthetic or scenic resources. It is difficult to quantify aesthetic and scenic values associated with the alternatives because the location of mitigation activities are unknown. Logging activity associated with mitigation measures in Alternatives B, C, and D would

occur in an 8 million acre landscape dominated by commercial forest management activity. Clearcutting or heavy partial harvesting would likely be used to create lynx habitat. Clearcutting is regulated by the Maine Forest Service and Forest Practices Act (http://www.maine.gov/doc/mfs/pubs/htm/fpa_04.html), which limits the size of clearcuts to 250 acres (but most clearcuts are usually <60 acres). Clearcutting is still used in northern Maine, but the public may object to its use on public lands. Other silvicultural alternatives, such as some forms of heavy partial harvesting or shelterwood harvesting, can be used to create lynx and hare habitat. Even though Alternative D would create up to 10,000 acres of habitat, it would likely have less effect on aesthetic and scenic resources because it would occur on industrial forestland. Mitigation on Alternative B (5,000 acres) would have less effect than Alternative C (10,000 acres) on public lands, but both may create substantial negative public reaction because the mitigation area would comprise 5% to 10% of Maine public lands in northern Maine.

4.8 Effects on cultural, historic and paleontological resources

Section 106 of the National Historic Preservation Act (NHPA) sets forth federal policy and procedures regarding "historic properties" -- that is, districts, sites, buildings, structures and objects included in or eligible for the National Register of Historic Places. Section 106 of NHPA requires that Federal agencies consider the effects of their actions on such properties and resources, following regulations issued by the Advisory Council on Historic Preservation (36 CFR 800). Other legislation governing these resources include The American Indian Religious Freedom Act (AIRFA), which requires the U.S. Government to respect and protect the rights of Indian tribes to the free exercise of their traditional religions, and the Archeological Resources Protection Act (ARPA), which prohibits the excavation of archeological resources (anything of archeological interest) on Federal or Indian lands, without a permit from the land manager. In Maine the State Historic Preservation Officer (SHPO) for the NHPA is the Maine Historic Preservation Commission). We intend to use the NEPA process to help fulfill our obligations under NHPA and consultation with Maine tribes (see section 5 of this EA for additional details).

Trapping

Trappers may rarely encounter cultural, historic, and paleontological sites while conducting their activities throughout the state. We have no information to know exactly where trapping occurs, but it likely takes place in all organized and unorganized towns in Maine. To an unknown extent, trappers may collect artifacts or fossils while they are trapping, however, the state is heavily forested and most archeological, historic, and paleontological resources are not readily detectable. It is unlikely that trappers would affect historic buildings or structures because Maine statutes require that traps be placed within 200 yards of occupied dwellings without written permission from the owner or within ½ mile of a compact or built up portion of a town (draft ITP p. 199).

Alternatives A, B, C, and D are similar in that trapping activity would produce negligible effects on cultural, historic and paleontological resources because they are rarely

encountered and excavations made by trappers are shallow (<6 inches) and unlikely to disturb these resources. Alternative E would have an even smaller effect on these resources because upland trapping would be discontinued in northern Maine.

Mitigation

Logging activities associated with mitigation measures in Alternatives B, C, and D could occur in areas having cultural, historic, or paleontological resources. On public lands (Alternatives B and C) Maine Bureau of Public Lands policy (http://www.maine.gov/doc/parks/programs/planning/index.html) requires that forestry projects be reviewed according to the following procedures:

> *If improvement projects appear likely to have an impact on cultural and historical resources, managers will contact the historic site specialist who, as appropriate, will coordinate further assessment, evaluation, or mitigation with the Maine Historic Preservation Commission, Maine State Museum, potentially affected native American and other communities, interest groups, or entities specified by law or regulation.*
>
> *The Bureau will provide for professionally conducted, interdisciplinary historical and cultural resource inventories during the preparation of management plans, and persons with historical/cultural resource expertise will be included on management plan advisory committees.*
>
> *The Bureau will provide for professionally conducted, interdisciplinary surveys of historical and cultural resources on undeveloped Bureau lands to identify, protect, and monitor resources that will not be addressed by management plans in the near future. Priorities for this work will be based on the expected presence and value of historical and cultural resources and the threat of loss or damage to the resources. As much as possible, the Bureau will use the content and results of inventories and surveys as opportunities for public education.*

Areas of cultural and paleontological resources have been identified on state forest lands. Additional survey work may be needed before forest management begins on Maine public lands. Before forest management begins, the Maine Bureau of Public Lands would announce management plans and activities and request public review and comment.

In a similar way, private forest landowners maintain information on the location of cultural, historic, and paleontological resources. The Maine Historic Preservation Commission provides this information to landowners. Although not bound by the same rigorous policies as the state, private landowners are sensitive to the needs of these resources and there is a high likelihood that they would be protected if lynx habitat mitigation should occur on or near these sites. Most archaeological sites in northern Maine are associated with waterways. Since mitigation in Alternative C would be

occurring far from water or wetlands (see Sect. 4.5 above), it is unlikely there would be significant impacts of forestry operations on these historical and cultural resources.

Without specific information, we cannot fully evaluate the effects of mitigation in Alternatives B, C, and D on cultural, historic, and paleontological resources. MDIFW must provide the details of the location of mitigation lands, associated roads, etc. in their final ITP. The Service will need this information to evaluate and analyze whether mitigation causes adverse effects to historic properties. We will review in greater detail in the final EA when MDIFW identifies a mitigation site.

4.9 Effects on climate

Greenhouse gas emission from trapping

The Council for Environmental Quality (CEQ Memorandum for Heads of Federal Departments and Agencies, February 18, 2010) provides NEPA guidance to address contributions of projects on greenhouse gas emissions and how climate change will affect projects. As estimated in the air quality section of this draft EA (Section 4.4), greenhouse gas generated by 2,700 trappers in Maine may be 7,200 metric tons annually, which is less than the 25,000 metric ton CEQ annual guideline that may trigger a more detailed quantitative analyses. Global climate change is the result of numerous and varied sources, each of which may make a relatively small addition to global greenhouse gas concentrations. Alternatives A, B and C would contribute to climate change similarly because travel associated trapping activities would be similar. Alternative D would likely produce more greenhouse gasses than B and C because it would require 24-hour tending of conibear traps in unorganized townships. However, additional driving to tend traps more frequently may be offset by reduced trapper participation. Alternatives E would produce the least effect on climate change because upland trapping would be discontinued in northern Maine and associated travel associated with trapping would be less.

Climate change is unlikely to have a significant effect on trapping and furbearing wildlife populations during the 15 year life of the incidental take permit. Anticipated changes to Maine's climate will likely affect the distribution and abundance of wildlife and their habitats (Jacobson *et al.* 2009, Whitman *et al.* 2010). For example, climate change is expected to reduce spruce-fir habitat, which could reduce the range of lynx, marten, and other boreal furbearer species; reduce snowfall, which could favor temperate furbearer species like bobcat, fisher, gray fox, and opossum; and result in warmer, dryer summers, which could affect beaver, muskrat, and other aquatic furbearers. However, shifts in furbearer populations and their habitat are likely to occur incrementally over many decades or within the next 100 years (Jacobsen *et al.* 2009, Whitman *et al.* 2010).

Greenhouse gas emissions from mitigation

Alternative A and E have no effect on greenhouse gas emissions because there is no mitigation. Alternatives B, C, and D mitigate trapped lynx mortality by creating 5,000,

10,000, and at lease 7,000 acres of new lynx habitat, respectively. This would require cutting mature forest to create early successional habitat that would support lynx. While rapid carbon sequestration can occur in rapidly growing young forests, the greatest whole-ecosystem carbon accumulations are typically in old growth forests (Jacobsen *et al.* 2009). The amount of forestry harvest in Alternatives B, C, and D would represent 0.01-0.02% of the annual 500,000-acre forest harvest in Maine (Maine Forest Service statistics http://www.maine.gov/doc/mfs/pubs.htm), and thus would have little effect on carbon sequestration on Maine's forest. Whether the cumulative effects of these forest harvests on carbon sequestration are positive or negative is unknown because the balance of carbon released and sequestered is unknown.

Greenhouse gasses produced by logging trucks and equipment needed to harvest 5,000 to 10,000 acres is unknown because the location of the harvest in relation to markets, logging camps, type of harvest and transport equipment, etc. is unknown. Forest harvests in Alternatives B would likely have the less effect on greenhouse gasses than Alternatives C and D because transportation associated with 5,000 acres is likely to be less than 7,000 to 10,000 acres. Alternatives C and D would have a similar effect on greenhouse gas production because of the similar acreages involved. Total greenhouse gasses produced by harvest are likely far less than 25,000 metric tons that would trigger a more detailed evaluation according to CEQ guidance.

Short term (during the 15 year life of the incidental take permit), climate change is unlikely to have a significant effect on the outcome of mitigation harvests to create lynx habitat. In recent years, climate change and harvest may be interacting to change the way the forest grows and these factors are believed to have resulted in an overall shift toward hardwood forest in northern Maine (Jacobsen *et al.* 2009). Thus climate change is likely already affecting Maine's forest and could affect regeneration outcomes for mitigation areas and affect habitat quality for snowshoe hares and Canada lynx.

Long term, the anticipated changes to Maine's climate will likely affect the distribution and abundance of tree species. Models of forest response to climate change in the Northeast forests predict that increasing temperature, changing water balance, rising CO_2 concentrations, and atmospheric deposition of nitrogen will interact to increase growth in some tree species and slow growth in others (Jacobsen *et al.* 2009). How these factors will interact with forest management is unknown. Red spruce and balsam fir are expected to become less abundant in the interior forests. Red maple may become more abundant. These changes will likely affect future lynx populations and distribution (Gonzales *et al.* 2007). Careful silvicultural prescriptions (time of year of clearcut, herbicides) could assure a more positive outcome for mitigation.

4.10 Effects on non-ESA wildlife (trapped species and non-target species)

4.10.1 Trapped wildlife

Trapping has been conducted in Maine since the area was first occupied by humans. For many furbearer species, trapping, as implemented by MDIFW, is intended to manage

populations at a local and sometimes on a statewide scale and is conducted according to principles of wildlife management. Trapping can be a population management measure (Novak *et al.* 1987, Northeast Furbearer Resources Technical Committee 2001, The Wildlife Society http://joomla.wildlife.org/documents/positionstatements/09-Trapping.pdf) and be used to regulate populations at large or small scales (Fleming *et al.* 1998). For most species, trapping is compensatory to a threshold and additive thereafter, which means below a certain level, trapping mortality has little effect on populations (Burnham and Anderson 1984). Trapping is also a primary tool of most animal damage control programs, an important technique in wildlife research, and may be used to suppress some wildlife diseases (The Wildlife Society, see web site above). Even when trapping is not intensive enough to suppress wildlife populations, these activities can still reduce wildlife damage by removing individuals from the population, some of which may have caused damage had they been allowed to live longer (Conover 2001). Generally, trapping is the most cost-effective means of removing furbearer species that cause damage (Conover 2001).

As a population management tool, Maine's trapping program has and will continue to have effects on furbearer species' populations (direct effects) and linked ecosystem-level effects (indirect effects). For example, most of Maine's mammalian carnivores are legally harvested furbearers (the lynx, cougar and wolf being exceptions because of their endangered or threatened status). Influencing populations of carnivores has ecosystem-level effects on populations of their prey, which in turn may have effects on vegetation, soils, and the environment. For example, reducing red fox populations may increase survival rates of ruffed grouse, which may increase the abundance of goshawks, which may reduce populations of scarlet tanagers, which may increase forest canopy insect populations, and so forth. Maine currently lacks breeding populations of large carnivores (wolves, cougars), which historically kept mesocarnivore (raccoon, fox) populations in check. "Mesocarnivore release" has been recognized as a consequence of extirpating top-level carnivores and has substantial effects to ecosystem process (Prugh *et al.* 2009). In the absence of top-level carnivores, trapping may bring some "balance" to ecosystems. Trapping may control populations of herbivores (beaver, muskrat) that can have substantial effects on local vegetation when populations increase beyond carrying capacity (Naiman *et al.* 1986, McCall *et al.* 1996, and see Section 4.5 for discussion of possible indirect effects on vegetation from variable rates of herbivore trapping).

Trapping may not be necessary to regulate wildlife populations as there are other natural checks and balances (e.g., disease, predation, competition, food limitations, and stochastic events) that limit populations. Where trapping has been curtailed or regulated (e.g., states with banned foothold and conibear traps) there have been noticeable ecological and social implications (Batcheller *et al.* 2000). For example, in states where trapping has been banned there is increased beaver and muskrat damage to habitat, which affects other species of fish and wildlife, may increase the incidence of wildlife disease, reduce ground-nesting bird populations, increase predation on some species of wildlife, and other effects (Northeast Furbearer Technical Committee 2001). Humans are part of the ecosystem, and are affected by many of these changes. Animal damage control

complaints increase when trapping is banned or discontinued in an area (Loker *et al.* 1999, DeStefano and DeGraaf 2003).

The total number of animals trapped in Maine is unknown because MDIFW does not require that all species of trapped animals be reported. Approximately 22,400 fox, coyote, bobcat, mink, marten, fisher, beaver and otter are tagged and registered annually in Maine (draft ITP, Table 3.1). During recent trapping seasons the most commonly tagged furbearer was beaver (9,646), followed by marten (3,667), fisher (2,509), coyote (2,244), and red fox (1,499) (draft ITP Table 3.1). Bobcat, coyote, and fox are also hunted, and the number of coyotes and fox taken by hunting cannot be separated from the above totals. Of the species not requiring tags and registration, muskrat are the most abundant furbearer harvested in Maine. There are no recent estimates of numbers taken, but approximately 45,000-70,000 were taken annually in the early 1980s (Hunt 1986, MDIFW Muskrat Assessment). It is estimated that about fewer than 5,000 raccoons and fewer than 10,000 muskrats are taken annually in recent years (J. DePueMDIFW, pers. comm. 7.27.2011). An unknown number of weasels, skunks, and opossums are taken in Maine. Thus, approximately 40,000 furbearing animals may be taken annually in Maine's trapping season.

MDIFW established public working groups to develop population goals and objectives for each furbearer species through the Department's wildlife planning process. An assessment and management system is available for most furbearer species to document how harvest level decisions are made. Furbearer species assessments and management systems can be found at MDIFW's web site: http://www.maine.gov/ifw/wildlife/species/plans/mammals/index.htm. Harvest levels are maintained within sustainable population goals. Number of furbearers harvested is regulated through seasons, limits on some species, trap type restrictions, and other regulations. The harvest of fox, coyote, bobcat, mink, marten, fisher, beaver and otter is monitored through a mandatory fur tagging system. Although substantial numbers of furbearing species are trapped in Maine annually, harvest levels are believed to be within scientifically-defensible sustained yields. No legally targeted furbearing species in Maine is on the state or federal special concern, threatened, or endangered lists.

Landscape changes can affect furbearer populations and affect trapper distribution, numbers, and harvest patterns (Webb *et al.* 2008). For example, marten in Maine avoid recently clearcut areas (Payer 1999) and are most abundant in undisturbed forests with large core habitats of mature forest (Hargis and Bissonette 1997). Landscape features and habitat conditions (particularly mature conifer forest), in turn, greatly influence the distribution and abundance of marten trapping effort (Webb *et al.* 2008). Logging roads create access for trappers allowing them to distribute traps over a larger area, thus increasing marten harvest (Marshall 1951).

4.10.1.1 Alternative A

Trapping

Under Alternative A, trapping activity would continue much as it has in recent years. Furbearer harvest would be similar to recent harvests (~40,000 animals statewide). MDIFW would continue to have the ability to manage furbearer populations throughout the state.

Trapping effort and participation would remain the same as current conditions under Alternative A. The outreach and education, lynx handling procedures and protocols, regulations implemented in 2007-2008, lynx research, and mitigation proposed do not seem to have affected or otherwise inconvenience trappers. Many of the actions in Alternative A have been phased in over the last 10-15 years. During this time there have not been major changes in trapper numbers or effort. As a result, the number of harvested furbearer species has remained relatively constant since 2000 (MDIFW Wildlife Division Report 2008). An exception was the substantially reduced harvest of many species in 2007-08, attributed to high gas prices, early heavy snows, and closing the trapping season for fisher in December (MDIFW Wildlife Division Report 2008, http://www.maine.gov/ifw/wildlife/surveys_reports/research_management/). Fur prices for marten and fisher ($32 and $63, respectively in 2008) has increased substantially from previous years. Marten trapping, in particular, draws trappers to northern Maine. Because of higher fur prices, demand and participation in trapping effort for these species is unlikely to diminish in the short-term.

There is no mitigation under Alternative A.

4.10.1.2 Alternative B

Trapping

Under Alternative B, trapping activity would be similar to Alternative A.

Mitigation and trapped wildlife

Alternative B mitigates trapped lynx mortality by creating 5,000 acres of new lynx habitat on public land, which would support at least 1 pair of adult lynx (draft ITP p. 102). Creating 5,000 acres of early successional habitat would affect the furbearer species of wildlife on, and adjacent to, these lands. A 5,000-acre area of mature forest could support 4 or 5 adult male pine marten and multiple female marten. Some land managers in northern Maine strive to maintain 3 to 6 pine marten home range units of 1,250 acres each per township (D. Harrison and J. Heppinstal, UMaine, unpub. data). Studies by Bissonette *et al.* (1997), Hargis and Bissonette (1997), Chapin *et al.* (1998), Payer (1999), and Potvin and Breton (2000) suggest that habitat occupancy by marten declines when 25-40% of the landscape is composed of young forest. Thus, creating early successional habitat for mitigation under Alternative B could reduce marten populations in 1 township-sized area. State lands are generally open to trapping, and forestry associated with mitigation could alter the number of trappers in the local area, but not statewide. This could change the geographic distribution of incidentally-trapped wildlife. Additional logging roads needed to create 5,000 acres of lynx habitat would

increase access for trappers, which could affect trapping distribution and harvest in a township-sized area.

4.10.1.3 Alternative C

Trapping

Alternative C would impose new conservation measures (e.g., conibear exclusion devices, foothold traps that meet BMP standards, eliminate drags, increased enforcement) that could accelerate declining trends in trapper participation. Some trappers may discontinue upland trapping or all forms of trapping. Alternative C would likely result in slightly reduced furbearer harvest than Alternative B.

Compared to Alternative B, Alternative C is expected to reduce the number of furbearer species trapped annually in Maine a negligible amount (i.e., less than the annual variance in fur harvest) over the next 15 years for the following reasons. First, eliminating drags (C.5) may affect some trappers who set long lines of foothold traps along logging roads and check them from their vehicles. If these trappers choose to stop trapping rather than stake their traps, fox and coyote harvest would likely be reduced in northern Maine. Second, the cost of phasing in BMP trapping standards (C.4) may cause some trappers to discontinue trapping. Third, the cost of requiring exclusion devices (C.3) for all upland conibear trapping in northern Maine may discourage some trappers from trapping for fisher and marten. The exclusion devices may lower the effectiveness for trapping fisher and marten, but this has not been the experience in Minnesota (J. Erb, MN furbearer biologist, pers. comm., November, 2009). Fur prices for marten and fisher ($32 and $63, respectively in 2008) has increased substantially from previous years. Marten trapping, in particular, draws trappers to northern Maine. Because of higher fur prices, demand and participation in trapping effort for these species is unlikely to diminish in the short-term. Alternative C eliminates the use of "blind" set conibear traps (C.3) and requires they be placed in a box or exclusion device. Trappers could still use foothold traps for mink in blind sets. If attractants are used in conibear blind sets, they are legally restricted to use urine and feces..

Although many trappers use blind or pocket conibear sets for mink (they are quick to deploy), mink trapping BMPs (AFWA) indicate that conibear traps can be effective in a cubby set. Alternative C could result in reduced number of mink taken, although trappers would likely adapt and use foothold traps or exclusion (cubby) devices for mink. Trapped aquatic species (e.g., beaver, muskrat) would not be affected by the conservation measures in Alternative C, and the number of these species trapped should remain similar to Alternative B and D. The number of harvested furbearer species has remained relatively constant since 2000 (MDIFW Wildlife Division Report 2008) and would be expected to continue under Alternative C.

Mitigation

Alternative C mitigates incidental take of trapped lynx by creating 10,000 acres of new lynx habitat on public land. Mitigation in Alternative C would double the potential effects on furbearer species described for Alternative B (section 4.10.1.2 above). In particular, removing 10,000 acres of mature softwood habitat would substantially reduce pine marten distribution and numbers over a 2 or 3 township area. This would reduce the number and activity of trappers who trap for pine marten in these areas. The number of marten trapped statewide may be reduced by 25 to 50 animals. Unless adaptive management provisions to close trapping on mitigations lands were triggered by documented take of lynx, trappers would still trap the area for fisher, coyotes, and foxes, which use early successional habitats. State lands are generally open to trapping, and forestry associated with mitigation could alter the number of trappers in the local area, but not statewide. This could change the geographic distribution of furbearers. The additional roads needed to create 10,000 acres of lynx habitat would increase access for trappers, which could affect trapping distribution and increase trapping harvest in a several township-sized area for many years into the future.

4.10.1.4 Alternative D

Alternative D would impose new conservation measures (e.g., immediate conversion to foothold traps meeting BMP standards, 24-hour tending of conibear traps, pan tension devices, reduced trapping season, no drags, and increased enforcement and compliance monitoring), which would likely reduce trapper participation more than Alternatives A, B and C, but not as much as E. Trapper attrition would reduce furbearer harvest especially in northern Maine, but could also result in trappers shifting effort to other WMDs. This could result in increased furbearer harvest in these areas.

Conservation measures in Alternative D would be expected to moderately reduce trapping effort and therefore reduce the number of furbearer species trapped annually in Maine, including fisher and marten, for the following reasons. First, limiting conibear traps to size #120 or smaller and require these traps be set in trees in WMDs 1-11, 14, 18 and 19 (D.4) would discourage some trapping for fisher and marten, even though smaller conibear traps can be effective for these species. Requiring 24-hour tending of conibear traps (D.5) could substantially reduce trapping effort for fisher and marten in northern Maine. Trappers are used to a five-day trap tend for conibear traps. Requiring daily presence would require trappers to take vacations to trap, stay overnight in remote, interior sections of northern Maine, or drive long distances to check their traps daily. Fur prices for marten and fisher ($32 and $63, respectively in 2008) has increased substantially from previous years. Marten trapping, in particular, draws trappers to northern Maine. Because of higher fur prices, demand and participation in trapping effort for these species may offset some of the trends predicted above. How increased costs to trappers (in terms of time, effort, new equipment, new regulations, increased law enforcement) will outweigh increased rewards (high pelt prices) is difficult to predict. Eliminating blind sets for conibear traps (C.3) could reduce mink and other furbearer harvest similar to Alternative C. The cost of requiring trappers to immediately switch to conibear and foothold traps that meet BMP standards (D.6) would likely reduce trapping effort in the short-term until trappers could re-equip. As in Alternative C, eliminating

drags (C.5) would reduce or eliminate trappers who have long traplines of foothold traps along logging roads and checked from their vehicles. Immediate use of BMPs and eliminating drag sets would likely reduce fox and coyote harvest in northern Maine. Trapped aquatic species (e.g. beaver, muskrat) would not be affected by the conservation measures in Alternative D, and the number of these species trapped should remain similar to Alternatives B and C.

Eliminating the December trapping season (D.8) would result in reduced furbearer harvests for many species. However, trappers may compensate for a shortened season by intensifying their trapping activity in October and November. Given the current distribution of fur animals harvested, eliminating the December trapping season in WMDs 1-11would decrease the coyote harvest in these zones by 11.7% and decrease statewide harvest by 2.9%. For red fox it would decrease the harvest in WMDs 1-11 by 14.8% and decrease the statewide harvest by 3.8% (W. Jakubas, MDIFW, email July 1, 2009)[10]. Reduced seasons also limit recreational opportunity for trappers. However, heavy snowfalls in northern Maine in late November and early December have similar effects on limiting fur harvest and opportunity.

Alternative D would be expected to have more long-term, indirect ecosystem-level effects than Alternatives A, B and C. As explained above, measures in Alternative D would be expected to reduce trapper effort and furbearer harvest in northern Maine greater than Alternatives A, B and C. Reduced carnivore harvest could have indirect effects on other wildlife species. For example, increased coyote populations could result in increased competitive interactions with other species (e.g., fox) and increased predation on local deer populations. Increased fisher populations could affect Canada lynx because fisher predation is a major source of lynx mortality in Maine (J. Vashon, MDIFW, unpub. data). Increased marten populations may affect small mammal populations. In general, increased predator populations would be expected to have secondary effects on their prey, which in turn would have other ecological effects within northern forest ecosystems. Aquatic species should not be affected because trapping measures in Alternative D are focused on upland trapping.

Mitigation

Alternative D mitigates trapped lynx mortality by identifying an area on private forest to create at least at least 7,000 acres of early successional habitat in optimal condition, which can support several Canada lynx even when hare populations are lower and lynx home ranges may be greater. Mitigation in Alternative D would harvest at least 7,000 acres of mature softwood habitat, which would substantially reduce pine marten distribution and numbers over a 1 to 3 township area. This would substantially reduce the number and activity of trappers who trap for pine marten in these local areas, but not statewide. As a result, Maine's marten harvest may be reduced by 25 to 50 animals, which is greater than would be expected to occur under Alternative B, but the same as Alternative C. Unless adaptive management provisions to close trapping on mitigation

[10] Note: WMDs 14, 18 and 19 were not included in Dr. Jakubas' calculations because closures on these WMDs was not in effect in 2009.

lands were triggered by documented take of lynx, trappers could still trap the area for fisher, coyotes, and foxes, which use early successional habitats. Private forest lands are generally open to trapping, and forestry associated with mitigation could alter the number of trappers in the local area, but not statewide. This could change the geographic distribution of incidentally-trapped wildlife. The additional roads needed to create at least 7,000 acres of lynx habitat would increase access for trappers, which could affect trapping distribution and increase trapping harvest in a several township-sized area.

4.10.1.5 Alternative E

Under Alternative E, MDIFW would discontinue upland trapping in WMDs 1-11, 14, 18 and 19 in northern Maine. According to the draft ITP (Table 3.2) this would reduce bobcat harvest from 290 to 188 (-35%), fisher harvest from 2,509 to 1329 (-47%), marten harvest from 3667 to 78 (-98%), red fox harvest from 1,499 to 868 (-42%), gray fox harvest from 138 to 136 (-1%), and coyote harvest from 2,244 to 1,129 (-50%). It should not have an effect on aquatic species trapped (e.g., beaver, mink, otter, muskrat) because trapping would remain open for aquatic species. Thus, discontinuing trapping in WMDs 1-11, 14, 18 and 19 would reduce statewide furbearer harvest for all species from 40,000 to 31,000 (-18%).

Under Alternative E, MDIFW would diminish its ability to manage or regulate upland furbearer populations in WMDs 1-11, 14, 18 and 19 (some species could still be hunted). As a result, some furbearer populations would likely increase (especially heavily-targeted species like pine marten), although compensatory mortality and changes in age structure may negate increases to some extent. Trapping pressure would be expected to increase in other WMDs because of trappers displaced from their traditional trapping areas in northern Maine. Barring other environmental stresses (e.g., disease, climate change, pollution, habitat loss or degradation), populations of Maine's furbearer species in other WMDs are likely robust and could sustain a slightly higher harvest for the foreseeable future (MDIFW species assessments, www.maine.gov/ifw/wildlife/species/plans/mammals). MDIFW may have to adjust trapping seasons in other WMDs if they observed significant increases in trapper effort and harvest.

Alternative E would have substantially greater long-term, indirect ecosystem-level effects than Alternatives A, B, C and D. There would be no trapping for upland furbearers through northern Maine. No carnivore harvest could have indirect effects on other wildlife species. For example, increased coyote populations could result in increased competitive interactions with other species (e.g., fox) and increased predation on local deer populations. Increased fisher populations could affect Canada lynx because fisher predation is a major source of lynx mortality in Maine (J. Vashon, MDIFW, unpub. data). Increased marten populations may affect small mammal populations. In general, increased predator populations would be expected to have secondary effects on their prey, which in turn would have other ecological effects within northern forest ecosystems. There would be little effect on aquatic species because trapping closures would only occur in upland areas.

There is no mitigation under Alternative E, thus no effect on trapped species.

4.10.2 Non-target wildlife

Incidental take of birds and mammals in traps

Susceptibility of non-target species to incidental trapping is influenced by their geographic distribution, abundance, seasonal movements, life history and diet, and habitats shared with the target species (Shivik *et al.* 2002). Selectivity of traps is determined by trapper experience, type of trap, trap modifications, manner in which the trap is set, its location (Novak 1987, Powell and Proulx. 2003), selectivity of the device (e.g. use of pan tension device; Turkowski *et al.* 1984), trap size (Newsome 1983), and proportion of animals that are restrained by the trap without escape (Shivik *et al.* 2002) and type of bait used (Novak 1987). Some non-target species die in traps, some are released with no injuries, some are released with minor injuries, and some are released with major injuries. Nontarget species, particularly those smaller than the target species, can be severely injured in foothold traps (Onderka *et al.* 1990, Powell and Proulx 2003, Iossa *et al.* 2007, American Veterinary Medical Association 2008), and those released alive may have impaired survival (Chapman *et al.* 1978). Large carnivores can be caught in traps intended for small carnivores, and if the trap is not well anchored, the larger animal may escape with a small trap on its paw.

Several North American studies document the high frequency of take of non-furbearer species[11] in foothold traps (Beasom 1974, Berchielli and Tullar 1980, Litvaitis 1984, Novak 1987, Barrett *et al.* 1989, Onderka *et al.* 1990, Proulx and Barrett 1993, Naylor and Novak 1994, Iossa *et al.* 2007). Incidental trapping of non-furbearer species in foothold traps ranged from .12/furbearer (Berchielli and Tullar 1980) to 2.0/furbearer (Reynolds (1953, 1955, de Vos *et al.* 1959 as reported in Novak 1987; note that trapping equipment, methods, and regulations in effect 50 years ago is much different than today). In Maine, Litvaitis *et al.* (1983) incidentally caught 0.81 non-furbearing species/furbearer (Litvaitis, 1984, Novak 1987). BMP studies of foothold trap effectiveness for fox and coyote in Maine, New York, and Pennsylvania documented 20% of animals trapper were non-furbearing animals such as birds, dogs, and cats (IAFWA 2000). Additionally, several studies document take of non-furbearer species in conibear traps (Novak 1987, Barrett *et al.* 1989, Proulx and Barrett 1993, Naylor and Novak 1994). Incidental trapping of non-furbearer species in upland use of conibear traps ranged from

[11] For many research studies, trap selectivity is frequently presented as the ratio of the number of trapped non-target species to trapped target species (Linhart and Linscombe 1987, Shivik and Gruver 2002). However, in other studies and all trap BMP studies, trap selectivity is presented as the ration of the number of trapped non-target species to **all** legally harvested furbearer species (not just the target furbearer species). Legally harvested furbearer species vary by state and province. Many of the studies cited in this section include the red squirrel as a furbearer. In Maine (but not NH, VT, CT, MA) the red squirrel is considered a furbearer. Inclusion or exclusion of red squirrels can change the ratios significantly. Where possible in this EA, the ratio of non-furbearing animals/legally harvested furbearers (including red squirrels) is presented.

.54/furbearer (Proulx and Barrett 1993), 0.68/furbearer (Barrett *et al.* 1989), and .74/furbearer (Naylor and Novak 1994).

Porcupines, snowshoe hare, red[12] and flying squirrels, and gray jays are the most common non-furbearer species caught in upland foothold and conibear evaluations in boreal habitats, but saw whet, boreal and hawk owls, and domestic pets are also taken (Litvaitis 1984, Novak 1987, Barrett *et al.* 1989, Proulx *et al.* 1989, Mowat *et al.* 1994, Naylor and Novak 1994). Crows and ravens are frequently represented in incidental catch in traps worldwide (Nocturnal Wildlife Research 2008). Crows, gray jays, ravens and blue jays were frequently taken in a range of foothold traps in New Brunswick, while hawks, owls, and eagles were caught less often and waterfowl are caught infrequently in aquatic sets (Stocek and Cartwright 1985). Litvaitis *et al.* (1983) incidentally caught 88 non-furbearing animals in foothold traps (scent post, blind, and baited sets) while trapping for bobcat in eastern Maine; 52 porcupines (59%), 19 snowshoe hares (22%), 7 crows and ravens (8%), 5 miscellaneous birds (6%), 3 domestic dogs and cats (3%), and 2 squirrels (2%). Stocek and Cartwright (1985) interviewed 2,836 trappers in New Brunswick in the early 1980s, and 23-25% reported catching birds. Given these reporting rates, he estimated 1,862-2,080 birds were trapped in the province annually. In a survey of 859 Michigan fox and coyote trappers, Frawley *et al.* (2005) documented that relatively few trappers took non-furbearing species with 9% taking domestic cats, 7% domestic dogs, 7% rabbits and hares, 5% crows, 3% tree squirrels, and <2% other species. Given these reporting rates, they estimated 920 domestic cats, 328 domestic dogs, 367 rabbits and hares, 237 crows, 202 tree squirrels, and 34 miscellaneous birds were trapped by Michigan trappers annually.

Maine law requires that any non-furbearing animal caught in a trap must be removed. If the animal is alive it may either be released or humanely dispatched. Trappers are not allowed to keep trapped non-target animals unless the trapper has a license to possess captive wildlife. If the animal is found dead in the trap, trappers must report the incident to a game warden as soon as possible and turn the animal over to the MDIFW.

MDIFW does not keep information on incidental capture of non-furbearer species, and the number and species composition of non-furbearer species caught in Maine traps is unknown. There have been no summaries prepared of incidental take of non-furbearing animals in Maine (W. Jakubas, MDIFW, 7.2.09 pers. comm.). No information is available on the proportion of non-furbearer animals released alive, released injured, or die in traps, nor is there information documenting the effects of trapping on non-target wildlife populations.

The scientific literature of incidental trapping of non-furbearer species in Maine and boreal environments (e.g., Litvaitis *et al.* 1983, Stocek and Cartwright 1985, Novak 1987, Barrett *et al.* 1989, Proulx *et al.* 1989, Mowat *et al.* 1994, Naylor and Novak 1994), would suggest the birds expected to be caught in traps in upland settings in Maine would likely include gray jays, blue jays, ravens, and crows, and less frequently owls, and

[12] As noted above red squirrels are considered furbearers in some states and provinces and not a furbearer in others.

hawks. Bald and golden eagles have been caught infrequently in Maine (see discussion below). Frequently trapped non-furbearer mammals in northern Maine would be expected to include northern flying squirrels, snowshoe hares, and porcupines. Trapping occurs in late autumn when most migratory birds (including many species of hawks and owls) have departed and reptiles and amphibians have entered dormancy.

Non-furbearer wildlife may be taken in foothold and conibear traps in Maine, but MDIFW has no information to estimate this take. Recent scientific literature suggests a range of incidental take from 12-81% of total furbearer animals taken in foothold traps (Berchiellit and Tullar 1980, Litvaitis *et al.* 1983) and 54% to 74% of total furbearer animals taken in conibear traps (Proulx and Barrett 1993, Naylor and Novak 1994). The numbers of Maine furbearers caught in conibear and foothold traps is unknown, so it is impossible to estimate take of non-furbearer species by trap type. To calculate an approximation of the number of non-furbearer animals incidentally caught in Maine, we applied low (12%, Berchielli and Tullar 1980) and high (81% Litvaitis *et al*. 1983) rates of incidental take of non-furbearer species to Maine's total furbearer harvest (40,000 animals annually). Thus, 6,000 to 32,400 non-furbearing animals could be taken annually.

The effects of incidental trapping on non-furbearing wildlife populations have not been evaluated in the scientific literature. With the exception of bald and golden eagles and goshawk, species most likely to be incidentally trapped are not represented in Maine's special concern and threatened and endangered species lists. Some have hypothesized that, given the assumption that many trapped non-furbearing animals are injured and die, trapping could have local or possibly regional population effects on some non-furbearer species and is a matter of conservation concern (Novak 1987, Stocek and Cartwright 1985). Rare species would be expected to be most susceptible to population level effects. The upland species most likely to be incidentally trapped in Maine (gray and blue jays, crows, ravens, hawks, owls, snowshoe hare, red squirrel, flying squirrel, and porcupine) are not species at risk. The Maine Comprehensive Wildlife Conservation Strategy (MDIFW 2007) recognizes barred, screech, and long-eared owls as moderate priority species; and bald and golden eagles as moderate priority species.

Trapping effects on bald and golden eagles

Maine has trapping regulations intended to be protective of birds, i.e., it is mandatory that baited traps be covered so that they are not visible to birds, and traps must be set back 50 yards or more from a carcass in order to protect eagles. Despite increasing bald eagle populations and distribution, the number of trapping incidents of eagles has continued to diminish in Maine. Trapping was once a significant source of mortality of bald and golden eagles in North America (Coon 1970, Bortolotti 1984), but is now less so (Wayland et al. 2003). Since 1971, 38 bald eagles and 1 golden eagle have been documented incidentally trapped in Maine, with a majority caught prior to recent regulatory changes (C. Todd, MDIFW unpub. data). Bald and golden eagles in Maine have been killed and injured in both conibear and foothold traps (C. Todd, MDIFW, unpub. data; Todd 2000, Todd 2004). Despite increasing bald eagle populations and

distribution, the number of trapping incidents of eagles has continued to diminish in Maine. Nationwide, the frequency of trap-related deaths was only 2% of cases examined in the 1960s and 1970s (Coon *et al.* 1970, Mulhem *et al.* 1970, Belisle 1972, Cromartie *et al.* 1975, Prouty *et al.* 1977). Although many bald eagle trapping incidents that occurred during this era coincided with a low point for Maine's eagle population, human-caused mortality (e.g., incidental trapping, illegal shooting, poisonings, electrocutions, and impact trauma) did not prevent bald eagle recovery in Maine. However, various sources of human-caused mortality may threaten the much smaller golden eagle populations, such as occurs in eastern North America (Whitfield *et al.* 2004, Drewit and Langston 2006, Katzner *et al.* 2006, Katzner *et al.* 2008).

Several trapping-related rules and regulations were instituted by MDIFW to protect bald and golden eagles from trapping injury and mortality. For example:

- Prior to 1976, there was no closed season on bobcat. During this time period, bobcat trapping extended into late winter and resulted in multiple cases of dead and injured eagles each winter. Incidental trapping of bald eagles was almost always involved with exposed bait. Closing bobcat trapping season before December 31 and trapper educational efforts helped to reduce this problem.
- In the 1970s, several bald eagles were trapped during Maine's spring muskrat trapping season. This season was ended in 1979 to protect both bald and golden eagles.
- In recent years, several bald eagles were caught in foothold traps set next to exposed carcasses. In 2007, MDIFW adopted regulations requiring that traps not be set within 50 yards of bait which can be seen from above. Exposed bait at trap sites must not be visible from above.

The primary issue affecting incidental take of bald and golden eagles, placing traps around an exposed carcass, has been addressed. New regulations concerning exposed bait, if implemented properly and enforced, would further minimize take of bald and golden eagles. However, the risk to eagles has not been completely eliminated. Two eagles were trapped after these 2007 regulations were implemented, possibly in illegally set traps.

Several dozen bald eagles are known to die in Maine annually from human-caused sources of mortality (e.g., poisoning, contaminants, illegal shooting, electrocution, collisions, intraspecific aggression), but this does significantly affect growth of the breeding population, which continues to increase at about 8%/year (Todd 2004). In contrast, human-caused mortality of golden eagles is much more infrequent, however, loss of individuals from a small population could be of greater conservation concern (Whitfield *et al.* 2004).

Trapping effects on other migratory birds

The majority of migratory bird species migrate out of Maine by the time trapping season occurs (mid-October to December), and Maine has implemented regulations to reduce the risk of incidentally trapping migratory birds. For example, new spring muskrat trapping

regulations are designed to prevent risk to waterfowl and bald eagles by requiring conibear-type traps be set underwater or foothold traps on floats covered with hardware cloth (to prevent access by birds)(J. DePue, MDIFW, pers. comm.). About 60 species (of 292 regularly occurring species in Maine) are typically resident for the winter (e.g., chickadees, crows, ravens, jays, herring and ring-billed gulls, woodpeckers, turkeys, ruffed grouse, mourning dove, several owl species) or migrate to Maine to winter (e.g., redpolls, pine siskins, evening and pine grosbeaks, hawk and snowy owls, several species of sea ducks) (http://www.mainebirding.net/news/cbc). Based on the scientific literature cited above, we anticipate take of migratory birds from trapping in Maine to primarily include raptors (hawks, owls, eagles) and corvids (jays, crows, ravens). It is unknown how many birds are incidentally taken in legally set traps.

For this draft EA, we examine effects of trapping and mitigation on gray jays. Although this is not the only species incidentally trapped, it likely represents the most frequently trapped non-furbearer species in boreal environments (e.g. Novak 1987, Barrett *et al.* 1989, Naylor and Novak 1994).

Gray jays (*Perisoreus canadensis*) consume a wide variety of carrion, are attracted to human-related sources of food, spend over 95% of the day caching food, and thus are particularly vulnerable to traps baited with exposed meat (Strickland and Ouellet 1993). Gray jays are monogamous, remain on their territory year-round, first breed at 2 years of age, and have low reproductive rates (Ha and Lehner 1990, Ibarzabal and Desrochers 2004). Literature on population-level effects of trapping on gray jay populations is limited. In one experimental study in Ontario, gray jays were subjected to "10-times normal trapping pressure," which did seriously affect the local population (deVos *et al.* 1959 cited in Strickland and Ouellet 1993). In the first fall and winter of the study, 292 gray jays were killed (nearly all of the birds estimated to occupy the study area). This study does not represent the amount of incidental take of gray jays that would be expected under normal trapping pressure. There are reports of gray jays taken in traps in northern Maine (19 gray jays taken in 1 day by 1 trapper in the 1980s though it is unclear if these traps were set legally, R. Joseph, USFWS, pers. comm., November, 2009), New Brunswick (Stocek 1985), and elsewhere (Novak 1987, Barrett *et al.* 1989, Proulx and Barrett 1993, Mowat *et al.* 1994). However, there is no indication that incidental trapping has a serious impact on gray jay populations even at a local level (Novak 1987).

MDIFW does not keep records of how many gray jays are taken in traps. To determine if estimating how many gray jays could possibly be taken in Maine marten trapping studies in Ontario (Naylor and Novak 1994) and Alberta (Barrett *et al.* 1989) were consulted. Trapping conditions and regulations in these two jurisdictions are believed to be different than Maine. For example, incidental take of gray jays is likely reduced in Maine because of recent MDIFW regulations requiring that bait be covered (Ontario and Alberta allow exposed bait). In Ontario, 26 gray jays were taken for 408 marten trapped (6.4% of target species) in conibear and foothold traps (Naylor and Novak (1994), and in Alberta, 30 gray jays were trapped for 55 marten taken in conibear traps (55% of target species) (Barrett *et al.* 1989). If similar ratios were applied to Maine marten harvest in recent years (2,350 – 5,529 animals), 150 – 3,015 gray jays could be taken in northern Maine

annually. Gray jay densities were 1.79 to 3.53 birds/km^2 in La Verendrye Park, Quebec and Algonquin Park, Ontario, respectively (Strickland and Ouellet 1993). If similar densities occur in northern Maine, 47,077 – 92,839 gray jays may be present in the autumn in the 6.5 million-acre (26,300 km^2) lynx critical habitat area. Incidental take from trapping at these rates would not have a statewide population-level effect on gray jays, but could affect local populations. However, given the significant uncertainty stemming from limited information and substantially different variables (e.g., the regulatory differences), it is unreasonable to extrapolate from the Alberta and Ontario studies to Maine.

Prohibited take under the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

Section 10(a)(B) of the Endangered Species Act grants the Secretary of the Interior authority to issue incidental take permits only if the taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Take of migratory birds is not lawful and the Department may not issue a permit unless measures are taken in the final ITP to minimize take of migratory bird to the maximum extent practicable. The Migratory Bird Treaty Act prohibits the take of all migratory birds and provides no mechanism to permit the take of migratory birds. Therefore, the take of migratory birds in Maine's trapping program is prohibited. The final ITP should address measures to monitor (or to enforce provisions already in Maine regulations to report take of birds and other non-furbearer species) and include an adaptive management plan to address take of migratory birds. The Bald and Golden Eagle Protection Act prohibits the take of these birds. The regulation set forth in 50 CFR § 22.26 provides for issuance of permits to take bald eagles and golden eagles where the taking is associated with but not the purpose of the activity and cannot practicably be avoided. To meet the issuance criteria for an ESA Permit, the MDIFW will need to demonstrate that take of migratory birds and bald and golden eagles by trapping has been adequately addressed or otherwise permitted to ensure that the trapping program is "an otherwise lawful activity."

Trapping effects on non-furbearing mammals

Most of Maine's 61 mammal species are resident in the state year-round (except migratory bats). It is unknown how many and which species of non-furbearing mammals are incidentally taken by trapping as specific records are not kept. Based on the scientific literature cited above, we anticipate take of non-furbearing mammals to primarily include flying squirrels, red squirrels, and snowshoe hare.

For this draft EA, we examine effects of trapping and mitigation on northern flying squirrels (*Glaucomys sabrinus*) and snowshoe hares (*Lepus americanus*). Although these are not the only mammal species incidentally trapped, they likely represent the most frequently trapped non-furbearer species in boreal environments (e.g. Novak 1987, Barrett *et al.* 1989, Naylor and Novak 1994). We also examined the effects of trapping and mitigation on the snowshoe hare because it is the primary food of the Canada lynx.

Northern flying squirrel

Northern flying squirrel populations seem to be secure in Maine and elsewhere in the northern part of their range. There are only 6 records of southern flying squirrels in Maine, all in southern and coastal Maine outside of the range of the Canada lynx (O'Connell *et al.* 2001). Flying squirrels have demographic characteristics that contribute to their rarity – delayed age to first breeding; low reproductive rates for a small mammal; small, single litters annually; females are prone to reproductive failure or delay; often distributed in small, isolated populations; and high annual variability in population size (Smith 2007, Weigl 2007). A large portion of their diet is fungi and staminate cones of spruce and fir, but they readily consume carrion, and are vulnerable to traps baited with meat (Novak 1987, Naylor and Novak 1994).

MDIFW does not keep records of how many northern flying squirrels are taken in traps. To estimate how many could possibly be taken in Maine we reviewed two marten trapping studies in Ontario (Naylor and Novak 1994) and Alberta (Barrett *et al.* 1989). Trapping conditions and regulations in these two jurisdictions are believed to be different than Maine. For example, incidental take of gray jays is likely reduced in Maine because of recent MDIFW regulations requiring that bait be covered (Ontario and Alberta allow exposed bait). In Ontario, 382 northern flying squirrels were taken for 408 marten trapped (94% of target species) (Naylor and Novak 1994), and in Alberta, 46 northern flying squirrels were taken for 55 marten trapped (84% of target species) (Barrett *et al.* 1989). If similar ratios were applied to Maine marten harvest in recent years (2,350 – 5,529 animals), 1,974 – 5,197 flying squirrels could be taken in northern Maine annually. Northern flying squirrel densities in the Pacific Northwest range from 0.5 – 4.0/ha (Smith *et al.* 2003, Smith and Nichols 2003), and there are few estimates of density for populations in the eastern portion of its range (Bowman *et al.* 2005). If similar densities occur in northern Maine, 7.2 million – 57.2 million northern flying squirrels may be present in the 6.5 million-acre (26,300 km^2) lynx critical habitat area. Incidental take from trapping at these rates would not have a statewide population-level effect on flying squirrels, but could affect local populations.

Snowshoe hare

The snowshoe hare is one of the most abundant land mammals in Maine and is distributed throughout the state wherever appropriate habitat exists. Although it is found in all forest types, it reaches its highest density (up to 2.0 hares/ha, Scott (2009)) in dense, regenerating softwood stands. Populations cycle about every 10 years in Canada and Alaska, and they likely have dampened cycles or fluctuations in Maine (Hodges 2000, Scott 2009). Between 2005 and 2010, snowshoe hare populations in Maine and southern Quebec declined to 50% of their former abundance (Scott 2009). In boreal ecosystems, lynx populations (and other predators) cycle in tandem with snowshoe hare. Snowshoe hares are a primary prey species for many predators in Maine including Canada lynx, bobcat, eastern coyotes, fox, fisher, pine marten, weasels, great-horned owls, red-tailed hawks and other large raptors.

Snowshoe hares are a hunted species with liberal seasons (October through March) and daily limits of 4 animals per day. Approximately 250,000 are believed to be killed by hunters each year in Maine, although there have been no hunter surveys to determine harvest since the early 1980s (Jakubas and Cross 2002). MDIFW estimated statewide populations to be approximately 8.5 million animals in the mid-1980s, the last time such estimates were made (Jakubas and Cross 2002).

Snowshoe hare are commonly incidentally caught in foothold and conibear traps (Novak 1987, Barrett *et al.* 1989, Proulx *et al.* 1989, Mowat *et al.* 1994, Naylor and Novak 1994). MDIFW does not keep records of how many snowshoe hares are taken in traps. To estimate how many could possibly be taken in Maine we reviewed two marten trapping studies in Ontario (Naylor and Novak 1994) and Alberta (Barrett *et al.* 1989). Trapping conditions and regulations in these two jurisdictions are different than Maine. In Alberta, no snowshoe hares were taken for 55 marten trapped (0% of target species) (Barrett *et al.* 1989) and in Ontario, 18 snowshoe hares were taken for 408 marten taken (4% of target species)(Naylor and Novak 1994). If similar ratios were applied to Maine marten harvest in recent years (2,350 – 5,529 animals), 0 – 5,750 snowshoe hares could be taken in northern Maine annually. Landscape hare densities in northern Maine currently average 0.6 hares/ha (Simon 2009, Scott 2009), therefore approximately 1.8 million snowshoe hares may be present in the 6.5 million-acre (26,300 km^2) lynx critical habitat area. Incidental trapping at most may take 0.3% of the population and is likely a compensatory source of mortality. Incidental take from trapping at these rates would not have a population-level effect on snowshoe hares within the core range of the Canada lynx, much less statewide. Incidental trapping is not likely great enough to affect local populations.

4.10.2.1 Alternative A

Under Alternative A (status quo statewide trapping, no Permit), incidental take of non-furearer wildlife may be approximately 6,000 to 32,400 non-furbearing animals taken taken annually (see analysis above in Section 4.10.2). Regulations adopted by MDIFW in 2007 to restrict the use of visible bait are included in Alternative A. These regulations likely reduced incidental take of crows, jays, hawks, owls, eagles and other birds. Regulations pertaining to leaning pole sets for baited conibear traps (A.10) may reduce the incidental take of some birds and mammals, however, the benefits are not well documented because MDIFW does not keep records. "Blind sets" (conibear traps set on the ground with scents or scat, not bait) would still be used under Alternative A and would likely take non-target species.

Alternative A would likely take the same number of migratory birds, bald and golden eagles, and non-target mammals than Alternative B and more than Alternatives C, D, and E because Alternatives A and B are the least restrictive alternatives.

There is no mitigation under Alternative A.

4.10.2.2 Alternative B

Trapping

Under Alternative B (statewide trapping, draft ITP), incidental take of nontarget wildlife would be similar to Alternative A; approximately 6,000 to 32,400 non-furbearing animals taken annually (see analysis above in Section 4.10.2). The probability of incidental trapping of migratory birds, bald and golden eagles, and non-target mammals will be similar to Alternative A because the trapping practices are similar.

Mitigation and non-target wildlife

Alternative B mitigates trapped lynx mortality by creating 5,000 acres of new snowshoe hare and lynx habitat on public land, which would support at least 1 pair of adult lynx (draft ITP p. 102). Creating 5,000 acres of early successional habitat would temporarily affect the species of plants and wildlife on, and adjacent to, these lands. For example, wildlife that requires mature forest (e.g., deer wintering habitat, pine marten, flying squirrels, blackburnian, bay-breasted and Canada warblers, ovenbird, hermit thrush, pileated woodpeckers) would be replaced by wildlife species that require young forest (e.g., moose, snowshoe hare, chestnut-sided warblers, mourning warbler, white-throated sparrows, American kestrels, and woodcock). In a similar way, late successional trees, plants, lichens and invertebrates would be replaced by early successional organisms. These changes would be temporary as a natural succession of plants and animals occurs as the mitigation areas mature. Large patches of early successional habitat may affect local wildlife movement patterns and corridors and affect the distribution and abundance of species that are sensitive to changes at the landscape scale (e.g., fisher, marten, and some raptors).

State lands are generally open to trapping, but to preserve mitigation values for lynx 1 township of state lands may be closed to trapping (see conservation measure B.7).

Habitat mitigation for lynx (creating early successional habitat) is likely to have few short- or long-term effects for bald and golden eagles. Clearcuts may provide some foraging habitat for golden eagles. Logging would not affect nesting habitat for either species because golden eagles usually nest on cliffs and bald eagles nests near lakes and rivers. Maine Bureau of Public Lands policy required large buffers near lakes and river that will adequately protect nesting habitat for bald eagles.

Gray jays are habitat generalists unlikely to be affected by habitat management for lynx. Cutting 5,000 acres of mature forest will temporarily eliminate mature forest habitat for 1100 – 9000 northern flying squirrels (assuming densities discussed above). Creating 5,000 acres of early successional forest will increase snowshoe hare populations from approximately 450 hares (0.2 hares/ha) to 4545 hares (2 hares/ha), which will benefit lynx.

4.10.2.3 Alternative C

Trapping

Based on the scientific information presented above, we believe fewer non-target wildlife would likely be incidentally trapped under Alternative C than Alternatives A and B because:

- A DVD (C.1) would improve outreach for all trappers and provide specific instruction on how to avoid trapping lynx and other non-target species and explain trapping BMPs – all of which would improve trapper skills and compliance with practices to reduce incidental take of non-target wildlife.
- Requiring exclusion devices with all upland conibear traps (including blind sets) (C.3) would greatly reduce, if not eliminate, take of non-target birds and larger mammals (e.g. porcupines) in conibear traps because they would not be able to enter the devices. Flying squirrels would still enter exclusion devices.
- Eliminating drags (C.5) may reduce injury, and thus mortality, to some non-target species because there would be less chance of twisting and tugging in short-staked foothold traps.
- Increased enforcement details (C.6) and penalties (C.7) would ideally improve compliance with practices to reduce trapping non-target species.

Alternative C requires the use of exclusion devices for conibear traps and eliminates blind sets of conibear traps in upland settings, which would substantially diminish the probability of taking many species, especially birds. Thus Alternative C would be expected to take many fewer birds than Alternatives A and B. However, without specific data on past incidental take of non-target animals from trapping in Maine (nontarget species caught, numbers, types of traps, etc.), it is impossible to quantify and predict the short- and long-term effects of Alternative C; which non-target species would benefit or decline, how much incidental take and injury would be avoided, and what the direct and indirect effects of these improvements would have on ecosystems.

Several conservation measures in Alternative C would further reduce the probability of trapping and injury to eagles compared to Alternatives A and B. Although overhead bait regulations (A.9) have undoubtedly substantially reduced risk to eagles, conibear exclusion devices (C.3) would eliminate any possibility of catching bald and golden eagles in upland conibear traps in WMDs 1-11, 14, and 18, however, eagles could still be caught outside of this area. Increased enforcement details (C.6) would ensure that new regulations are being applied, especially those pertaining to exposed bait regulations and conibear exclusions devices and would further reduce risk to bald and golden eagles. Under Alternative C, we would expect a small number of bald and golden eagles to be caught in foothold traps, likely at about the same rate as Alternatives A and B because exposed bait regulations are in effect for all three Alternatives.

Under Alternative C, take of gray jays and other migratory birds would be eliminated from conibear traps (see discussion above). Although excluding devices will deter many non-target mammals, this conservation measure could possibly increase the take of

northern flying squirrels in conibear traps because flying squirrels are attracted to cavities and are easily trapped in boxes. Under Alternative C, gray jays and other migratory birds and northern flying squirrels and other non-target mammals would be caught in foothold traps at the same rate as Alternative B. Use of conibear exclusion devices and eliminating blind sets would eliminate trapping of snowshoe hares in conibear traps, but they would still be caught at the same rate in foothold traps as Alternatives A and B.

Mitigation and non-target wildlife

Creating 10,000 acres of early successional habitat on public lands would double the effects documented in Alternative B (creating 5,000 acres) (see section 4.10.2.2).

4.10.2.4 Alternative D

Alternative D would result in less incidental take of non-target species than Alternatives A and B because:

- Periodic, required retraining of trappers (D.1) would provide specific instruction on how to avoid catch of lynx and trapping BMPs, which would improve trapper skills and compliance with practices to reduce incidental take of non-target species.
- Requiring 24-hour tending of conibear traps (D.5) would reduce the amount of time incidentally-caught non-target species are in traps, thereby possibly reducing injury, harm and harassment.
- As in Alternative C, eliminating drags would reduce injury, and thus mortality, to non-target species because there would be less chance of twisting and tugging in short-staked foothold traps.
- Requiring smaller conibear traps be used only in trees (D.4) would reduce incidental take of some species. Eliminating blind sets of conibears would reduce incidental take of some species.
- Increased enforcement details and penalties as in Alternative C (C.7) would help ensure compliance with trapping regulations.
- Limiting the trapping season to October and November (D.8) would reduce the time when non-target animals are exposed to traps and trapping would occur in warmer months thereby reducing the possibility of harm or harassment due to freezing weather conditions and an incidentally trapped animal.

The relative impacts of Alternative C and D on non-target species are uncertain because of the various trade-offs in the conservation measures used. Use of conibear exclusion devices (C.3) would greatly reduce incidental capture of birds and large mammals, whereas 24-hour tending of conibears and reduced conibear trap sizes (D.5) may produce similar results. Absent specific data from MDIFW on incidental take of non-target animals from trapping (species, number, types of traps, etc.), it is difficult to predict the long-term ecosystem effects of Alternative D - which species would benefit and how much incidental take and injury would be avoided.

Several conservation measures in Alternative D will further reduce risk of injury and mortality to bald and golden eagles than Alternative A and B. Under Alternative D, 24-hour tending requirements for all traps (D.5) would help to reduce injury rates to eagles. Increased enforcement of exposed bait regulations (C.6) would benefit bald and golden eagles. It is uncertain to what extent traps that meet BMP standards (padded, offset jaws, laminated jaws) (D.6) are less injurious to bald and golden eagles as all traps will cause bruising, which can be fatal to these birds. Thus, Alternative D provides increased benefits to bald and golden eagles over Alternatives A and B. Alternative D provides similar benefits for eagles compared with Alternative C because of 24-hour trap tending for foothold and conibear traps and immediate deployment of BMP traps.

Conibear traps

Injury and mortality of gray jays and other migratory birds and northern flying squirrels and non-target mammals would be reduced in conibear traps compared to Alternatives A and B because of increased education, more frequent trap checking, and the reduced trapping season. The differences in injury and mortality to non-target species between Alternatives C and D are more difficult to discern because of the numerous tradeoffs in trapping measures. For instance, take of northern flying squirrels may increase in Alternative C because they are attracted to cavities and conibear excluding devices. However, incidental capture of other non-target mammals under Alternative C would be nearly eliminated. Take of migratory birds would be greater under Alternative D than C because conibear excluding devices (C.3) would eliminate take of birds from conibear traps.

Foothold traps

Under Alternative D, injury and mortality of gray jays and other migratory birds and northern flying squirrels, snowshoe hares and other non-target mammals in foothold traps would be less than Alternatives A and B because of increased education, and shorter trapping season. Differences between Alternatives D and C are more difficult to discern because of the numerous tradeoffs.

Mitigation
Mitigation in Alternative D (at least 7,000 acres) would affect larger populations of wildlife than Alternative B (creating 5,000 acres on state lands) and would have similar effects on other wildlife as described in Alternative C (creating 10,000 acres on state lands).

4.10.2.5 Alternative E

Alternative E would have substantially lower incidental take of non-target birds and mammals than Alternatives A, B, C, and D because upland trapping would be closed in northern Maine WMDs 1-11, 14, 18 and 19. By closing upland trapping in northern Maine, total furbearer harvest in Maine would be reduced to approximately 31,800 animals (6,700 fewer tagged furbearers, 1000 fewer raccoons, 500 fewer skunks and

weasels). Incidental take of non-furbearer species may be reduced to approximately 3,800 to 25,700 animals (12-81% of furbearers taken) annually. Under Alternative E, 20–37% fewer non-furbearer species would be taken than expected under Alternatives A and B.

Discontinuing upland trapping in northern Maine would result in fewer bald and golden eagles taken. Most bald eagle taken in traps occurs in central, southern Maine where bald eagle densities are greatest. Discontinuing upland trapping in northern Maine would further reduce the probability of take of bald eagles, but not as much as if closures occurred in the southern regions of the state. There has been only a single golden eagle recorded taken in a trap. Although trapping of golden eagles is a rare occurrence, trapping closure in northern Maine under Alternative E would further reduce the probability of capture.

Under Alternative E, upland trapping would be discontinued in northern Maine where gray jays, northern flying squirrels, and snowshoe hares are most numerous and substantially fewer of these species would be taken than under the other Alternatives. Similarly, under Alternative E the number of other non-target mammals and migratory birds incidentally trapped would be substantially less than the other Alternatives.

There is no mitigation under Alternative E, thus no mitigation effects on non-target wildlife.

4.11 Effects on federally-listed, proposed and candidate species

Trapping is expected to have no effect on the federally-listed Furbish lousewort and eastern prairie-fringed orchid, which occur within the range of the lynx in northern Maine. Both species have restricted distributions, and the plants are dormant during the trapping season. New England cottontails are evaluated in this EA (see discussion in Section 4.10.2).

The eastern cougar and gray wolf are federally endangered in Maine, but both species are believed to be extirpated from Maine. The closest breeding populations of cougars occur in Manitoba and Florida. Cougars that occur infrequently in the Northeast region are most likely released or escaped pets (McCollough 2011). We are aware of no cougars incidentally captured in traps in the Northeast since they were extirpated. The last cougar trapped in Maine was in 1938. For these reasons, conservation measures in the 5 Alternatives would likely have similar, minimal effects on cougars. MDIFW is not seeking an ESA section 10 permit for wolf or cougar because they are not currently known to exist in Maine.

Breeding populations of eastern Canadian wolves occur in Quebec, Canada north of the St. Lawrence River, approximately 75 miles from Maine. Barriers to the southward dispersal of wolves include the St. Lawrence River, extensive urban and agricultural landscapes, heavy trapping pressure, and Quebec policy to exclude wolves south of the St. Lawrence River. Thus, eastern Canadian wolves disperse into Maine and the Northeast very infrequently. MDIFW is not seeking a Section 10 permit for wolves

because they currently are not known to exist in Maine (draft ITP p. 5, see also 15859 FR 62, v.68). Since the mid-1990s, MDIFW has provided information to trappers about the potential presence of wolves in Maine. At this time, the probability of wolves being present and caught in traps in Maine is extremely low. The probability of incidentally trapping a wolf is so low that we cannot predict differences in effects between the conservation measures presented in Alternatives A, B, C, and D. If wolves were to successfully disperse into Maine, then some of the measures reducing take and injury to lynx (trapper education, excluding devices, and eliminate drags) would be expected to benefit wolves.

The Gulf of Maine DPS of the Atlantic salmon extends into the range of the lynx in northern Maine in the upper Penobscot and Kennebec Rivers. Atlantic salmon are present in streams and rivers (all life stages) during trapping season. Adults have been taken in conibear traps set for beaver and otter in spawning streams, however, these instances have been extremely rare (W. Mahaney, USFWS, pers. comm., July, 2009). Conservation measures in all 5 Alternatives are focused at upland trapping and do not modify aquatic trapping. Thus, trapping under all alternatives would have a similar, extremely low probability of taking a salmon. MDIFW is not seeking an ESA section 10 permit for Atlantic salmon.

The New England cottontail is one of the rarest mammals in Maine, is state-endangered, and a candidate for federal listing. New England cottontails have undergone a dramatic decline in their numbers and distribution in recent years. There are likely fewer than 200 rabbits in southern Maine (W. Jakubas, MDIFW, pers. comm.). Although New England cottontails have demographic characteristics that enable fast population growth, they occur primarily in small habitat patches where they experience low over-winter survival, primarily caused by predation (Litvaitis and Tash 2006). Deep snows and low survival at small habitat patches have reduced cottontail populations to just 17% of the sites that previously held cottontails in the mid-2000s (MDIFW 2009).

Trapping is not considered a threat to the species, but the New England cottontail has habits similar to snowshoe hares, which are frequently caught in traps (Barrett *et al.* 1989, Proulx *et al.* 1989, Mowat *et al.* 1994, Naylor and Novak 1994). We are unaware of records of New England cottontails caught in traps in Maine. There are several reasons why trapping is an extremely small risk to New England cottontails. The rabbit occurs in densely populated areas in southern Maine where trapping is not a common activity. Major population centers on the Sprague Corporation lands in Cape Elizabeth and the Wells Estuarine Reserve are closed to trapping as are other sites. Some of the populations are in within ½ mile of densely settled towns or villages, which are closed to trapping by MDIFW regulations (draft ITP, p. 199). We conclude risk to incidental trapping is extremely small for New England cottontail rabbits under all 5 alternatives considered in this EA. Trapping measures in Alternative C and D would not further reduce the small risk to New England cottontails because these measures would only be implemented in northern Maine WMDs 1-11, 14, 18 and 19. Under Alternative E, the currently extremely small trapping risk to New England cottontails would not be reduced because they occur in southern Maine where trapping would still occur. Habitat

mitigation under Alternatives B, C, and D will have no effect on New England cottontails because they only occur in southern Maine outside of the geographic area of the proposed mitigation.

Canada lynx

In Maine, a total of 53 lynx were incidentally-trapped and reported or otherwise documented from 1999-2010. Some of these lynx were caught in illegal trap sets or legal sets at the time that are no longer legal. The number of Canada lynx incidentally trapped and documented varied from 1 to 11 lynx annually (42 incidents are summarized in Table 4.2 p. 48 of draft ITP, which represents lynx taken through 2007; 4 were reported in 2008; 3 were reported in 2009, and 4 were reported in 2010). MDIFW biologists and trappers released most of the lynx caught by trappers, however 7 died; 6 in conibear traps (see details in conservation measure C.3) and 1 was shot by a hunter in a foothold trap (which was illegal). No lynx have been reported trapped or killed in conibear traps since revised leaning pole regulations were instituted in 2008. In addition, 1 had a broken leg (foothold with long drag chain), and several others were known to have injuries (lacerations, bruising, frozen toes) (draft ITP Table 4.1, p. 45). Twenty-four of the 42 incidental lynx captures in Table 4.2 of the draft ITP were released by trappers with no assessment of injury. There could be additional mortality from lynx trapped but not reported, lynx released with trap-related injuries, and kittens being separated from their mothers and unable to survive. MDIFW's research study documents that the majority (but not all) of lynx caught in foothold traps survive for at least several months after trapping (draft ITP pp. 18, 58). No comparison is available of the post release survival rates of radio-tagged lynx a) caught in foothold traps set by trapper, b) foothold traps set by researchers, and c) lynx caught in box traps.

The ESA recognizes several types of take. Take of lynx by trapping may include "harass, harm, shoot, wound, kill, trap, and capture" as defined by Section 9 of the ESA (see Section 1.2 of this draft EA for definitions). Complete case histories, including extent of injuries, for all incidentally trapped lynx are not known so it is difficult to accurately assign the type of take to all 53 incidents (and in most cases multiple types of take occurred in a single incident). All 53 lynx were trapped and captured. Five lynx were killed. Twelve lynx were wounded (Table 4.1 p. 45-47 in draft ITP). In addition, we would expect additional lynx to die from trap-related injuries after being released. Also, we speculate some kittens separated from their mothers would be expected to die.

The population-level effects of trapping on lynx populations for any of the alternatives in this draft EA are difficult to predict because important information is unknown. First, there is not a complete count or statistically valid estimate of the incidental take of trapped lynx. The 53 lynx reported or otherwise documented represents a minimum count and an unknown percentage of the actual number of lynx caught (draft ITP p. 117, Section 1.5 of this draft EA). Second, estimates of the size of Maine's lynx population (500 to greater than 1,000 by MDIFW, draft ITP p.21, Section 1.5 of this draft EA) are uncertain and lack statistical confidence limits. This is because reliable and statistically robust methods to evaluate lynx populations have not been developed, existing methods

are imprecise, or prohibitively expensive (Section 1.5 of this draft EA). In addition, the pattern and magnitude of fluctuation in Maine's lynx populations are unknown. However, we do know some important pieces of information. Lynx distribution has been documented using snow track surveys (MDIFW unpub. data, Robinson 2006, Simons 2009). Lynx home ranges, movements, population density, and demographic rates have been documented on the Clayton Lake study area (Vashon *et al.* 2008a, b). Satellite imagery has been used to document lynx habitat trends in Maine's northern forest since the early 1970s, and have been projected over the next few decades (Simons 2009). Hare fluctuations are well documented (Scott 2009). Long-term trends in climate change on lynx have also been projected (Gonzales *et al.* 2007, Carroll 2007), but are unlikely to affect populations over the 15-year life of a permit for trapping. Collectively, these sources of information help inform our analysis of the Alternatives.

The number of lynx incidentally trapped and killed in Maine is small compared to state or province-wide trapping programs where trappers specifically target lynx. In Maine, human-caused lynx mortality of any kind (including incidental trapping) would have the greatest effect at times when lynx populations fluctuate to very low levels as could occur during periods of low snowshoe hare density. Furthermore, Maine's lynx population is part of a larger population shared with New Brunswick and southern Quebec. Immigration into Maine could add to the resiliency of Maine's population.

In the draft ITP, MDIFW used Stella modeling software to develop a deterministic population model using demographic information from Maine lynx studies and previously published information on lynx resource relationships (Steury and Murray 2004) to estimate the effect of lynx trapping-related mortalities over the 15-year life of a Section 10 permit. After evaluating several scenarios, MDIFW concluded that the level of incidental trapping had only a small incremental effect on Maine's lynx population (draft ITP pp. 70-73, Appendix 7). Although not specified in the draft ITP, all population simulations predicted a rapidly increasing population. For example, in 1 simulation, an initial population of 651 lynx increased to 4,001 lynx in 15 years. Under another scenario, an initial population of 13 lynx increased to 45 animals.

We are aware of other population models for Maine lynx populations. For example, Paul Paquette used VORTEX population viability modeling software to develop a deterministic population model using similar demographic input as the MDIFW model to estimate the effect of lynx trapping-related mortalities and predicted a 16.4% annual population decline (testimony in *Animal Welfare Institute vs. Martin*, June, 2009). Some of the discrepancy may be attributed to slightly different survival rates, age of first maturity, and immigration rates used by Paquet. Carroll (2005, 2007) used spatially explicit models to evaluate the effects of habitat loss, trapping in Quebec, and climate change on the Maine-New Brunswick-Quebec lynx population. Based on the modeling exercise, he concluded that Quebec's lynx trapping program on the Gaspe would increase the vulnerability of lynx populations in southeastern Canada and northeastern U. S. (including Maine).

Discrepancies among population model outcomes could result from the type of model used (e.g., demographic vs. stochastic; spatially explicit vs. not), the mechanics of how computer programs run population simulations and the output, model assumptions, and sensitivity to slight changes in demographic inputs.

The Service continues to examine the model presented in MDIFW's draft ITP, as well as other models. Further, the Notice of Availability for this draft EA solicits comments on the model used in MDIFW's draft ITP. The effects of incidental take from the final permit on Maine's lynx population will be further evaluated in a final Biological Opinion under Section 7 of the ESA and Findings required under section 10(a)(1)(B)(iv).

4.11.1 Alternative A

Trapping under Alternative A (status quo, No Permit issued) would be expected to result in reported take similar to what has occurred since 2000 (i.e., 1 – 11 lynx reported annually; draft ITP Table 4.1 p.45; Table 4.2 p.48). We estimate the proportion of take in each category defined in the ESA will be similar under Alternative A to what has occurred in the past:

- "trap" or "capture" - 100% of trapped lynx are captured
- "harm" - approximately 50% of trapped lynx will be actually be injured or killed; 11 of 21 trapped lynx examined by MDIFW had some form of injury, mostly mild; "harm" is defined by regulation as any act which actually kills or injures fish or wildlife, such acts may include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife
- "harass" - 100% of trapped lynx are harassed; "harass" is defined by regulation as an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to breeding, feeding, or sheltering
- injure – 50% of trapped lynx will be injured (similar explanation to "harm")
- wound – 50% of trapped lynx will receive wounds (similar to injury)
- and kill (5% of trapped lynx die immediately or afterward from injuries).

MDIFW estimated take (all categories) to be 195 lynx over the next 15 years (5 killed, 190 trapped or captured, no further breakdown of category of take provided)(draft ITP, Table 4.5, pp.63-64.). The relationship between incidental take reported by trappers and actual take by trappers is unknown. Although 2008 regulations require mandatory reporting of incidentally caught lynx, there are reasons why some trappers may not report – concern about being fined and litigation associated with trapping a lynx. In their draft ITP, MDIFW does not specify whether the anticipated take is reported or actual take. If it is reported take, actual take could be higher depending on the proportion of incidentally trapped lynx that are reported.

Conservation measures in Alternatives A include measures that reduce the likelihood of killing or injuring a lynx: a 24/7 hotline for reporting lynx captures (A.3), 2008

regulations requiring mandatory reporting of lynx captures (A.12), 2007 regulations concerning use of bait (A.9), MDIFW staff at lynx captures (A.7), and the availability of veterinary assistance to rehabilitate injured lynx (A.8). The 2008 leaning pole restrictions for conibear traps (A.10) could reduce take, but these regulations have only been in effect for two years (2009 and 2010). No lynx have been reported taken in leaning pole conibear sets during this time (some may have occurred, but not reported) and compliance with regulations may be a problem (R. Rothe, USFWS Law Enforcment, 2009 pers. comm.). Commitments to monitor lynx populations and habitat (A.14) would improve knowledge on the status and distribution of lynx populations, but it is unclear if they will affect the amount or type of take from trapping. These measures are similar to those in Alternative B, and for this reason we believe the amount of incidental take of lynx under Alternatives A and B to be similar.

4.11.2 Alternative B

Trapping

The number of lynx reported taken and proportions in different types of take (1 – 11 annually, up to 13 reported/year per draft ITP) would be similar under Alternatives A and B (see discussion above) because the conservation measures are similar. With the exception of the restriction on size of foothold traps (A.11), trapping measures and regulations developed and implemented by MDIFW in the last 15 years would continue under Alternative B as outlined in the draft ITP.

Alternative B contains measures that could further reduce incidental take of lynx compared with current practices, although the incremental reduction in lynx take is difficult to quantify. Increased education and outreach about incidental take of lynx (B.1 and B.2) would better educate trappers about methods to avoid take. Most education would be focused at first-time trappers. Nonresident and older Maine trappers would receive mailings, but are unlikely to have first-hand instruction from trapping instructors or MDIFW staff. Developing guidelines to evaluate lynx injury (B.3) may help better diagnose injury and increase the chances of rehabilitating lynx.

Mitigation

The commitment to develop land management BMPs for landowners (B.5) may result in improving the quantity and quality of habitat, but there is no guarantee that landowners would use the guidelines. Monitoring and measuring the effectiveness of these measures would be difficult. Although conservation benefits are expected, many may be unquantifiable.

Unlike Alternative A, Alternative B (the draft ITP) proposed to mitigate trapped lynx mortality by creating 5,000 acres of new lynx habitat on public land, which should support at least 1 pair of adult lynx (draft ITP p. 102). MDIFW also wishes develop and implement forestry BMPs for private landowners (B.5, draft ITP p. 114). In principle this may provide tangible benefits to Maine lynx population and contribute toward lynx

persistence, though more specifics are need to evaluate the sufficiency of BMPs and agreements proposed in the draft ITP to meet our Section 10 issuance criteria.

4.11.3 Alternative C

Trapping

Under Alternative C, fewer lynx would be incidentally trapped and there would be fewer injuries than under Alternatives A and B because:

- A DVD would improve outreach for all trappers and provide specific instruction on how to avoid catch of lynx and trapping BMPs (C.1). The DVD would provide trappers with state-of-the-art instruction on which traps and techniques to use to avoid lynx capture, how to respond to lynx caught in traps, and general information about lynx and trapping. DVDs are inexpensive and can be easily distributed to all trappers and shown at all new trapper training sessions to ensure a consistent message. The DVD could also have some mitigation value if shared with other jurisdictions within the range of the lynx.
- Requiring a veterinarian to evaluate several lynx caught in traps (C.2) would provide valuable information on the nature and extent of injuries, can be used to train MDIFW personnel, can be incorporated into the DVD, and can be used in an adaptive sense to adjust how future incidents are handled.
- Requiring exclusion devices for all upland conibear traps (C.3) should reduce take of lynx in conibear traps because they would not be able to enter the devices and become trapped.
- Requiring phased in BMP traps (C.4) and eliminating drags (C.5) would ideally over time reduce injury and possibly mortality to lynx caught in foothold traps.
- Increased enforcement details (C.6), penalties (C.7), and joining the Wildlife Violator Compact (C.8) would improve compliance with trapping laws and reporting rates.

Alternative C would reduce all forms of take (trap, capture, kill, harm, harass, injure, and injury to lynx) compared to Alternatives A and B, but quantifying the improvements are difficult. Effective exclusion devices (C.3) should nearly eliminate all killing of lynx, which occurs primarily from upland conibear traps. Six of 53 incidentally trapped lynx occurred in conibear traps, and these traps were responsible for 4 of 5 lynx mortalities in Maine. Incidental capture of lynx would still occur in foothold traps, but use of traps that meet BMP standards, eliminating drags, and the results of the veterinary investigation may reduce foothold trapping injury and harassment.

Mitigation

Mitigation in Alternative C (10,000 acres of new lynx habitat on state land) has a greater chance of being supporting at least one breeding pair of lynx than mitigation in Alternative B (5,000 acres). During times of low hare density lynx may require larger home ranges, thus, larger areas of habitat are more likely to support resident lynx.

Because of the larger area, it is likely that mitigation in Alternative C would be more likely to contribute to lynx population persistence than mitigation in Alternative B. These measures would help offset lynx habitat losses anticipated in Maine over the next few decades (Simons 2009). Finally, mitigation under Alternative C may better compensate for all forms of take (including harm and wounding) by supporting more than 1 pair of lynx and their offspring during times when hare populations are high. Also, under adaptive management, trapping may be closed in mitigation areas on state land if monitoring shows that take from trapping has occurred.

4.11.4 Alternative D

Trapping

Fewer Canada lynx would be incidentally trapped and injured under Alternative D than Alternatives A and B because:

- A DVD would improve outreach for all trappers and provide specific instruction on how to avoid catch of lynx and trapping BMPs (C.1). The DVD would provide trappers with state-of-the-art instruction on which traps and techniques to use to avoid lynx capture, video of how to respond to lynx caught in traps, and general information about lynx and trapping. DVDs are inexpensive and can be easily distributed to all trappers and shown at all new trapper trainings to ensure a consistent message. The DVD could also have some mitigation value if shared with other jurisdictions within the range of the lynx.
- Requiring periodic retraining of all trappers (D.1) would ensure that all trappers receive the latest information on how to avoid capture and minimize injury to Canada lynx. It is likely that new approaches and techniques to trapping would be discovered as more information is learned about lynx captures. Periodic retraining is superior to outreach in Alternatives A, B, and C because it ensures all trappers receive regular and accurate training.
- Requiring that MDIFW personnel teach the endangered species/lynx module at trapper training will help ensure the correct information is being provided to trappers and will allow trappers to ask questions from a resource professional.
- Requiring a veterinarian to evaluate all lynx caught in traps (D.3) would provide valuable information on the nature and extent of injuries, can be used to train MDIFW personnel, can be incorporated into the DVD, can be applied to future trapper training, and can be used in an adaptive sense to adjust how future incidents are handled. (However, these benefits could be offset by causing further injury to lynx that must wait in traps until a veterinarian arrives.)
- Limiting conibear traps to size #120 or smaller (D.4) and requiring 24-hour tending requirements (D.5) but keeping leaning pole requirements would not eliminate incidental trapping in conibear traps, but the 24-hour tending requirement, in particular, may reduce death and injury from these kinds of traps.
- Requiring pan tension devices (D.7) would exclude lynx from some foothold traps, especially those set for coyotes

- Requiring immediate use of traps that meet BMP standards (D.6) and eliminating drags (C.5) may reduce injury and possibly mortality to lynx caught in foothold traps.
- Limiting trapping season to October and November (D.8) would reduce the chances of freezing injury to lynx caught in foothold or conibear traps.
- Increased enforcement details (C.6) and penalties (C.7) would improve compliance with trapping laws and reporting rates. These efforts, in combination with required reporting of trapped lynx (A.12) and better evaluation of lynx injury (B.3 and D.3) should result in more information on captured lynx. This information can be used to help adapt future trapping procedures and inform periodic retraining of trappers (D.1).

It is difficult to assess whether the conservation measures in Alternative D would result in less take (harm, harassment, injury) to lynx than Alternative C because there are a number of trade-offs. Instead of conibear exclusion devices, Alternative D employs smaller conibear traps required to be set in trees, 24-hour trap tending, reduced trapping season, immediate deployment of traps meeting BMP standards, and use of pan tension devices to minimize take. The effectiveness and tradeoffs involved are difficult to assess, because these combinations of measures have not been deployed in Maine or other jurisdictions having lynx. The exclusion devices in Alternative C should function to reduce nearly all take of lynx by conibear traps. This would likely be a superior choice over smaller conibear traps, 24-hour trap tending, and a reduced trapping season. Although conservation measures in Alternative D would decrease mortality and injury to lynx in conibear traps, these measures would not be as effective as exclusion devices in preventing lynx from being caught in these traps. Limiting upland use of conibears to #120 or smaller in trees would reduce some, but not all, potential for death and injury to lynx (a lynx in Maine was killed in a #120 conibear trap in 2005). Potential for injury from conibear traps would be further reduced by a 24-hour trap tending requirement and shortening of the trapping season. Both Alternatives C and D share many measures affecting foothold traps including eliminating drags, producing DVDs, participating in Wildlife Violator Compact, and requiring veterinarians evaluate trapped lynx (see Table 2.2). The immediate deployment of traps that meet BMP standards, reduced trapping season, and pan tension devices in Alternative D may minimize take and injury from foothold traps better than measures in Alternative C. In summary, Alternative C would result in less incidental take of lynx in conibear traps (primarily because of conibear exclusion devices) and Alternative D may result in less injury and mortality to lynx in foothold traps (primarily because all traps would adhere to BMP standards, full-time veterinary, shortened trapping season), but the likelihood of take in foothold traps would not be reduced in Alternative D.

Mitigation

Mitigation in Alternative D (at least 7,000 acres of new lynx habitat on private land) has a greater probability of supporting at least one breeding pair of lynx than Alternative B (5,000 acres on public land) because a) there is greater probability of supporting a breeding pair of lynx on a larger area when hare populations are low, b) there are many

more options for selecting high quality areas for lynx conservation on private lands than on state lands, and c) long term, legally binding management agreements would be required in Alternative D. Mitigation in Alternative D is likely to produce outcomes similar to Alternative C because both create similar amounts of lynx habitat. During times of low hare density and lynx populations are low, larger areas of habitat (i.e., mitigation in Alternatives C and D) are more likely to support resident lynx. For these reasons the mitigation in Alternative D would be better than the mitigation in Alternative B.

4.11.5 Alternative E

Trapping

The conservation measures in Alternative E include the most restrictive protection for lynx – an upland trapping closure in WMDs 1-11, 14, 18 and 19, which would eliminate nearly all incidental trapping of lynx in Maine. All forms of lynx take would be greatly reduced or eliminated if upland trapping were discontinued in northern Maine.

All 53 incidentally-trapped lynx reported or otherwise documented 1999-2010 occurred in WMDs 1-11, 14, 18 and 19. Occasionally (once or twice a year), lynx have been observed or killed on highways south of WMDs 1-11, 14, 18 and 19 but there is no evidence that breeding populations occur in these areas. Hoving's (2001) Maine lynx habitat model predicts no potential lynx habitat occurs outside of WMDs 1-11, 14, 18 and 19. Thus, there would be a very low probability of a lynx being incidentally trapped outside of WMDs 1-11, 14, 18 and 19.

Under Alternative E, MDIFW would continue some measures to avoid incidentally trapping a lynx – 24/7 hotline to report lynx captures (A.3), educate trappers (B.2), and respond to lynx captures (A.7) (section 2.2.5 of this draft EA). These measures would further prevent take and injury of lynx in the rare event that a lynx is trapped outside WMDs 1-11, 14, 18 and 19.

Mitigation

There is no habitat mitigation for lynx under Alternative E.

4.11.6 Summary of Environmental Consequences for Canada lynx:

MDIFW requests incidental take coverage for 13 lynx per year for 15 years (195 total lynx trapped) based on the number of incidentally trapped lynx reported in since 1999 (draft ITP Table 4.1 p.45; Table 4.2 p.48). This apparently does not account for lynx incidentally trapped, but not reported. We do not know what percentage of lynx are taken and not reported by trappers (see discussion of measure C.7 Section 2.2.3 of this draft EA). Non-reporting of incidental take and categories of take defined in the ESA will need to be addressed as part of the incidental take calculation in MDIFW's final ITP.

We anticipate that incidental take of lynx will occur under numerous categories as defined in the ESA; trapped, captured, wounded, and harassed, harmed, wounded, and killed.

Additional conclusions in Section 4.11

- The number of lynx trapped and captured in conibear and foothold traps would be least under Alternative E because upland trapping would be closed in northern Maine. Of the remaining 4 alternatives, the number of lynx trapped would be least in Alternatives C and D primarily because of conibear excluding devices (C.3), pan tension devices (D.7), and restricted trapping season (D.8). Alternatives A and B would have reported take similar to what is provided in the draft ITP (Table 4.11.6)
- Wounding lynx may be least under Alternatives C and D primarily because of conibear excluding devices (C.3), adherence to BMP trapping standards (C.4, D.6), eliminating drag sets (C.5), and on-site veterinary evaluation (C.2, D.3).
- Compliance with trapping regulations would be greatest under Alternatives C and D primarily because of increased enforcement details (C.6), increased penalties for not reporting take of lynx (C.7), Maine becoming a member of the Wildlife Violator Compact (C.8), and third party inspections and evaluation of compliance (D.10).
- Enforcement would be most effective under Alternatives C and D primarily because of increased enforcement details (C.6) and penalties for non-reporting (C.7).
- Lynx take would be most effectively mitigated under Alternatives C (C.9) and D (D.9) primarily because larger acreages of habitat would be created; long term, legally binding agreements would ensure mitigation is achieved, and larger acreages would better ensure mitigation goals are met even during times of low hare density.

4.12 Effects on outdoor recreation and economy

In accordance with recent national trends, trapping participation in Maine may decline slightly during the next 15-years, even in the absence of any measures contemplated in the alternative presented in this EA, although fur prices are currently favorable to keeping participation rates relatively stable. Current regulations protecting lynx and regulating trapping (e.g., conibear leaning pole regulations, mandatory reporting of lynx taken), seem to have little negative effect on recent trapping participation rates and trapping license sales have been stable. Encounters with trapped animals or trappers may negatively influence some individuals pursuing outdoor recreational activities, however, trapping is usually discreet and done at times of year when there are fewer people recreating in the outdoors.

4.12.1 Alternative A

Alternative A (status quo, Maine continues trapping program without a Permit) would not significantly affect outdoor recreation and the economy. However, without a Permit,

considerable uncertainty and controversy would affect the Maine trapping program. New statutes or regulations may be proposed to avoid and minimize take of lynx. MDIFW would continue to implement the trapping policies, statutes, and regulations developed over the last 15 years, which seem to have had little negative effect on the recreational experience of trapping. Measures instituted under Alternative A would not be expected to greatly affect other forms of outdoor recreation.

Alternative A would be anticipated to have minimal economic effects. Trapping organizations would incur minor expenses to maintain the current level of trapper education. MDIFW would incur expenses to increase education of trappers develop new regulations, if needed, and enforce them. The costs of implementing Alternative A are likely very similar to those enumerated in the draft ITP (Table 6.1 p. 125) and are generally less than $20,000 per year. The greatest expense is investigating incidental lynx captures ($10,000 per year). Economic activity associated with trapping (purchasing trapping supplies, gas, equipment, cabin rentals) would be similar to Alternative B because the number of trappers would likely decline slightly or remain stable over the next 15 years.

4.12.2 Alternative B

Trapping

Alternative B (the draft ITP as submitted) would not significantly affect outdoor recreation and the economy. Under Alternative B, no new rules or regulations would be proposed, and new commitments to reduce take of lynx would primarily focus on education and outreach approach. The conservation measures in Alternative B would be expected to have little negative effect on the recreational experience of trapping. Measures instituted under Alternative B would not be expected to greatly affect other forms of outdoor recreation.

Alternative B would be anticipated to have minimal economic effects similar to those described for Alternative A.

Economic activity associated with trapping (e.g., purchasing trapping supplies, gas, equipment, cabin rentals) would be similar under Alternatives A and B because the number of trappers would likely remain stable or decline slightly (paralleling recent national trends) over the next 15 years.

Mitigation

Creating 5,000 acres of lynx habitat on state land could be controversial. MBPL rarely uses clearcutting, in part because of the adverse public reaction to this form of silviculture. MBPL would likely used shelterwood or heavy partial harvest to create lynx habitat. Nevertheless, heavy cutting of 5,000 acres of public land may substantially affect outdoor recreation users of State lands from logging traffic, aesthetic changes to public land, and habitat changes that influence human uses of public lands. These

changes would likely draw some public opposition. However, changes would be temporary (15 to 25 years) as the forest matures and the public adapts to changes to the landscape.

Harvesting 5,000 acres would provide substantial revenue for the State. Average stumpage prices for spruce-fir sawlogs was $135/thousand board feet in Aroostook County in 2007 (Maine Forest Service www.**maine**.gov/doc/mfs/pubs/pdf/**stumpage**/07stump.pdf). An averaged stocked mature spruce-fir stand may have 9000 board feet per acre, thus harvesting 5,000 acres would have a gross value of $6 million (actual income would be less the costs of roads, logging crews, etc.). Several logging crews would be employed for many months to complete road construction and harvests. Local mills would benefit from the wood supply.

4.12.3 Alternative C

Trapping

Alternative C would impose additional conservation measures over Alternatives B that would moderately affect outdoor recreation and the economy. New equipment expenses (conibear excluding devices >$5 each and time to construct devices, traps meeting BMP standards ~$15 each, chains and swivels ~$2 per trap, stakes ~$2 per trap) would result in substantial costs to trappers. If the average trapper owns 111 traps (Duda *et al.* 2005) it would cost trappers at least $2,644 to re-outfit. Alternative C would phase in these costs over 5 years.

These increased costs would be expected to moderately diminish participation in trapping and contribute to ongoing declines in participation in trapping. However, fur prices are currently favorable to keeping participation rates relatively stable. Purchasing new traps, conibear excluding devices and equipment may encourage local trapping-related enterprise. New regulations may be met with reluctance by trappers and diminish their recreational and economic experience.

Some of the conservation measures in Alternative C may help neutralize negative public opinion of trapping. The public may have a higher opinion of trapping if measures are being taken to exclude non-target species from traps and reduce injury to trapped animals. In this way, Alternative C may generate more public support than Alternatives B.

Under Alternative C, trapping organizations would incur moderate expenses to address increased requirements for trapper education. In addition to costs associated with measures in Alternatives B, MDIFW would incur new expenses to develop a DVD, pay for veterinarians, implement BMP standards and eliminate drags, and increase enforcement details and penalties. The costs of implementing Alternative C would be about $150,000-$200,000 per year to pay for developing a DVD, hiring a veterinarian,

developing new regulations, and compliance monitoring. This is substantially greater than enumerated for Alternative B (Table 6.1 draft ITP p. 125).

Mitigation

Creating 10,000 acres of lynx habitat on state or another landowner's land would be controversial (e.g., 10% of 100,000 acres of state land in northern Maine). Focusing on the state-owned land, MBPL rarely uses clearcutting, in part because of the adverse public reaction to this form of silviculture. MBPL would likely used shelterwood or heavy partial harvest to create lynx habitat. Nevertheless, heavy cutting of 10,000 acres of public land will substantially affect outdoor recreation users of State lands from logging traffic, aesthetic changes to public land, and habitat changes that influence human uses of public lands. These changes would draw public opposition from some user groups. However, changes would be temporary (15 to 25 years) as the forest matures and the public adapts to changes to the landscape.

Harvesting 10,000 acres would provide substantial revenue for the State. Average stumpage prices for spruce-fir sawlogs was $135/thousand board feet in Aroostook County in 2007 (Maine Forest Service www.**maine**.gov/doc/mfs/pubs/pdf/**stumpage**/07stump.pdf). An average stocked mature spruce-fir stand may have 9000 board feet per acre, thus harvesting 10,000 acres would have a gross value of $12.2 million (actual income would be less the costs of roads, logging crews, etc.). Several logging crews would be employed for many months to complete road construction and harvests. Local mills would benefit from the wood supply.

4.12.4 Alternative D

Alternative D would have greater effect on trappers and the outdoor economy than Alternatives A, B and C. New equipment outlays (trapping equipment meeting BMP standards, chains, stakes, and drags, small conibear traps) would cost the average trapper about $2,600 (see Section 4.12.3 above), and trappers would have to re-outfit within 1 year of MDIFW receiving a Section 10 permit. New regulations may be met with reluctance by trappers and diminish their recreational and economic experience.

These increased costs and requirement to immediately outfit with traps that meet BMP standards would be expected to moderately lower participation in trapping and contribute to ongoing declines in participation. However, fur prices are currently favorable to keeping participation rates relatively stable. Purchasing new traps and equipment could encourage local trapping-related vendors.

Some of the conservation measures in Alternative D may help neutralize negative public opinion of trapping. The public may have a higher opinion of trapping if measures are being taken to exclude non-target species from traps and reduce injury to trapped animals. In this way, Alternative D may generate more public support than Alternatives A and B.

Trapping organizations would incur expenses to maintain the current level of trapper education. In addition to measures in Alternatives A and B, under Alternative D, MDIFW would incur expenses to develop a DVD, pay for veterinarians, implement BMP standards and eliminating drags, and increase enforcement details and penalties. The cost of implementing Alternative D may be $200,000-300,000/year and would be substantially greater than Alternative A and B (~$20,000, Table 6.1, p. 125 of draft ITP) and Alternative C (~$150,000-200,000/year) because of the costs associated with developing a mandatory trapper retraining program, enforcing immediate use of BMP and conibear trap standards, and hiring veterinarians to investigate all lynx captures.

Mitigation

Creating at least 7,000 acres of lynx habitat on private forest land would be less controversial than on State lands because there are greater than 8 million acres of commercial forestland in WMDs 1-11, 14, 18 and 19, and over 500,000 acres are harvested statewide each year. Clearcutting or shelterwood harvest would be the most effective and proven means of creating lynx habitat. Industrial forest landowner regularly use smaller clearcuts (<75 acres). Using larger clearcuts (250 acres is permitted under the Maine Forest Practices Act) to create lynx habitat could be controversial. Clearcutting 7,000-10,000 acres in 75-250-acre clearcuts on industrial forest lands will have little effect on outdoor recreation users of private lands because logging traffic is commonplace on private lands, the public is less sensitive to aesthetic changes to public forest land, and recreational uses are more dispersed on private lands than public lands. Habitat mitigation of 10,000 acres on private lands is less likely to draw public opposition from outdoor user groups and may even be welcomed by some (moose and small game hunters). Changes would be temporary (15 to 25 years) as the forest matures and the public adapts to changes to the landscape.

Harvesting at least 7,000 acres would provide substantial revenue for the private landowner and may be an incentive for cooperation. Average stumpage prices for spruce-fir sawlogs was $135/thousand board feet in Aroostook County in 2007 (Maine Forest Service www.**maine**.gov/doc/mfs/pubs/pdf/**stumpage**/07stump.pdf). An average stocked mature spruce-fir stand may have 9000 board feet per acre, thus harvesting at least 7,000 acres would have a gross value of at least $8.5 million (actual income would be less the costs of roads, logging crews, etc.). Several logging crews would be employed for many months to complete road construction and harvests. Local mills would benefit from the wood supply. Forest companies may need to forego precommercial thinning on mitigation lands to ensure the highest hare densities are achieved. Although this may save forest companies in the short term, it may cost them in the long term as longer rotation times may be needed to achieve marketable forest products.

4.12.5 Alternative E

Trapping

Alternative E (discontinue trapping in WMDs 1-11, 14, 18 and 19) would have the greatest economic affect of all the alternatives considered because it would discontinue upland trapping over half of the state. Although aquatic trapping would continue, if an upland trapping ban persisted for more than several years, trapper participation rates and trapping license sales would decline, perhaps by as much as half. Trapping opportunities and potential trapping income would mostly affect trappers that live in WMDs 1-11, 14, 18 and 19. Discontinuing upland trapping would also affect the many trappers that take vacations and travel to northern Maine to specifically trap marten, coyotes, and other species. This would affect trapping income to individual trappers and would be expected to have a substantial negative effect on camp owners, campgrounds, grocery stores and other businesses in northern Maine that provide goods and services to trappers in northern Maine. Although economic data are not available, discontinuing trapping in northern Maine would have a moderate negative effect on northern Maine's tourism economy because trappers and hunters comprise the majority of autumn use of northern Maine sporting camps.

Discontinuing trapping in northern Maine would also have implications to MDIFW and the state agency ability to conduct furbearer and other wildlife species management. Fewer trappers would purchase licenses, which would reduce income to MDIFW. MDIFW trapping license income is approximately $93,900 (i.e. 2100 residents at $35/license, 200 juniors at $9/license, 60 non-residents at $310/license, and 300 complimentary licenses, draft ITP p. 32). Without these funds, MDIFW may not be able to hire a furbearer biologist (who also has roles in conservation programs for rare and endangered species of mammals). The MDIFW Warden Service may experience increased costs to enforce a trapping ban in northern Maine. An upland trapping ban would be extremely controversial to trappers and groups that represent them, and MDIFW could incur substantial outreach costs to address the controversy.

The public may also have to bear additional costs. With fewer trappers, animal damage complaints will increase. Animal damage control costs would have to be paid for by MDIFW and the public.

Mitigation

Alternative E has no habitat mitigation.

4.13 Effects on environmental justice

The Executive Order on Environmental Justice issued by President Clinton on February 11, 1994 requires all Federal agencies to assess the impacts of Federal actions with respect to environmental justice. The Executive Order states that to the extent practicable

and permitted by law, neither minority nor low-income populations may receive disproportionately large and adverse impacts as a result of a proposed project. In 2008, median household income in Aroostook County in 2008 ($36,107) and Washington County ($31,856) was substantially lower than the state median income $46,419 (U. S. Census Bureau, http://quickfacts.census.gov). Average income for trappers in the Northeast in 2004 was $50,600, which is 19% lower than the total Northeast population (AFWA 2005). Nationally, household incomes of trappers in 2004 were: >$60,000 (36%), $40,000-60,000 (25%), $20,000-40,000 (27%), and <20,000 (12%)(AFWA 2005). Nationally, average annual income of trappers has risen substantially. In 1992 average annual income was 20% lower than the national average income, whereas in 2004 it slightly exceeded the national average (AFWA 2005). Average income from trapping in the Northeast was $1,587 and expenditures were $924. Alternatives C and D require purchase of about $2,500 of new trapping equipment, which may disproportionately affect those trappers with low annual incomes. Alternative E would reduce or eliminate trapping income by discontinuing upland trapping in northern Maine. This could affect an important source of income for some low-income trappers. Thus, Alternative E would likely have the greatest effect on low-income trappers. Alternative A and B would have the least effect on low-income trappers. Alternatives C and D would have the substantial effect on low-income trappers because of required new equipment purchases. Minority or low-income populations are not likely to be displaced but low income individuals (~37% of trappers) could be negatively affected by the Alternatives C, D, and E. All four recognized tribes in Maine, the Passamaquoddy, The Penobscot Indian Nation, the Houlton Band of Maliseets, and Aroostook Band of Micmacs have lands in WMD 1-11, 14, 18 and 19. Changes in trapping laws may affect trappers in Maine's Native American communities that may trap outside of their trust lands. Maine's Native American's control trapping activities on trust and reservation lands, and the alternatives considered in this draft EA would not pertain to these lands.

4.14 Cumulative effects

Cumulative impacts, as defined by the U.S. Council on Environmental Quality (40 CFR §1508.7), are impacts on the environment which result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. This analysis considers all reasonably foreseeable, relevant factors that could contribute to cumulative impacts on the Canada lynx, furbearer species, and other incidentally trapped wildlife and associated biological/socioeconomic environmental factors that were considered in this draft EA. This cumulative impacts analysis focuses on WMDs 1-11, 14, 18 and 19 in northern Maine because this is where Canada lynx occur and trapping conservation measures will occur. We also take into consideration that MDIFW requests a Section 10 permit for statewide coverage and a duration of 15 years.

Maine's statewide trapping program will result in take of furbearer species and incidental take of Canada lynx and other incidentally trapped wildlife under all 5 alternatives

considered in this draft EA. In addition to trapping, mortality of these wildlife populations occurs by other natural causes including predation, disease, competition with other species, starvation, and other factors. Anthropogenic-related sources that incrementally add to wildlife mortality in Maine including vehicle collision, power lines, wind turbines, exposure to toxins and pollution, hunting (for some species), and incidental take by trapping. The Service recognizes that these factors will continue to play a role in the mortality of wildlife in Maine, although the intensity of any 1 factor may vary from year to year, making it difficult to predict cumulative impacts. For furbearers, the adaptive process MDIFW uses in setting regulations and harvest quotas based on annual assessments of population status ensures that harvest regulations are consistent with long-term conservation of these species. The effects of incidental trap mortality is less certain for lynx and other non-target species of wildlife, because the magnitude of the number trapped and population status of these species are uncertain, and the ability of these species to withstand trapping mortality in addition to other sources of mortality has not been studied.

The factors that will have the greatest influence on northern Maine's forest in WMD 1-11, 14, 18 and 19 in the next 15 years (the duration of the incidental take permit) to 50-80 years (the duration of mitigation) include changing land ownership patterns, changing forest practices, energy-related development, residential and resort development, and climate change. These factors may interact to produce additive, countervailing and synergistic effects with the different levels of incidental take from trapping considered in the 5 alternatives evaluated in this draft EA.

Changing ownership patterns

Changing landownership in northern Maine is expected to continue in the reasonably foreseeable future. Frequent changes in land ownership affect the ability to conserve wildlife and warrants further discussion here. Many of Maine's logging industries and large family ownerships traced their ownership back to the 1800s. Large corporations that owned paper mills, sawmills, and other wood processing facilities owned lands that supplied their mills. However, in the 1980s and 1990s, changing global markets, the inability of Maine mills to keep up with technological advances, depressed economic conditions, and environmental concerns contributed to major shifts in forest ownership. Between 1980 and 2005, approximately 23.8 million acres changed ownership in northern Maine representing a shift from industrial and family ownership to a variety of financial investors, real estate development trusts, private individuals, and conservation organizations. In 1994, forest industry owned about 60% (4.6 million acres) of the large tracts (>5,000 acres) of timberland and investors owned about 3%. By May, 2005, financial investors owned about 33% of the large forest tracts and industry owned only 15.5% (1.8 million acres, mostly in a single ownership) (Hagan *et al.* 2005). Forest lands continue to be sold in northern Maine. One implication of the shift to investor owners is that interest in biodiversity practices has declined (Hagan *et al.* 2005). Most forest blocks have remained intact, however, there is a trend toward subdivision and smaller parcel sizes. New investor owners typically sell land holdings within 10-15 years. Furthermore, investors are looking for much higher rates of return (sometimes

several times that based on the actual growth rate of the forest) than was sought by the previous generations of owners. These trends will make it more difficult to secure long-term management agreements that could benefit lynx and other wildlife. Investor owners may not be interested in 70-year management plans (unless there are financial incentives) and likely will sell their lands before wildlife benefits can be realized. Existing management agreements may become negated when lands are sold unless there are legally-binding agreements or easements. On a positive note, because of the rapid land turnover, conservation groups have purchased fee title or easements on about 2 million acres in northern Maine. Easements usually require binding commitments by the owner to a forest certification program and associated management plans, which requires planning for biodiversity and endangered species. For example, Plum Creek Timber Company, Inc. recently encumbered its lands with a 363,000-acre conservation easement held by The Nature Conservancy and the Forest Society of Maine as a precondition of the Land Use Regulation Commission's rezoning process (which is currently contingent on state rezoning decisions being upheld in Maine courts). The Nature Conservancy also purchased 284,000 acres in northern Maine and is developing a model management system for lynx and pine marten under the Healthy Forest Reserve Program.

Maine's northern forest is likely to undergo cycles of real estate sales for the foreseeable future. Continued sales of forest land are predicted to result in 1) increased parcelization, 2) increased residential development and fragmentation of forestlands, 3) heightened concerns and regulations over timber harvests and recreational use, 4) reduction in land area available for timber harvests, recreation, and tourism, 5) decreased landowner investment in forest management, 6) increased taxes, and 7) increased traffic and congestion that may affect timber hauling costs (Alig *et al.* 2004). For the foreseeable future, conservation groups like The Nature Conservancy, Appalachian Mountain Club, and the Forest Society of Maine are expected to continue to pursue opportunities to purchase conservation easements. If successful, this will help offset future development pressures on northern Maine forests.

Changing forest practices

Starting in about 1783 northern Maine was divided into six-mile square townships that were sold at auction. Large tracts were purchased by individuals interested in timber speculation. By the time Maine became a state in 1820 over half of Maine (10 million acres) had been sold or granted. The lumber industry, concentrated in the undeveloped lands in northern Maine, became an important part of the Maine economy starting in the 1830s (Smith 1972). Early timber harvest was concentrated on large diameter white pine (for housing and ship building) and within several decades had shifted to smaller diameter spruce for the developing paper industry. Saw mills and paper mills flourished along Maine's major rivers, which were the primary corridor to move logs from the Maine woods. Today, the forest products industry is the largest industry in the state. Over 94% of the state's forest lands (16.7 million acres) are privately-owned. Maine is the most heavily forested state in the country (90% forested). The largest tracts of undeveloped forestland in the eastern United States are found in the western, northern, and eastern areas of the state.

The nature of logging changed little during the first half of the 1900s. After World War II, chainsaws replaced axes and tractors and skidders replaced horses, but otherwise the economics and nature of Maine's forest industry was similar to that of the late 1800s. In the 1960s and 1970s increasing environmental concerns about river driving of logs, pollution in Maine's rivers from paper mills, and a spruce budworm epidemic greatly changed the nature of the forest industry in Maine. River drives were discontinued on Maine rivers in the 1970s. In the 1970s and 1980s thousands of miles of logging roads were built to salvage large volumes of timber killed by the spruce budworm opening vast areas of previously accessible areas to logging and the public. Hundreds of thousands of acres of clearcuts were used to salvage diseased timber. Negative public reaction to clearcuts resulted in the Maine Forest Practices Act in 1989 and 3 subsequent public referenda to ban clearcutting in the 1990s. This public reaction prompted forest industry to undergo major changes, and clearcutting was replaced primarily by partial harvesting in the 1990s and early 2000s. In the 1990s increasing concern about conservation and the health and sustainability of Maine's forest prompted landowners to adopt biodiversity standards, and many landowners enrolled in sustainable forestry programs. In the last decade, mechanized logging machinery has eliminated chain-saw crews.

Clearcuts during the 1970s and 1980s in combination with herbicides to remove hardwood competition provided extensive regenerating softwood stands. This young forest created habitat that supports Maine's current lynx population (Hoving 2005). Because of the extensive, optimal habitat, lynx numbers were possibly at historic highs in the early 2000s. At their peak in the early 2000s, hare densities in regenerating Maine clearcuts averaged 2.0 to 2.5 hares/ha (Lachowski 1997, Robinson 2006), which is comparable to hare population in many areas of Canada and Alaska at the peak of the 10-year hare cycle (Poole and Graf 1996, Mowat *et al.* 1997, Krebs *et al.* 1986, Bailey *et al.* 1986, Hodges 2000a). Peak hare densities as high as 5.9 to 11.8 hares/ha (Keith and Windberg 1978, Sullivan 1994) occur in some parts of Canada.

Since the inception of the Maine Forest Practices Act (1989) there has been a major shift in silviculture from clearcutting to various forms of partial harvesting. To harvest the same volume of wood, twice the acreage (about 500,000 acres per year) is cut under partial harvesting-dominated systems in contrast to 250,000 acres cut annually under clearcut-dominated systems. Regenerating partial harvested stands support less than half the snowshoe hare density (0.8 hares/ha) than regenerating clearcuts (2.0 to 2.5 hares/ha)(Robinson 2006). Landscape hare densities needed to support lynx are believed to be about 0.7 hares/ha (Simons 2009, Scott 2009) to 1.1-1.8 hares/ha Steury and Murray 2004). Loss of regenerating clearcuts and extensive partial harvesting will contribute to decline of lynx habitat, which is expected to reduce lynx densities by 65% by 2032 (Simons 2009). This does not take into consideration cycles or fluctuations in hare densities that may occur in the future. From 2006-2010 hare densities in Maine and southern Quebec dropped by 50% even in optimal, regenerating clearcut stands (Assels *et al.* 2007, Scott 2009) then began to recover in 2010-11 (D. Harrison, UMaine, unpub. data). Landscape hare densities (about 0.4 hares in partial harvested stands and 1 hare/ha in regenerating clearcuts) during low hare populations could be low enough to no longer

support lynx in some portions of northern Maine (Scott 2009). MDIFW lynx studies documented a near absence of reproduction and higher adult mortality 2007-2009 (J. Vashon, pers. comm., 2010), which is a likely response to the hare decline.

Maine's forest products industry is part of a global industry influenced by international markets, consumer demand, labor and environmental regulations, real estate trends, distribution costs and technologies, climate, and changing forest conditions. Global demand for timber-related building and consumer products will undoubtedly increase in the future. Maine's forest may play an important role in carbon sequestration and cap-and-trade policies, and carbon credits could become a new source of income to northern Maine landowners. The nature of markets for forest products will largely determine the silvicultural systems use in future forestland management, which in turn determine the quantity and quality of habitat for wildlife.

Energy related development

Until recently, Maine's northern forest has contributed little role to regional or national energy needs. In 1920 the Great Northern Paper Company built the Ripogenus Dam to power their paper mills in Millinocket. Waters on the upper Kennebec in the Moosehead Lake region are impounded as storage for downstream power generation. At one time, the Dickey-Lincoln dam was proposed for the St. John, but was decommissioned, in part, because of the presence of the federally-endangered Furbish's lousewort. Otherwise, there is little hydro development, and most of this 8 million acre forest is undeveloped and lacks electrical infrastructure. There has been increased interest in the energy potential of the area. Maine forests supply 20% of the state's electrical needs, and 25% of overall energy (NEFA 2007). Nine biomass-fueled electricity generating plants and 3 wood pellet mills are located in Maine, with additional mills being planned. The U. S. Department of Agriculture Biomass Crop Assistance Program was initiated in 2010 and will spend hundreds of thousands of dollars to subsidize forest biomass energy production in the state. Biomass harvesting could greatly change silviculture of Maine's northern forest. As of 2010, at least 7 wind projects have been proposed in northern Maine and 2 projects are in operation. Increasing power infrastructure associated with these projects could greatly change development potential and patterns in northern Maine.

Residential and resort development

Maine's northern forest is unique in that there is little history of development in northwestern Maine. Several small farms and villages existed to support the logging industry and railroads in the early days of Maine's logging history, but they all vanished as logging became increasingly mechanized and road systems were created. Logging camps housing wood cutting crews persisted into the 1980s, but are almost a relic of the past now that chain saw logging is no longer used. The remains of hundreds of small "roll" dams are evident in northern Maine and were once used for storing timber and providing water to flush pulp logs down rivers and streams. Several hundred camps and cottages permitted by the Land Use Regulation Commission occur in the region.

One implication of changing land ownership (see discussion above) in northern Maine is that some owners seek to convert forestlands to real estate development and resorts. In 2009 the Maine Land Use Regulation Commission approved the Moosehead Lake concept plan for Plum Creek, which rezoned a large area to potentially allow development of about 1000 house lots and 2 resorts on 17,000 acres within the range of the lynx. This represents the largest development project in Maine's history.

Trends toward increased development are expected to increase in Maine's forested areas (Stein *et al.* 2005). Even in remote areas, forest land values have risen to prices above their forest management values (LeVert *et al.* 2007). "Shadow conversion" occurs when development predisposes forested areas to future forest management and is expected to magnify the effect of residential development on Maine's forest industry. Over time this is expected to affect the state's forest-based economy (Alig *et al.* 2004).

For the foreseeable future, development demands will be greatest around the fringes of the Maine woods where infrastructure (electricity and roads) provide easiest access to support residential development. There are currently no utilities in the interior of Maine's north woods, which greatly reduce development potential, but that could change with increasing wind and biomass power interest in the region.

Climate change

Between 1300 and mid-1800s, the northern hemisphere experience unusually cold temperatures referred to as the "Little Ice Age" (Lamb 1977). In the Northeast, the coldest temperatures occurred during the 1770s, with gradual warming through the 1800s (Baron 1992). Snowfall duration and depth was substantially greater than in recent times (Brook 1917). The extensive spruce-fir forest of Maine is a relatively recent phenomenon tied closely to the cool, moist climate of the Little Ice Age (Schauffler 1998, DeHayes *et al.* 2000).

For the past century the rate of warming in Maine has been increasing (Jacobsen *et al.* 2009). Today, Maine's climate is warmer and wetter than it was 30 years ago (Jacobsen *et al.* 2009). These changes have affected plant growing conditions, and horticultural plant hardiness zones for Maine have recently been shifted by 1 zone to the north. Effects of climate change on Maine's forested ecosystems are anticipated. Recently, a warming climate and selective logging for conifers has resulted in an increase in deciduous forest in northern Maine (Russel *et al.* 1993, Seymour 1992). Northward range shifts of birds and mammals have been observed in recent decades.

The effects of climate change on Maine's ecosystems, wildlife populations, and specifically Canada lynx are of increasing concern. The potential magnitude for ecosystem change from climate change will interact with other stresses on northern Maine forests - ownership patterns, changing forest practices, and energy and residential development. The 2009 report *Maine's Climate Future* (Jacobsen *et al.* 2009) predicts

major changes in Maine's flora and fauna, increased wildfire, and changing precipitation and snow conditions that will greatly affect ecosystems within the next 100 years.

During the 15-year life of this Permit, climate change will likely have negligible effects on Maine furbearers.

Lynx depend on extended periods (>4 months) of deep, fluffy snow, thus are vulnerable to climate change (Gonzales *et al.* 2007). Gonzales *et al.* 2007 estimate that up to 2/3 of potential lynx habitat could be lost in the lower 48 states by 2100, and Maine may lose its lynx population in the foreseeable future. Areas of boreal forest could shift northward as much as 200 km by 2100. Wildlife biologists expect that once annual snowfall declines below 270 centimeters per year (106 inches) for lynx (Hoving *et al.* 2005) and 192 cm/yr (76 inches) for marten (Krohn *et al.*1995) these 2 species will decline and could eventually disappear from the state. They would likely be replaced with 2 closely related but less snow-adapted species, the bobcat and the fisher. Given these predictions, maintaining lynx habitat in Maine will require intensive natural resource management intervention (Gonzales *et al.* 2007).

Interactions among effects

During the 15-year life of the Permit, we can reasonably predict that lynx habitat will continue to decline; forest land ownership will be unstable; energy, second-home and resort development will increase; and trapping effort will decline in parallel with national trends. Climate change will incrementally affect snowfall and forest composition, but the short-term effects are anticipated to be small.

Following national trends, trapping is expected to decline in the next century. However, demand for trapping for the most valuable fur species (e.g., beaver, marten, fisher) will likely continue. Unless carefully managed, trapping, could place incremental stresses on furbearer species and incidentally-trapped species already affected by changing forest management, climate change, and development. The Canada lynx and pine marten have been identified as sensitive to climate change and other environmental stresses (Jacobsen *et al.* 2009, Whitman *et al.* 2010, Gonzales *et al.* 2007, Carroll 2007). Boreal species that are common today (e.g., gray jays and northern flying squirrels) could become rarer in the future because of climate change.

In turn, changing land ownership, changing forest practices, residential and energy development, and climate change will undoubtedly have a significant effect on trapping participation and effort. These stressors are likely to significantly change trapper activity, trapping seasons, season lengths, and fur conditions. Changing land ownership and residential and energy development could result in land posting and restricted access (gated areas) that would limit trapping activity. Within a century October temperatures in Maine are predicted to be as warm as September is currently (Jacobsen *et al.* 2009). The absence of snow could increase trapper mobility. The cost of fuel, carbon emission restrictions, or changing landowners could affect trapper participation. Fur may become less fashionable and practical in a warmer world. Increased development and ecotourism

in northern Maine could cause conflict between trappers and other outdoor user groups. Changing forest practices and climate change could affect some furbearer populations. For example, biomass harvesting and a warmer climate could greatly diminish mature spruce-fir and reduce pine marten populations, which would likely exacerbate declines in trapping participation and effort. Even without the stressors mentioned above, participation in trapping in Maine is anticipated to continue to decline in the foreseeable future.

Carroll (2007) modeled the incremental effects of habitat change, climate change, lynx population cycles, and trapping on regional lynx and marten populations in eastern Canada and Maine. Maine's population of lynx was more vulnerable to climate change than populations in New Brunswick and Gaspe, Quebec where there was greater elevation relief. Maine lynx populations were expected to decline 59% by 2055 because of climate change. Lynx trapping in Quebec could increase vulnerability of Maine and New Brunswick's lynx populations, even though lynx are not trapped in the latter jurisdictions. Carroll found that an increase of 10% lynx harvested on the Gaspe region of Quebec could exacerbate the expected declines in Maine's lynx populations from climate change and habitat changes. Lynx population cycles would further reduce the likelihood of persistence of Maine's lynx population.

Although the long-term cumulative effects from changing land ownership patterns, changing forest practices, residential and energy development and climate change may substantially influence the human environment in Maine, the incremental effects of trapping over the 15-year life of this Permit will be negligible. Furthermore, most of the effects of alternatives evaluated in this EA, including population-level effects on wildlife, would be reversed over just a few years if a different approach is adopted at the end of the 15 year Permit life.

Cumulative effects and the alternatives considered

In this final section addressing cumulative effects, we evaluate how the conservation measures in the 5 alternatives considered in this draft EA interact with changing land ownership patterns, changing forest practices, residential and energy development and climate change to affect the human environment.

Alternatives A and B would likely result in the greatest incidental take of non-target wildlife species, although exposed bait provisions have likely reduced incidental take of birds in recent years. Most non-target species trapped are not rare, threatened or endangered (with the exception of bald and golden eagles, see section 4.10.1 of this draft EA), and populations are likely able to withstand some loss. Incidental take of boreal species (e.g., gray jays, snowshoe hares, northern flying squirrels, red squirrels which are all abundant today) from trapping is likely to be compensatory in the short term (i.e., trapping takes excess animals that would have normally died from other causes and does not affect population viability), however, climate change will eventually negatively affect these species' populations and incidental take may exacerbate future population declines. We believe this is unlikely to occur within the 15 year life of a Section 10 permit,

because gray jay, snowshoe hare, northern flying squirrels, and red squirrels will likely continue to have robust populations in Maine during the next 15 years.

Alternatives A and B would result in the greatest incidental take of lynx. The degree to which incidental trapping of lynx would exacerbate anticipated or ongoing lynx population declines from other stressors (hare fluctuations, habitat declines, climate change) is unknown. As discussed in section 4.11 of this draft EA, population models could help predict the additive effect of increasing lynx mortality from incidental trapping.

Alternatives C and D would likely result in fewer non-target wildlife taken than Alternatives A and B because of more restrictive conservation measures (especially conibear excluding devices, pan tension devices, increased compliance, see analysis in section 4.10.3 and 4.10.4 in this draft EA). In particular, conibear excluding devices in Alternative C should nearly eliminate take of birds and many non-target mammals. Although the long-term cumulative effects from changing land ownership patterns, changing forest practices, residential and energy development and climate change may substantially influence the human environment in Maine, the incremental effects of trapping, particularly for Alternatives C and D, over the 15-year life of this Permit will be negligible.

Alternatives C and D would likely result in fewer lynx taken than Alternatives A and B. As discussed in section 4.11 of this draft EA, population models could help predict the effects of anticipated take of lynx from incidental trapping, especially in the context of other stressors and sources of mortality.

Alternative E would have the least likelihood of exacerbating other stresses on lynx and other non-target wildlife as there would be no trapping of upland furbearing species in the northern part of the state. Although lynx and other boreal wildlife populations have a high probability of declining in the next century as a result of the combined contributions of changing land use, changing forest practices, residential and energy development, and climate change, trapping under Alternative E would contribute little to these declines.

4.15 Summary of Environmental Consequences

The Environmental Consequences are summarized in Table 4.15. The 5 alternatives had negligible effects on air quality, geology, soils, water quality, vegetation, threatened and endangered species (other than lynx), and cultural and economic resources. All 5 alternatives affect Canada lynx, furbearer species, and incidentally trapped non-target wildlife species:

- Furbearer populations are affected by trapping, but all species (with the exception of pine marten) are believed to have robust populations that are not sensitive to anthropogenic environmental changes (including climate change) in the foreseeable future. Furbearer harvest under Alternatives A and B would remain at their current levels. Furbearer harvest under Alternatives C and D perhaps may be reduced if trapper participation declines because of increased trapping

requirements. Alternative E would reduce furbearer harvest in Maine significantly because upland trapping would be closed in northern Maine.

- Discontinuing upland trapping (Alternative E) would greatly reduce trapper participation and effort. Alternatives C and D are the next most restrictive and are likely to reduce trapper participation and effort, which would diminish future furbearer harvests. Alternatives A and B have the least restrictive conservation measures and are unlikely to have an effect on trapper participation and effort and future harvests.
- Non-target species are likely to be incidentally caught in foothold and conibear traps under all alternatives, as many studies show trapping is not completely selective for target species. The number of non-target wildlife trapped would be least under Alternative E because upland trapping would be discontinued in northern Maine. Alternatives C and D may reduce non-target wildlife mortality and injury by employing conibear excluding devices, foothold traps that meet BMP standards, eliminating drags, and other measures that will improve trap selectivity, lower injury rates, and improve animal welfare. Alternatives A and B would reduce non-target wildlife mortality and injury through increased trapper education, exposed bait regulation, and leaning pole regulations (although the number and species of non-target wildlife taken in leaning pole sets is unknown). Incidental trapping has the greatest effect on species having small populations, especially of rare, threatened, and endangered species. However, the species most likely to be incidentally trapped in Maine are abundant, widespread, and are not considered rare, threatened, and endangered (with exception of bald and golden eagles). Although many individuals may be trapped, it is unlikely that robust populations will be affected.
- Take of Canada lynx (trap, kill, injure, harm, harass) would occur with Alternatives A – D, but would not occur under Alternative E in the regulated area because upland trapping would be discontinued in northern Maine. Mortality and injury would be greatest under Alternative A and B because many of the conservation measures currently in use and enumerated in the draft ITP are focused primarily on outreach and education in nature, and the effectiveness of 2008 leaning pole regulations is not fully understood. Mortality and injury would be least under Alternatives C and D because of restrictive measures (excluding devices, traps meeting BMP standards, no drags), increased compliance and increased enforcement (increased enforcement details, mandatory fines, Wildlife Violators Compact). Incidental lynx mortalities are likely to have the greatest effect when populations are small and declining (as could occur when snowshoe hare populations are low).
- The environmental consequences of habitat mitigation in Alternatives B, C, and D are small. Mitigation would create from 5,000 to 10,000 of early successional habitat for lynx. This area is small in the context of 8 million acres of forestland in northern Maine and 500,000 acres of forestland harvested annually in the state. Mitigation in Alternatives B, C, and D would replace mature forest with young forest, and would have negative effects on pine marten and their habitat, which is limited in northern Maine.

Table 4.15 Summary of Environmental Consequences by Alternative

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
Physical features: ***Geology and soils*** ***Hydrology and water quality*** ***Air quality*** ***Climate change***	All conservation measures	Effects occur statewide. Geology and soils – minor anticipated effect on soils Hydrology and water quality – no anticipated effects Air quality – minor anticipated effects Climate – minor anticipated contribution of greenhouse gasses No mitigation, thus no effects from logging	Effects occur statewide. Effects the same as Alternative A except habitat mitigation creating 5,000 acres of early successional forest would result in greater soil disturbance from permanent and temporary logging roads	Effects the same as Alternatives A and B except habitat mitigation creating 10,000 acres of early successional forest would result in greater soil disturbance from permanent and temporary logging roads - similar air emissions and contribution to climate change as Alternatives A and B	Effects the same as Alternatives A and B except habitat mitigation creating at least 7,000 acres of early successional forest would result in greater soil disturbance from permanent and temporary logging roads - increased air emissions and slightly greater contribution to climate change than Alternative C because of daily conibear trap tending requirement, but still minor	Effects limited to central and southern Maine because of discontinuing upland trapping in northern Maine. Geology and soils – minor anticipated effect on soils Hydrology and water quality – no anticipated effects Air quality – minor anticipated effects Climate – minor anticipated contribution of greenhouse gasses No mitigation, thus no effects from logging.

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
Biological features: ***Vegetation and native plants Wetlands and waters***	All conservation measures	Effects occur statewide but are minor because most plants are dormant during trapping season. Vegetation and plants – minor, temporary anticipated effects from trappers disturbing vegetation Wetlands and waters – minor, temporary anticipated effects No mitigation, thus no effects from logging	Same as A, except habitat mitigation would result in: - vegetation changes on 5,000 acres of state-owned forest converted from mature to early successional forest - possible stream crossings associated with logging	Effects the same as Alternatives A and B except habitat mitigation would result in vegetation changes on 10,000 acres of state or another owner's forest converted from mature to early successional forest - possible stream crossings associated with logging	Effects the same as Alternatives, A, B, and C except habitat mitigation would result in vegetation changes on at least 7,000 acres of privately-owned forest converted from mature to early successional forest - possible stream crossings associated with logging	Effects less than Alternatives A – D and limited to central and southern Maine because of discontinuing trapping in northern Maine. Vegetation and plants – minor, temporary anticipated effects from trappers disturbing vegetation Wetlands and waters – minor, temporary anticipated effects No mitigation, thus no effects from logging
Cost to trappers and land use	All conservation measures	Economic effects occur statewide but are minor because there are no significant changes to Maine trapping program Land use – trapping has minor effects	Economic and land use effects similar to Alternative A.	Economic effects include increased cost of conibear excluding devices, stakes and chains, and trapping equipment meeting BMP standards. Cost may be hundreds of dollars per trapper. Land use effects	Economic effects include increased cost of stakes and chains, trapping equipment meeting BMP standards, pan tension devices. Cost is greater to trappers than Alterntive C. Land use effects similar	Effects limited to central and southern Maine because of discontinuing trapping in northern Maine. Substantial economic costs to those to live and trap in northern Maine. However, no new equipment requirements for those

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
				similar to Alternatives A and B	to Alternatives A - C	who trap in central and southern Maine. Land use – trapping has no anticipated effects
Cultural, archaeological, paleontological resources (National Historic Preservation Act)	All conservation measures	Effects statewide. Trapping has minor anticipated effects because trapping is not allowed within ½ mile of densely settled areas. Impacts to archaeological and paleontological sites are minor because of shallow excavation for some traps. No mitigation, thus no effects from logging	Effects similar to Alternative A except habitat mitigation on state lands could result in effects to cultural resources from logging on 5,000 acres on state lands. Procedures in place on state lands to identify cultural resources.	Effects similar to Alternatives B except habitat mitigation on state lands could result in effects to cultural resources from logging on 10,000 acres on state or another landowner's lands. Procedures in place on state lands to identify cultural resources.	Effects similar to Alternatives B and C except habitat mitigation could result in effects to cultural resources from logging on at least 7,000 acres on state lands.	Cultural and paleontological resources – trapping has minor anticipated effects No mitigation, thus no effects from logging
Furbearers and non-target wildlife	Outreach and education	Minor continued reduction in the number of animals trapped and non-target species incidentally trapped. Numbers taken would likely stay at current	Outreach and anticipated effects on take of furbearer species and non-target wildlife are similar to Alternative A.	Restrictions in Alternative C could reduce trapper effort and number of furbearers caught annually.	Same as Alternative C.	Level of outreach would likely contributed to reduced numbers of eagles trapped and encouraged trappers to report incidents.

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
		levels. Level of outreach has likely contributed to reduced numbers of eagles trapped and encouraged trappers to report incidents. No mitigation, thus no effects from logging	Outreach with Maine Trappers Association (B.2) could reduce take of non-target species	Outreach associated with Alternative C improve protection of non-target wildlife. DVD (C.1) could teach techniques to increase specificity of traps and reduce take of non-target species and would result in fewer non-target animals being taken than Alternatives A or B.		
	New regulations	No new regulations.	No new regulations. Effects same as Alternative A.	New regulations would reduce the number of furbearer animals harvested annually by no more than 5% over the next 15 years by reducing trapper effort. Measures would substantially reduce incidental trapping of non-target species and eagles: - Conibear exclusion devices (C.3) would	New regulations would reduce the number of furbearer species trapped annually in Maine by 10-20% over the next 15 years. Limiting size of conibear traps (D.4), requiring 24-hour tending of conibear traps (D.5), BMP traps (D.6), pan tension devices (D.7), and reducing the trapping season (D.8) would reduce trapper effort and the number of	Number of furbearers harvested and incidentally trapped non-target species decline from current levels by 40-50% because of trapping closure in northern Maine.

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
				nearly eliminate take of birds and many mammals - Traps meeting BMP standards (C.4) and eliminating drags (C.5) would reduce injury to birds and mammals	target animals trapped greater than Alternative C.	
	Enforcement	No increase in enforcement.	No increase in enforcement proposed in draft ITP. Same as Alternative A	Increased enforcement (C.6) and penalties (C.7) would improve compliance regulations, especially those requiring reporting on take of non-target species	Same as Alternative C	No increase in enforcement other than to maintain upland trapping ban in northern Maine.
	Other conservation measures.	Telemetry studies would conclude in 2010. Future studies uncertain and unspecified in draft ITP. Would have no effect on number of target and non-target animals taken in traps.	Same as Alternative A. Periodic lynx surveys (B.4) and forestry BMPs (B.5) would have no effect on number of target and non-target animals taken in traps.	Same as Alternatives A and B	Same as Alternatives A and B	Same as Alternatives A and B
	Mitigation	No habitat mitigation	Habitat mitigation (B.7) would affect species composition on 5,000 acres	Habitat mitigation (C.9) would affect species composition on 10,000 acres	Habitat mitigation (D.9) would affect species composition on at least 7,000 acres converted	No habitat mitigation

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
			converted from mature to early-succesional forest. Would diminish marten habitat on public lands.	converted from mature to early-succesional forest. Would have a greater effect than Alternative B because it would further diminish marten habitat on public lands.	from mature to early-succesional forest. Would diminish marten habitat on private lands.	
Federally-listed species (Canada lynx)	Outreach and education	Current levels of outreach would occur, which would reduce incidental take of lynx in traps.	In addition to measures in Alternative A, lynx module in new trapper education (B.1) and working with Maine Trapper's Association (B.2) would further reduce numbers of lynx trapped.	DVD (C.1) would teach techniques to reduce take of lynx and would be distributed to all trappers. Would result in fewer lynx trapped than B.	Same as Alternative C.	Moderate to low levels of outreach would be anticipated concerning lynx because trapping is discontinued in northern Maine.
	Lynx handling procedures and protocols	Current levels of attending to lynx caught in traps would occur, which would reduce injury to lynx.	In addition to measures in Alternative A, guidelines would be developed to evaluate injury to lynx (B.3) would further reduce likelihood of injury to lynx.	In addition to measures in A and B, requiring veterinarian to attend several lynx captures (C.2) would further reduce likelihood of injury to lynx.	In addition to measures in A and B, requiring veterinarian to attend all lynx captures (D.3) would further reduce likelihood of injury to lynx.	Lynx handling protocols would likely remain in place but be rarely used because no lynx would be incidentally trapped.
	New regulations	Current regulations would continue. Take of lynx would continue	Regulations would continue similar to Alternative A.	New regulations would be expected to reduce incidental take	New regulations would be expected to reduce incidental take and	New regulations to discontinue upland trapping in northern

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
		at current rates.	Incidental take would be similar to A.	and injury of lynx: - Conibear exclusion devices (C.3) should eliminate take and injury of lynx in conibear traps - Traps meeting BMP standards (C.4) and eliminating drags (C.5) would reduce injury to lynx Alternative C would result in less take and injury to lynx than Alternatives A and B.	injury of lynx: Limiting size of conibear traps (D.4) , requiring 24-hour tending of conibear traps (D.5), traps meeting BMP standards (D.6), pan tension devices (D.7), and reducing the trapping season (D.8) would reduce the incidental take and injury. Comparisons with Alternative C are difficult because of trade-offs.	Maine would nearly eliminate incidental take of lynx.
	Enforcement	No new enforcement.	No new enforcement. Enforcement of regulations put into place during the last 15 years would help reduce the incidental trapping of lynx.	Increased enforcement (C.6) and penalties (C.7) would improve compliance with regulations, especially new conibear and BMP trapping regulations. This would result in less incidental take and injury to lynx than Alternatives A and B.	Same as Alternative C.	No new enforcement, but new regulations to discontinue upland trapping in northern Maine would nearly eliminate incidental take of lynx.
	Other conservation	Telemetry studies concluded in 2010.	Increased lynx population and habitat	Same as Alternative B.	Same as Alternative B.	Likely would be few new conservation

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
	measures.	Future studies uncertain and unspecified in draft ITP. Effects on research on incidental take and injury to lynx are uncertain unless MDIFW does future studies directed at evaluating the effects of trapping.	surveys (B.4) should help determine changes in lynx abundance and distribution, which would better inform trapping decisions. BMPs for forestry (B.5) could result in improved habitat, which could mitigate for lynx trapping take and injury.			measures put in place if trapping is discontinued in northern Maine.
	Mitigation	No habitat mitigation.	Habitat mitigation (B.7) would support 1 pair of lynx on 5,000 acres of new habitat (at high hare densities). Lynx may not be found in the mitigation area during periods of low hare density.	Habitat mitigation (C.9) would support >1-2 pairs of lynx on on 10,000 acres of new habitat. Mitigation is likely to be more successful than Alternative B even if hare densities are lower in future.	Habitat mitigation (D.9) would support >1-2 pairs of lynx on at least 7,000 acres of new habitat. Mitigation is likely to be more successful than Alternative B even if hare densities are lower in future.	No habitat mitigation.
Outdoor recreation and the economy	All measures	Trapper participation and effort likely would remain at current levels or decline over the long-term. Costs of all measures	Effects similar to Alternative A. Trapper participation and effort likely would stay the same as current levels or decline over the long-	New regulations (conibear excluding devices, traps meeting BMP standards, no drags) would result in greater costs to trappers (~$2,500 per	Effects similar to Alternative C. Costs of all measures may be $200,000-$300,000 per year.	Discontinuing trapping in northern Maine would have major effect on trapper participation. Decreased trapper participation would

Environmental component	Activity	Alternative A Status Quo, No Permit	Alternative B Draft ITP	Alternative C Modified ITP	Alternative D Modified ITP	Alternative E Discontinue upland trapping in WMDs 1-11, 14, 18 and 19
		<$20,000/year.	term. Costs of all measures <$20,000/year.	average trapper) and slightly lower trapper participation rates. Costs of all measures may be $150,000-$200,000/yr. Economic activity would increase because trappers would have to purchase new equipment.		result in reduced funds to MDIFW to manage furbearers. Costs of all measures minimal and less than Alternatives A and B.
Environmental justice	All measures	No environmental justice issues.	No environmental justice issues	No environmental justice issues	No environmental justice issues	No environmental justice issues.

5.0 CONSULTATION AND COORDINATION WITH THE PUBLIC AND OTHERS

MDIFW opted not to involve the public when developing several drafts of the ITP. MDIFW prominently posts information related to avoiding lynx trapping on their website (http://www.maine.gov/ifw/hunting_trapping/trapping/index.htm), but there is no information about the draft ITP.

In addition to the alternative evaluated in the draft EA, we offer 4 alternatives, and seek public comment[13]. During the public comment period, we plan to hold a public meeting to seek input on the draft ITP and draft EA and the alternatives offered. We are open to additional alternatives not considered in this EA, and we have not identified a preferred alternative.

During the preparation of this draft EA, unsolicited information was sent to us by the Wildlife Alliance of Maine and the Animal Welfare Institute. MDIFW responded to our requests for trapping-related information as we prepared this draft EA. MDIFW met with the Service in November, 2009 to review the draft Alternatives. MDIFW reviewed the draft EA in March, 2010 and March, 2011. In the preparation of this EA, we sought information from 2 experienced trappers, Steve Lock of Babbitt, MN and Carter Niemeyer of Boise, Idaho.

Compliance with the National Historic Preservation Act

This draft EA addresses the effects of trapping throughout the state of Maine on the human environment, including cultural resources. Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to consider the effects of their undertakings on historic properties and afford the Council on Historic Preservation (or in this case the state-designee, the Maine Historic Preservation Commission, SHPO) a reasonable opportunity to comment on such undertakings. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties. In accordance with section 101(b)(3) of the act, the SHPO advises and assists Federal

---

[13] We are seeking public input to help with completion of a final EA, specifically:

- Did we review an appropriate list of feasible or practicable alternatives and conservation measures?
- Is there additional information that would help assess the effectiveness of the conservation measures proposed under the 4 alternatives?
- Are there additional feasible or practicable conservation measures that we should consider?
- Is there additional information that could better inform this environmental assessment?
- Have we appropriately anticipated the direct, indirect, and cumulative environmental effects of the various alternatives?

agencies in carrying out their section 106 responsibilities and cooperates with such agencies, local governments and organizations and individuals to ensure that historic properties are taking into consideration at all levels of planning and development.

The Federal Government has a unique legal relationship with Indian tribes set forth in the Constitution of the United States, treaties, statutes, executive orders, and court decisions. Consultation with Indian tribes will be conducted in a sensitive manner respectful of the government-to government relationship between the Federal Government and Indian tribes consistent with NHPA and Secretarial Order #3206 (June 5, 1997); American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act.

Federal agencies are encouraged to coordinate compliance with section 106 when addressing the National Environmental Policy Act (NEPA). We do not anticipate that covered activities will cause significant impacts to historic and cultural resources, largely because they are temporary, non-earth disturbing, and occur primarily in a linear fashion on the landscape over frozen or snow-covered ground. But, we intend to use this NEPA process to engage the participation of Maine tribes and seek their council of potential effects to cultural resources at these location(s) and on trapping activities that occur throughout the state. If undertakings associated with MDIFW's draft ITP occur in sensitive areas, we will develop in consultation with the tribes alternatives and proposed measures that might avoid, minimize or mitigate any adverse effects of the undertaking on historic properties and describe them in the EA.

The Service will submit the draft EA to the SHPO and Indian tribes that might attach religious and cultural significance to affected historic properties, and other consulting parties prior to or when making the document available for public comment. There is also potential that management of mitigation lands may cause impacts. We anticipate the final location(s) for mitigation lands will be identified prior to issuing a Permit, and need to further coordinate under section 106 to assess the cultural resources or proposed mitigation lands.

6.0 PUBLIC COMMENT ON DRAFT ENVIRONMENTAL ASSESSMENT AND RESPONSE

(To be completed following public comment period)

7.0 REFERENCES CITED

AFWA Association of Fish and Wildlife Agencies. 2005. Ownership and use of traps by trappers in the United States in 2004. Responsive Management. Harrisonville, Virginia.

AFWA Association of Fish and Wildlife Agencies. 2006. Best management practices for trapping in the United States. Introduction.

AFWA Association of Fish and Wildlife Agencies. 2007. Summary of trapping regulations for fur harvesting in the United States.

Agee, J.K. 2000. Disturbance ecology of North American boreal forests and associated northern mixed/subalpine forests. Pages 39-82 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

American Veterinary Medical Association. 2008. Leghold trap use in conservation and research. http://www.avma.org/issues/animal_welfare/leghold_traps_bgnd.asp.

Andelt, W. F., R. L. Phillips, R. H. Schmidt, and R. B. Gill. 1999. Trapping furbearers: an overview of the biological and social issues surrounding a public policy controversy. Wildlife Society Bulletin 27:53-64.

Armstrong, J. B. and A. N. Rossi. 2000. Status of avocational trapping based on the perspectives of state furbearer biologists. Wildlife Society Bulletin 28(4):825-832.

Arnemo, J. M., P. Ahlqvist, R. Anderson, F. Berntsen, G. Ericsson, J. Odden, S. Brunberg, P. Segerstrom, and J. E. Swenson. 2006. Risk of capture-related mortality in large free-ranging mammals: experiences from Scandinavia. Wildlife Biology 12(1):109-113.

Assels, A., H. Boulanger, B. Martin, and M. C. Pelletier-Leclerc. 2007. Suivi de l'abondance du lièvre d'Amérique (*Lepus americanus*), de 2000 à 2006 dans sept régions du Québec. Page 38 Ministère des Ressources naturelles et de la Faune, Direction de l'aménagement de la faune, Gaspésie-Îles-de-la-Madeleine

Aubry, K.B., G.M. Koehler, J.R. Squires. 2000. Ecology of Canada lynx in southern boreal forests. Pages 373-369 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Bailey, T. N., E. E. Bangs, M. F. Portner, J. C. Malloy, and R. McAvinchy. 1986. An apparently overexploited lynx population on the Kenai Peninsula, Alaska. Journal of Wildlife Management 50:279-290.

Barrett, M. W., G. Proulx, D. Hobson, D. Nelson, and J. W. Nolan. 1989. Field evaluation of the C120 Magnum trap for marten. Wildlife Society Bulletin 17:299-306.

Batcheller, G. R., T. A. Decker, D. A. Hamilton, and J. F. Organ. 2000. A vision for the future of furbearer management in the United States. Wildlife Society Bulletin 28:833-840.

Beasom, S. L. 1974. Selectivity of predator control techniques in South Texas. The Journal of Wildlife Management 38:837-844.

Beattie, K. H. 1975. Anti-poaching campaigns: a tool of wildlife law enforcement? Proceedings of the Southeastern Association of Fish and Wildlife Agencies 29:728-743.

Beckman, K. 2007. Wildlife Health and Disease Surveillance in Alaska. 16 May 2003 – 30 June 2007. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration research final performance report, grants W-33-1 through W-33-4; project 18.73. Juneau, Alaska.

Belisle, A. A. 1972. Residues of organo-chlorine pesticides, polychlorinated biphenyls, and mercury and autopsy data for bald eagles, 1969 and 1970. Pesticide Monitoring Journal 6:133-138

Berchielli, L. T. and B. F. Tullar. 1980. Comparison of a leg snare with a standard leg-gripping trap. New York Fish and Game Journal 27:63-71.

Bissonette, J. A., D. J. Harrison, C. D. Hargis, and T. G. Chapin. 1997. The influence of spatial scale and scale sensitive properties on habitat selection by American marten. Pages 368-385 *in* J. A. Bissonette (editor). Wildlife and Landscape Ecology: effects of pattern and scale. Springer-Verlag, New York.

Bittner, S.L. and O.J. Rongstad. 1982. Snowshoe hare and allies. in J.A. Chapman and G.A. Feldhamer (eds.). Wild mammals of North America biology, management and economics. Johns Hopkins University Press, Baltimore, MD.

Bowman, J., G. L. Holloway, J. R. Malcolm, K. R. Middel, and P. J. Wilson. 2005. Northern range boundary dynamics of southern flying squirrels: evidence of an energetic bottleneck. Canadian Journal of Zoology 83:1486-1494.

Brand, C. J., L. B. Keith, and C. A. Fischer. 1976. Lynx responses to changing snowshoe hare densities in Alberta. Journal of Wildlife Management 40:416-428.

Brand, C.J., and L.B. Keith. 1979. Lynx demography during a snowshoe hare decline in Alberta. J. Wildl. Manage. 43:827-849.

Broley, C. L. 1947. Migration and nesting of Florida bald eagles. Wilson Bulletin 59:3-20.

Brown, G.W. 1985. Controlling nonpoint source pollution from silvicultural operations: what we know and don't know. In Perspectives on Nonpoint Source Pollution, pp. 332-333. U.S. Environmental Protection Agency.

Buehler, D.A., and L.B. Keith. 1982. Snowshoe hare distribution and habitat use in Wisconsin. Can. Field-Nat. 96:19-29.

Burnham, K. P., and D. R. Anderson. 1984. The need for distance data in transect counts. Journal of Wildlife Management 48:1248-1254.

Buskirk, S.W., L.F. Ruggiero, K.B. Aubry, D.E. Pearson, J.R. Squires, K.S. McKelvey. 2000b. Comparative ecology of lynx in North America. Pages 397-417 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Carroll, C. 2005. A regional-scale analysis of habitat and population viability for wolf, lynx, and marten. Report 2: Lynx and marten viability analysis. Wildlands Project Special Paper No. 6. Richmon, Vermont.

Carroll, C. 2007. Interacting effects of climate change, landscape conversion, and harvest on carnivore populations at range margin: marten and lynx in the northern Appalachians. Conservation Biology 21:1092-1104.

Cattet, M., J. Boulangeir, G. Stenhouse, R. A. Powell, and M. J. Reynolds-Hogland. 2008. An evaluation of long-term capture effects in ursids: implications for wildlife welfare and research. Journal of Mammalogy 89:973-990.

Chapin, T. G., D. J. Harrison, and D. D. Katnik. 1998. Influence of landscape pattern on habitat use by American marten in an industrial forest. Conservation Biology 12:1327-1337.

Chapman, J., G. Willner, and K. Dixon. 1978. Differential survival rates among leg-trapped and live-trapped nutria. Journal of Wildlife Management 42:926-928.

Coats, R.N., and T.O. Miller. 1981. Cumulative silvicultural impacts on watersheds: a hydrologic and regulatory dilemma. Environmental Management 5(2):147-160.

Conover, M. R. 2001. Effect of hunting and trapping on wildlife damage. Wildlife Society Bulletin 29:521–532.

Coon, N. C., N. Locke, E. Cromartie, and W. L. Reichel. 1970. Causes of bald eagle mortality, 1960-1965. Journal of Wildlife Diseases 6:72-76.

Cowles, C. J., K. H. Beattie, and R. H. Giles. 1979. Limitations of wildlife law compliance estimators. Wildlife Society Bulleting 7:188-191.

Daigle, J. J., R. M. Muth, R. R. Zwick, and R. J. Glass. 1998. Sociocultural dimensions of trapping: a factor analytic study of trappers in six northeastern states. Wildlife Society Bulletin 26:614-625.

Danby, R.K. and D.S. Hik. 2007. Variability, contingency, and rapid change in recent subarctic alpine tree line dynamics. Journal of Ecology 95: 352-363.

Decker, D. L. and N. A. Connolly. 1990. The need for hunter education in deer management: insights from New York. Wildlife Society Bulletin 18:447-452.

DeStefano S., and R. M. DeGraaf (2003) Exploring the ecology of suburban wildlife. Frontiers in Ecology and the Environment: Vol. 1(2): 95-101.

Duda, M. D, P. E. De Michele, M. Jones, A. Criscione, C. Craun, T. Winegord, A. Lanier, S. Bissell, and J. B. Herrick. 2005. Ownership and use of traps by trappers in the United States in 2004. Responsive Management. Harrisonville, Virginia.

Earle, R. D., D. M. Lunning, V. R. Tuovila, and J. A. Shivik. 2003. Evaluating injury and performance of #3 Victor Soft Catch traps to restrain bobcats. Wildlife Society Bulletin 31:617-629.

Elliot-Fisk, D. 1988. The boreal forest. Pp. 34-62 *In* North American Terrestrial Vegetation. Eds. M. Barbour and W. Billings. Cambridge University Press, Cambridge, United Kingdom.

Engeman, R. M., H. W. Krupa, and J. Kern. 1997. On the use of injury scores for judging the acceptability of restraining traps. Journal of Wildlife Research 2(2):124-127.

Englund, J. 1982. A comparison of injuries to leghold trapped and foot-snared red foxes. Journal of Wildlife Management 46:113-117.

Fleming, P. J. S., L. R. Allen, M. J. Berghout, P. D. Meek, P. M. Pavlov, P. Stevens, K. Strong, J. A. Thompson, and P. C. Thomson, P.C. 1998: The performance of wild-canid traps in Australia: efficiency, selectivity and trap-related injuries. Wildlife Research 25: 327-338.

Fox, C. H. and C. M. Papouchis. 2004. Cull of the wild: a contemporary analysis of wildlife trapping in the United States. Bang Publishing, Brainerd, Minnesota.

Frawley, B. J., D. Etter, and D. Bostick. 2005. Fox and coyote trapping survey. Michigan Department of Natural Resources, Wildlife Division Report No. 3430.

Fuller, A. K. 1999. Influence of partial timber harvesting on American marten and their primary prey in Northcentral Maine. M. S. Thesis, University of Maine, Orono, Maine USA. 141 pp.

Fuller, A. K. 2006. Multi-scalar responses of forest carnivores to habitat and spatial pattern: case studies with Canada lynx and American martens. Ph.D. dissertation, University of Maine, Orono. 223pp.

Fuller, A. K., D. J. Harrison, and J. H. Vashon. 2007. Winter habitat selection by Canada lynx in Maine: prey abundance or accessibility? Journal of Wildlife Management 71(6):1980-1986.

Garcia-Perea, R. 2000. Survival of injured Iberian lynx (*Lunx pardinus*) and non-natural mortality in central-southern Spain. Biological Conservation 93:265-269.

Golden, H. N. 2004. Furbearer management technique development. Alaska Fish and Game. Research Final Report, Federal Aid in Wildlife Restoration. Grants W-27-5, W-33-1, and W-33-2, Study 7.19. Juneau, Alaska.

Gonzales, P., R.P. Neilson, K.S. McKelvey, J.M. Lenihan, and R.J. Drapek. 2007. Potential impacts of climate change on habitat and conservation priority areas for Lynx canadensis (Canada lynx). Report to the Forest Service, U.S. Department of Agriculture, Washington D.C., and NatureServe, Arlington, VA. 19 pages.

Griffin, P. C. 2004. Landscape ecology of snowshoe hares in Montana. Dissertation, University of Montana, Missoula, USA.

Griffith DM and Alerich CL. 1996. Forest statistics for Maine, 1995. Northeastern Forest Experiment Station Resource Bulletin NE–135. Radnor, PA: USDA Forest Service.

Ha, J. C. and P. N. Lehner. 1990. Notes of gray jay demographics in Colorado. The Wilson Bulletin 102:698-702.

Hagan, J. M., L. C. Irland, and A. A. Whitman. 2005. Changing timberland ownership in the northern forest and implications for biodiversity. Manoment Center for Conservation Sciences, Report#MCCS-FPC-2005-1, Brunswick, Maine, 25pp.

Hahn, P. H. 1998. Emerging criminal justice. Sage Publications, Thousand Oaks, California.

Hargis, C. D. and Bissonette. 1997. Effects of forest fragmentation on populations of American marten in the intermountain west. Pages 437-451 *in* G. Proulx, H. N. Bryant, and P. M. Woodard, editors. Martes: taxonomy, ecology, techniques, and management. Provincial Museum of Alberta, Edmonton, Canada.

Harris, S., C. Soulsbury, and G. Iossa. 2006. A scientific review on proposed humane trapping standards in Europe. The ISO Standards and the European proposal for a proposed Directive on humane trapping standards. University of Bristol, School of Biological Sciences, Bristol, United Kingdom.

Harris, S., C. Soulsbury, and G. Iossa. 2006. A scientific review on proposed humane trapping standards in Europe1999

Hartup, B. K., G. V. Kollias, M. C. Jacobsen, and K. R. Kimber. 1999. Exertional myopathy in translocated river otters in New York. Journal of Wildlife Diseases 35:542-547. Heberlein, T. A. 1991. Changing attitudes and funding for wildlife – preserving the sport hunter. Wildlife Society Bulletin 19:528-534.

Hodges, K.E. 2000a. Ecology of snowshoe hares in northern boreal forests. Pages 117-162 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Hodges, K.E. 2000b. Ecology of snowshoe hares in southern boreal and montane forests. Pages 163-206 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Hodgman, T.P., D. J. Harrison, D. D. Katnik, and K. D. Elowe. 1994. Survival in an intensively trapped marten population in Maine. Journal Wildlife Management 58:593-600.

Homyack, J.A. 2003. Effects of precommercial thinning on snowshoe hares, small mammals, and forest structure in northern Maine. M.S. Thesis, University of Maine.

Homyack, J. A., D. J. Harrison, J. A. Litvaitis, and W. B. Krohn. 2006. Quantifying densities of snowshoe hares in Maine using pellet plots. Wildlife Society Bulletin 34:74-80.

Homyack, J. A., D. J. Harrison, and W. B. Krohn. 2007. Effects of precommercia thinning on snowshoe hares in Maine. Journal of Wildlife Management 71:4-13.

Houben, J. M., M. Holland, S. W. Jack, and C. R. Boyle. 1993. An evaluation of laminated offset jawed traps for reducing injuries to coyotes. Proceedings of Great Plains Wildlife Damage Control Workshop, University of Nebraska, Lincoln, Nebraska.

Hoving, C.L. 2001. Historical occurrence and habitat ecology of Canada lynx (*Lynx canadensis*) in eastern North America. M.S. Thesis, University of Maine, Orono.

Hoving, C. L., R. A. Joseph, and W. B. Krohn. 2003. Recent and historical distributions of Canada lynx in Maine and the Northeast. Northeastern Naturalist 10(4):363-382.

Hoving, C.L., D.J. Harrison, W.B. Krohn, W. B. Jakubas and M. A. McCollough. 2004. Canada lynx Lynx canadensis habitat and forest succession in northern Maine, USA. Wildlife Biology 10:285-294.

Hoving, C.L., D.J. Harrison, W.B. Krohn, R.A. Joseph, and M. O'Brien. 2005. Broadscale predictors of Canada lynx occurrence in eastern North America. Journal of Wildlife Management 69:739-751.

Hulland,T. J. 1993. Muscle and tendon. Pages 183-265 in K. V. F.Jubb, P. C. Kennedy, and N. Palmer, editors. Pathology of domestic animals. Fourth edition. Volume 1. Academic Press, New York, USA.

International Association of Fish and Wildlife Agencies (IAFWA) Fur Resources Committee. 1993. Ownership and use of traps by trappers in the United States in 1992. Fur Resources Committee of the International Association of Fish and Wildlife Agencies and The Gallup Organization, Washington, D. C.

International Association of Fish and Wildlife Agencies (IAFWA) Fur Resources Committee. 1995. Summary of trapping regulations for fur harvesting in the United States and Canada. Fur Resources Technical Subcommittee of the International Association of Fish and Wildlife Agencies, Washington, D. C., USA.

International Association of Fish and Wildlife Agencies (IAFWA). 2000. Performance of restraining traps to capture furbearers in the United States. Progress Report. Washington, D. C.

International Association of Fish and Wildlife Agencies (IAFWA). 2003. Assessment of three restraining traps and two protocols to capture raccoons in the Midwest in 2002-2003.

Ibarzabal, J. and A. Desrochers. 2004. A nest predator's view of a managed forest" gray jay (*Perisoreus canadensis*) movement patterns in response to forest edges. The Auk 12:162-169.

Iossa, G., C. D. Soulsbury and S. Harris. 2007. Mammal trapping: a review of animal welfare standards of killing and restraining traps. Animal Welfare 16:335-352.

Iwaniuk, A. N., S. M. Pellis, and I. Q. Whishaw. 1999. The relationship between forelimb morphology and behavior in North American carnivores (Carnivora). Canadian Journal of Zoology 77:1064-1074.

Jacobson, G. L., I. J. Fernandez, P. A. Mayewski, and C. V. Schmidt (editors). 2009. Maine's climate future: an initial assessment. Orono, Maine: University of Maine.

Jakubas, W. and R. Cross. 2002. Snowshoe hare assessment. Maine Department of Inland Fisheries and Wildlife. Bangor, Maine.

Kamler, J. F., W. B. Ballard, R. L. Gilliland, and K. Mote. 2002. Improved trapping methods for swift foxes and sympatric coyotes. Wildlife Society Bulletin 30:1262-1266.

Katzner, T., E. Bragin and E.J. Milner-Gulland. 2006. Modelling populations of long lived birds of prey for conservation: a study of Imperial Eagles (*Aquila heliaca*) in Kazakhstan. *Biological Conservation* 132: 322-335.

Katzner, T., D. Brandes, M. Lanzone, and D. Ombalski. 2008.Raptors and wind energy development in the Central Appalachians. National Aviary White Paper, Pittsburgh, Pennsylvania.

Keith, L. B. and L. A. Windberg. 1978. A demographic analysis of the snowshoe hare cycle. Wildlife Monographs 58:1-70.

Keith, L. B. 1990. Dynamics of snowshoe hare populations. Pages 119-195 in H. H. Genoways, editor. Current mammalogy. Plenum, New York, New York, USA.

Keith, L. B., A. W. Todd, C. J. Brand, R. S. Adamcik, and D. H. Rusch. 1977. An analysis of predation during a cyclic fluctuation of snowshoe hares. Prceedings of the International Congress of Game Biologists 13:151-175.

Kellert, S. H. 1979. Public attitudes toward critical wildlife and natural habitat issues. Phase I. U. S. Department of the Interior Fish and Wildlife Service. Washington, D. C. 138pp.

Knowles, N., M.D. Dettinger, and D.R. Cayan. 2006. Trends in snowfall versus rainfall in the western United States. Journal of Climate 19: 4545-4559.

Koehler, G.M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. Canadian Journal of Zoology 68:845-851.

Koehler, G. M. and K. B. Aubry. 1994. Lynx. Pages 74-98 *in* Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the Western United States. USDA Forest Service Gen. Tech. Rep. RM-254.

Kolbe, J. A., J. R. Squires, and T. W. Parker. 2003. An effective box trap for capturing lynx. Wildlife Society Bulletin 31:980-985.

Krebs, C. J. S. Boutin, and B. S. Gilbert. 1986. A natural feeding experiment on a declining snowshoe hare population. Oecologia 70:194-197.

Kuehn, D. W., T. K. Fuller, L. D. Mech, W. J. Paul, S. H. Fritts, and W. E. Berg. 1986. Trap-related injuries to gray wolves in Minnesota. Journal of Wildlife Management 50:90-91.

Lachowski, H. J. 1997. Relationships among prey abundance, habitat and American marten in Northern Maine. M. S. Thesis, University of Maine, Orono, Maine, USA. 43pp.

Little, S. E., W. R. Davidson, E. W. Howerth, P. M. Rakich, and V. F. Nettles. 1998. Diseases diagnosed in red foxes from the southeastern United States. *Journal of Wildlife Diseases 34(3)*: 620-624.

Litvaitis, J. A. 1984. Bobcat movements in relation to prey density. Doctoral Dissertation, University of Maine, Orono.

Litvaitis, J. A., M. O'Donaghue, M. Miller, and J. A. Sherburne. 1983. An evaluation of trapping efforts to capture bocats, coyotes, and red fox. Proceedings of the Eastern Wildlife Damage Control Conference 1:125-127.

Litvaitis, J.A., J.A. Sherburne, J.A. Bissonette. 1985. Influence of understory characteristics on snowshoe hare habitat use and density. J. Wildl. Manage. 49:866-873.

Litvaitis, J. A. and J. P. Tash. 2006. Status, habitat features associated with remnant populations, and identification of sites for restoration and translocation of New England cottontails. Final report to the U. S. Fish and Wildlife Service, New England Field Office, Concord, New Hampshire.

Loker, C. A., D. J. Decker, and S. J. Schwager. 1999a. Social acceptability of wildlife management actions in suburban areas: 3 cases from New York. Wildlife Society Bulletin 27:152–159.

Lorimer, G. G. 1977. The pre-settlement forest and natural disturbance cycle of northeastern Maine. Ecology, 58:139-148.

Maine Department of Inland Fisheries and Wildlife. 2009. Wildlife Division Research and Management Report 2009. Resource Assessment Section, Bangor, Maine.

Maine Forest Service. 2004. Best management practices for forestry: protecting Maine's water quality. Maine Department of Conservation, Augusta, Maine.

Marshall, W. M., 1951. Pine marten as a forest product. Journal of Forestry 49: 899-905.

McCall, T. C., T. P. Hodgman, D. Diefenbach, and R. B. Owen. 1996. Beaver populations and their relation to wetland habitat and breeding waterfowl in Maine. Wetlands 16:163-172.

McCollough, M. A. 2007. Canada lynx habitat management guidelines for Maine. Unpublished document. Maine Field Office, U. S. Fish and Wildlife Service, Orono, Maine.

McCollough, M. A. 2011. Eastern puma (=cougar)(*Puma concolor couguar*) 5-year review. U. S. Fish and Wildlife Service, Maine Field Office. Orono, Maine.

McCord, C.M., and J.E. Cardoza. 1982. Bobcat and lynx. in J.A. Chapman and G.A. Feldhamer (eds.). Wild mammals of North America biology, management and economics. Johns Hopkins University Press, Baltimore, MD.

McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000. History and distribution of lynx in the contiguous United States. Pages 207-264 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

McWilliams, W.H., B.J. Butler, L.E. Caldwell, D.M. Griffith, M.L. Hoppus, K.M. Laustsen, A.J. Lister, T.W. Lister, J.W. Metzler, R.S. Morin, S.A. Sader, L.B. Stewart, J.R. Steinman, J.A. Westfall, D.A. Williams, A. Whitman, C. W. Woodall. 2005. The Forest of Maine 2003. Resource Bulletin NE-164. Newton Square, PA: U.S. Department of Agriculture, Forest Service, Northeast Research Station. 188p.

MEF. 1995. *Plan de gestion du lynx du Canada au Québec 1995 : Objectifs de gestion et stratégie d'exploitation*. Ministère de l'Environnement et de la Faune du Québec.

Megahan, W.F. 1986. Recent studies on erosion and its control on forest lands in the United States. In Environmental Geotechnics and Problematic Soils and Rocks pp. 178-189.

Minnis, D. L. 1998. Wildlife policy-making by the electorate: an overview of citizen-sponsored ballot measures on hunting and trapping. Wildlife Society Bulletin 26:75-83.

Monthey, R. W. 1986. Responses of snowshoe hares, *Lepus americanus*, to timber harvesting in northern Maine. Canadian Field-Naturalist 100:568-570.

Mowat, G. G. B. Slough, and R. Rivard. 1994. A comparison of three live capturing devices for lynx: capture efficiency and injuries. Wildlife Society Bulletin 22:644-650.

Mowat, G., J. A. Staniforth, and V. A. Loewen. 1997. The relationship between vegetative cover and snowhoe hare abundance in south and central Yukon. Unpublished report, Yukon Fish and Wildlife Branch, Department of Renewable Resources.

Mowat, G., K.G. Poole, M. O'Donoghue. 2000. Ecology of lynx in northern Canada and Alaska. Pages 265-306 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Musgrave, R. S., S. R. Parker, and M. Wolok. 1993. The status of poaching in the United States – are we protecting our wildlife? Natural Resources Journal 33:977-1014.

Muth, R. M., R. R. Zwick, M. E. Mather, J. F. Organ, J. J. Daigle, and S. A. Jonker. 2006. Unnecessary source of pain and suffering or necessary management tool: attitude of conservation professionals toward outlawing leghold traps. Wildlife Society Bulletin34:706-715.

Naiman, R. J., J. M. Mellillo, and J. E. Hobbie. 1986. Ecosystem alteration of boreal forest streams by beaver (*Castor canadensis*). Ecology (67:1254-1269).

Naylor, B. J. and M. Novak. 1994. Catch efficiency and selectivity of various traps and sets used for capturing American martens. Wildlife Society Bulletin 22:489-496.

Neary, D.G., W.T. Swank, and H. Riekerk. 1989. An overview of nonpoint source pollution in the southern United States. In Proceedings of the Symposium: Forested Wetlands of the Southern United States, July 12-14, 1988, Orlando, FL. USDA Forest Service. General Technical Report SE-50, pp. 1-7.

Nocturnal Wildlife Research. 2008. Welfare outcomes of leg-hold trap use in Victoria. Nocturnal Wildlife Research, Malvern, Victoria, Australia.

Northeast Furbearer Resources Technical Committee. 2001.Trapping and furbearer management in North American wildlife conservation. The Northeast Section of The Wildlife Society.

Noss, R. F. 1995. The ecological effects of roads or The road to destruction. Unpublished report. Wildlands CPR.

Novak, M. 1987. Traps and trap research. Pages 941-969 in M. Novak, J. A. Baker, M. E. Obbard and B. Malloch, editors. Wild furbearer management and conservation in North America. Ontario Trappers Association, North Bay.

Novak, M., J. A. Baker, M. E. Obbard and B. Malloch. 1987. Wild furbearer management and conservation in North America. Ontario Trappers Association, North Bay.

Nybakk, K., M. Kjorstad, K. Overskaug, T. Kvam, J. D. C. Linnell, R. Andersen, and F. Bernsten. 1996. Experiences with live-capture and radio collaring of lynx *Lynx lynx* in Norway. Fauna Norv. Ser. A 17:17-26.

O'Connell, A. F., F. A. Servello, J. Higgins, and W. Halteman. 2001. Status and habitat relationships of northern flying squirrels on Mount Desert Island, Maine. Northeastern Naturalist 8:127-136.

Olsen, G. H., R. G. Linscombe, V. L. Wright, and R. A. Holmes. 1988. Reducing injuries to terrestrial furbearers using padded foothold traps. Wildlife Society Bulletin 16:303-307.

Onderka, D. K., D. L. Skinner, and A. W. Todd. 1990. Injuries to coyotes and other species caused by 4 models of footholding devices. Wildlife Society Bulletin 18:303-307.

Parker, G. R. 1983. An evaluation of trap types for harvesting muskrats in New Brunswick. Wildlife Society Bulletin 11(4):339-343.

Parker, G. 1998. The eastern panther: mystery cat of the Appalachians. Nimbus, Halifax, Nova Scotia, Canada

Payer, D. C. 1999. Influences of timber harvesting and trapping on habitat selection and demographic characteristics of American merten. Ph.D. dissertation, University of Maine, Orono.

Phillips, R. L., K. S. Gruver, and E. S. Williams. 1996. Leg injuries to coyotes captured in three types of foothold traps. Wildlife Society Bulletin 24(2):260-263.

Poole, K.G. 1994. Characteristics of an unharvested lynx population during a snowshoe hare decline. Journal of Wildlife Management 58:608-618.

Poole, K.G. 1997. Dispersal patterns of lynx in the Northwest Territories. Journal of Wildlife Management 61:497-505.

Poole, K. G. 2003. A review of the Canada lynx, *Lynx canadensis*, in Canada. Canadian Field Naturalist 177:360-376.

Poole, K. G. and R. P. Graf. 1996. Winter diet of marten during a snowshoe hare decline. Canadian Journal of Zoology 74:456-466.

Powell, R. A. and G. Proulx. 2003. Trapping and marking terrestrial mammals for research: integrating ethics, performance criteria, techniques and common sense. ILAR Journal 44(4):259-276.

Proulx, G. A. 1999. Mammal trapping. Alpha Wildlife Research and Management, Sherwood Park, Alberta.

Proulx, G. and M. W. Barrett. 1993. Field testing the C120 Magnum for mink. Wildlife Society Bulletin 21:421-426.

Proulx, G., M. W. Barrett, and S. R. Cook. 1989. The C120 Magnum: an effective quick-kill trap for marten. Wildlife Society Bulletin 17:294-298.

Proulx, G., I. M. Pawlina, D. K. Onderka, M. J. Badry, and K. Seidel. 1994. Field evaluation of the number 1 ½ steel-jawed leghold and the Sauvageau 2001-8 traps to humanely capture arctic fox. Wildlife Society Bulletin 22:179-183.

Proulx, G, A. J. Kolenosky, P. J. Cole, and R. K. Drescher. 1995. A humane killing trap for lynx (*Felis lynx*): the Conibear 330™ with clamping bars. Journal of Wildlife Diseases 31*:* 57-61.

Prugh, L. R., C. J. Stoner, C. W. Epps, W. T. Bean, W. J. Ripple, A. S. Laliberte, J. S. Brashares. 2009. The rise of the mesopredator. BioScience (59):779-791.

Puettmann, K. J., A. W. D'Amato, M. Arikian, and J. C. Zasada. 2008. Spatial impacts of soil disturbance and residual overstory on density and growth of regenerating aspen. Forest Ecology and Management 256:2110-2120.

Quinn, N.W.S., and G. Parker. 1987. Pages 683-694 *in* Lynx. in M. Novak, J.A. Barber, M.E. Obbard, B. Malloch (eds.). Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources.

Quinn, N. W. S. and J. E. Thompson. 1987. Dynamics of an exploited Canada lynx population in Ontario. Journal of Wildlife Management 51:297-305.

Riekerk, H. 1983. Impacts of silviculture on flatwoods runoff, water quality, and nutrient budgets. Water Resources Bulletin 19(1):73-80.

Riekerk, H. 1985. Water quality effects of pine flatwoods silviculture. Journal of Soil and Water Conservation 40(3):306-309.

Riekerk, H., D.G. Neary, and W.J. Swank. 1989. The magnitude of upland silviculture nonpoint source pollution in the South. In Proceedings of the Symposium: Forested Wetlands of the Southern United States, July 12-14, Orlando, FL, pp. 8-18.

Robbins, S. L., and R. S. Cotran. 1979. Environmental pathology. Pages 521-560 in S. L. Robbins, and R. S. Cotran, editors. Pathologic basis of disease. Second edition. W. B. Saunders Co., Toronto, Ontario, Canada.

Robinson, L. 2006. Ecology relationships among partial harvesting, vegetation, snowshoe hares, and Canada lynx in Maine. Masters thesis. University of Maine, Orono. 184pp.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. 2000. The scientific basis for lynx conservation: qualified insights. Pages 443-454 *in* Ruggiero, L.F., K.B Aubry, S.W. Buskirk, *et al.* Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Scott, M. 1977. A contemporary analysis of animal traps and trapping. Institute for the Study of Animal Problems, the Humane Society of the United States, Washington, D. C. 192 pp.

Scott, S. A. 2009. Spatio-temporal dynamics of snowshoe hare density and relationships to Canada lynx occurrence in northern Maine. Masters thesis. University of Maine, Orono, Maine. 190pp.

Seddon, P. J., Y. Van Heezik, and R. M. Maloney. 1999. Short- and medium-term evaluation of foot-hold trap injuries in two species of fox in Sauidi Arabia. Pages 67-78

in G. Proulx (ed) Mammal Trapping. Alpha Wildlife Research and Management Ltd. Sherwood Park, Alberta.

Shepard, J. P. 2006. Water quality protection in bioenergy production: the US system of forestry Best Management Practices. Biomass and Bioenergy 30 (2006) 378-384.

Shivik, J. A., and K. S. Gruver. 2002. Animal attendance of coyote trap sites in Texas. Wildlife Society Bulletin 30:502-507.

Shivik, J. A., D. J. Martin, M. J. Pipas, J. Turnan, and T. J. DeLiberto. 2005. Initial comparison: jaws, cables, and cage traps to capture coyotes. Wildlife Society Bulletin 33(4):1375-1383.

Siemer, W. F., Batcheller, G. R., Glass, R. J., & Brown, T. L. 1994. Characteristics of trappers and trapping participation in New York. Wildlife Society Bulletin, 22:100-111.

Sigler, W. F. 1995. Wildlife law enforcement, 4th edition. William C. Brown Publishing, Dubuque, Iowa.

Simons, E. M. 2009. Influences of past and future forest management on the spatiotemporal dynamics of habitat supply for Canada lynx and American martens in northern Maine. Doctoral Dissertation, University of Maine, Orono, Maine. 247pp.

Slough, B.G. and G. Mowat. 1996. Population dynamics of lynx in a refuge and interactions between harvested and unharvested populations. J. Wildl. Manage. 60:946-961.

Smith, D., R., D. R. Anderson, and J. F. Smeltzer. 1989. Assessment of the violation simulation method. Wildlife Society Bulletin 17:179-184.

Smith, W. P., R. G. Anthony, J. R. Waters, N. L. Dodd, and C. J. Zael. 2003. Ecology and conservation of arboreal rodents of the Pacific Northwest. Pages 157-206 in C. J. Zabel and R. G. Anthony, editors, Mammal community dynamics in western coniferous forests: management and conservation. Cambridge University Press, Cambridge, United Kingdon.

Smith W. P. and J. V. Nichols. 2003. Demography of the Prince of Wales flying squirrel: an endemic of southeastern Alaska temperate rain forest. Journal of Mammalogy 84:1044-1058.

Southwick, R. 1 993. An economic profile of the U.S. fur industry. Southwick Associates, Arlington, Virginia

Steury, T.D. and D.L. Murray. 2004. Modeling the reintroduction of lynx to the southern portion of its range. Biological Conservation 117:127-141.

Stocek, R. F. and D. J. Cartwright. 1985. Birds as nontarget catches in the New Brunswick furbearer harvest. Wildlife Society Bulletin 13:314-317.

Stocker, L. 2005. Practical wildlife care, 2nd Edition. Blackwell: Oxford, United Kingdom.

Strickland, D. and H. Ouellet. 1993. Gray jay (*Perisoreus canadensis*). In The Birds of North America No. 40 A. Poole, P. Stettenheim, and F. Gill, editors. Academy of Natural Sciences, Philadelphia and American Ornithologist's Union, Washington, D. C.

Sullivan, T. P. 1994. Influence of herbicide-induced habitat alteration on vegetation and snowshoe hare populations in sub-boreal spruce forest. Journal of Applied Ecology 31:717-730.

Taylor, W.P. 2000. Wildlife capture and restraint manual. Alaska Department of Fish and Game, Anchorage, AK.

Teisl, M. F. and K. J. Boyle. 1998. The Economic Impacts of Hunting, Inland Fishing and Wildlife-Associated Recreation in Maine. Report to the Maine Department of Inland Fisheries and Wildlife. Resource Economics and Policy Staff Paper 479.

Todd, A. W. and E. K. Boggess. 1987. Characteristics, activities, lifestyles, and attitudes of trappers in North America. Pages. 59–76. *in* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, editors. Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources and Ontario Trappers Association, North Bay, Canada.

Todd, C. S. 1979. The ecology of the bald eagle in Maine. M.S. Thesis. Univ. Maine, Orono. 91pp.

Todd, C. S. 2000. Golden eagle assessment. Maine Department of Inland Fisheries and Wildlife, Bangor, Maine.

Todd, C. S. 2004. Bald eagle assessment. Maine Department of Inland Fisheries and Wildlife, Bangor, Maine.

Tullar, B. F. 1984. Evaluation of a padded leghold trap for capturing foxes and raccoons. New York Fish and Game Journal 31:97-103.

Turkowski, F. J., A. R. Armistead, and S. B. Linhart. 1984. Selectivity and effectiveness of pan tension devices for coyote foothold traps. Journal of Wildlife Management 48:700-708.

U. S. EPA. 1984. Report to Congress: Nonpoint source pollution in the U.S., U.S. Environmental Protection Agency, Office of Water Program Operations, Washington, DC.

U.S. EPA. 1992. Managing Nonpoint Source Pollution, Final Report to Congress on Section 319 of the Clean Water Act (1989). U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA-506/9-90.

U.S. Fish and Wildlife Service. 2005 Draft recovery outline for the contiguous United States distinct population segment of the Canada lynx. Unpublished draft. U.S. Fish and Wildlife Service, region 6, Denver, Colorado.

Van Ballengerghe, V. 1984. Injuries to wolves sustained during live-capture. Journal of Wildlife Management 48:1425-1459.

Vashon, J. H., J. Holloway, A. Winters, S. Crowley, and C. Todd. 2003. Canada lynx: snow track surveys. Pages 105-116 *in* H. L. Hermann, T. P. Hodgman, and P. deMaynadier, editors. A survey of rare, threatened, and endangered fauna in Maine: St. John Uplands and Boundary Plateau (2001-2002). Maine Department of Inland Fisheries and Wildlife, Bangor, Maine, USA.

Vashon, J. H., A.L. Meehan, W.J. Jakubas, J. F. Organ, W. J. Jakubas, C.R. McLaughlin, A. D. Vashon, and S. M. Crowley. 2008a. Diurnal home range and habitat use by Canada lynx in an intensively managed private forest in northern Maine. Journal of Wildlife Management 72(7):1488-1496.

Vashon, J. H., A. L. Meehan, W. J. Jakubas, J. F. Organ, A. D. Vashon, C. R. McLaughlin, G. J. Matula, Jr., S. M. Crowley. 2008b. Spatial ecology of a Canada lynx population in northern Maine. Journal of Wildlife Management 72(7):1479-1487.

Vashon, J. H, S. McLellan, S. Crowley, A. Meehan, and K. Laustsen. *In prep.* Canada lynx species assessment. MDIFW unpublished document.

Villemure, M. and H. Jolicoeur. 2004. The first confirmed occurrence of a wolf *Canis lupus* south of the Saint Lawrence River in over one hundred years. Can. Field Naturalist 118:608-610.

Walker, P. M. 1991. Ischemia/reperfusion injury in skeletal muscle. Annals of Vascular Surgery *5*: 399-402

Warburton, B. and N. Poutu. 2008. Effectiveness of chain springs on leghold traps for reducing injuries to captured brushtail possums (*Trichosurus vulpecula*). New Zealand Journal of Zoology 35:147-150.

Wayland, M., L. K. Wilson, J. E. Elliott, M. J. R. Miller, T. Bollinger, M. McAdie, K. Langelier, J. Keating, and J. M. W. Froese. 2003. Mortality, morbidity, and lead poisoning of eagles in western Canada, 1986-1998. Journal of Raptor Research 37:8-18.

Webb, S. M., D. J. Davidson, and M. S. Boyce. 2008. Trapper attitudes and industrial development on registered traplines in west-central Alberta. Human Dimensions of Wildlife 13:115-126.

Weigl. P. D. 2007. The northern flying squirrel (*Glaucomys sabrinus*): a conservation challenge. Journal of Mammalogy 88:897-907.

Whitfield, D. P., A. H. Fielding, D. R. A. Mcleod, and P. F. Hayworth. 2004. Modelling the effects of persecution on the population dynamics of golden eagles in Scotland. Biological Conservation 119:319-333.

Whitman, A., B. Vickery, P. deMaynadier, S. Stockwell, S. Walker, A. Cutko, and R. Houston. 2010. Climate change and biodiversity in Maine. Manomet Center for Conservation Sciences, Brunswick, Maine.

Whitman, R. 1989. Clean water or multiple use? Best management practices for water quality control in the National Forests. Ecology Law Quarterly 16:909-966.

Windberg, L. A. and F. F. Knowlton. 1990. Relative vulnerability of coyotes to some capture procedures. Wildlife Society Bulletin 18:282-290.

Wolff, J.O. 1980. The role of habitat patchiness in the population dynamics of snowshoe hares. Ecol. Monog. 50:111-130.

Zwick, R. R., R. Glass, K. Royar, and T. Decker. 2002. Sociocultural perspectives of trapping revisited: a comparative analysis of activities and motives 1994 and 2000. Pages 118-123 in S. Todd, compiler. Proceedings of the 2001 Northeastern Recreational Research Symposium. U. S. Department of Agriculture Forest Service, Northeastern Research Station, General Technical Report NE-289.