

Canada, whereas in Michigan and especially Wisconsin, spruce and fir were limited to scattered patches (Great Lakes Ecological Assessment no date, Mladenoff no date, Wisconsin Department Natural Resources, in litt. 2003). Therefore, within the Great Lakes region, potential lynx habitat has always been most abundant in northeastern Minnesota.

An accurate estimate of the amount of potential lynx habitat for all ownerships in the Great Lakes region was not available to us. The majority of potential lynx habitat in this region is in northeastern Minnesota under Federal ownership, although we cannot say precisely how much because we do not have acreages of lynx habitat on non-Federal lands. In the Great Lakes region, as currently mapped there are approximately 18,000 km² (7,000 mi²) of potential lynx habitat on National Forest lands (Table 1). This estimate includes National Forest lands in Minnesota and Michigan's Upper Peninsula. There is no potential lynx habitat on National Forest lands in Wisconsin (Weiland 2002).

Minnesota—As was true historically, northeastern Minnesota continues to support a substantial amount of transitional boreal forest (roughly estimated at 12,500 km² (4,800 mi²)) in a more evenly distributed pattern rather than in small patches (Great Lakes Ecological Assessment no date, Wisconsin Department Natural Resources, in litt. 2003). In Minnesota, the deepest snows occur in the northeast corner of the State (Minnesota Department Natural Resources in litt. 1998). Most of northeastern Minnesota is under Federal ownership, primarily in the Superior National Forest (Minnesota Department Natural Resources, in litt. 2003).

Minnesota provides a good example of the problems in assessing the status of lynx because of the complexity of lynx cycles and the difficulty in interpreting historical lynx occurrence data. As a result, scientists have debated whether lynx in Minnesota are members of a long-term resident population or dispersers from Canada that do not establish a resident population in the State (McKelvey *et al.* 2000b; R. Sando, Minnesota Department of Natural Resources, in litt. 1998). Minnesota has a substantial number of historic lynx reports, primarily trapping records (McKelvey *et al.* 2000b), as expected because of the direct connectivity of the boreal forest in northeastern Minnesota with that of Ontario, Canada, where lynx occur. Harvest and bounty records for Minnesota are available since 1930. Approximate 10-year cycles are

apparent in the data, with highs in the lynx cycle in 1940, 1952, 1962, and 1973 (Henderson 1978; McKelvey *et al.* 2000b). During a 47-year period (1930–1976), the Minnesota lynx harvest was substantial, ranging from 0 to 400 per year (Henderson 1978). These harvest returns for Minnesota are believed to be driven by immigration from Canada (Henderson 1978; Mech 1980; McKelvey *et al.* 2000b; M. DonCarlos, Minnesota Department of Natural Resources in litt. 1994). Outside of harvest data, 76 additional verified lynx records exist for Minnesota before 2001 (McKelvey *et al.* 2000b).

Reproduction and maintenance of home ranges by lynx were documented in the early 1970s (Mech 1973, 1980), potential evidence of the presence of a resident population. But this may have been an artifact of the early 1970s being a period of an extreme peak in the population cycle in Canada. Records of lynx in Minnesota have been rare in the past 2 decades; there were only 3 verified records of lynx in Minnesota in the 1990s (M. DonCarlos, in litt. 1994).

Individuals knowledgeable about lynx and snowshoe hares suggest that fires and logging created early successional forests that were conducive to abundant hare populations in northern Minnesota in the first half of the 20th century (S. Loch, in litt. 2003), resulting in the high numbers of lynx recorded during that time. In contrast, snowshoe hare numbers were exceptionally low in the 1980s through the 1990s (S. Loch, in litt. 2003), likely explaining the scarcity of lynx. Based on surveys in northern Minnesota, snowshoe hare numbers are currently high (J. Erb, Minnesota Department of Natural Resources, in litt. 2003).

In the past 3 years there have been 62 verified reports of lynx in northeastern Minnesota, 6 of which provided evidence of reproduction (usually visual observations of kittens accompanying an adult) (Minnesota Department of Natural Resources, in litt. 2003; S. Loch, in litt. 2003); it is assumed some of these reports are of the same animal or family group so the actual number of animals is likely lower. This dramatic increase in reports corresponds with a cyclic population high directly adjacent in Ontario (S. Loch, in litt. 2003). Research has been initiated that will help determine whether these animals are members of an established resident population in Minnesota or if these animals fail to persist when the cyclic population high recedes (University of Minnesota, in litt. 2002).

Lynx presence in Minnesota is an artifact of the international border between Canada and the United States

artificially splitting the lynx range in this area into two pieces of a whole that exists primarily in adjacent Ontario, highlighting a phenomenon that occurs with differing magnitude all along the international border where lynx habitat occurs on both sides of the border. It appears the Ontario lynx population sometimes expands and occupies northeastern Minnesota and sometimes it contracts and lynx recede from Minnesota. As a result, northeastern Minnesota may not always support lynx. However, we conclude that northeastern Minnesota often supports a resident lynx population because there is ample boreal forest habitat directly connected with that in Ontario, there is a high number of historic lynx records, evidence of lynx reproduction and cyclically abundant snowshoe hares.

Wisconsin—The mapping of Wisconsin shows the discrepancy that can occur between broad-scale vegetation mapping and more precise vegetation maps. Maps of the early vegetation of Wisconsin delineate only small patches of boreal forest primarily along the shore of Lake Superior in extreme northern Wisconsin (Mladenoff no date; Wisconsin Department Natural Resources, in litt. 2003; S. Hassett, in litt. 2003) compared to one third of the State being mapped as mixed deciduous-coniferous forest as broadly classified by Bailey (1998) (McKelvey *et al.* 2000b). Therefore, it is clear that historically in Wisconsin there actually was very little boreal forest and, as a result, little potential lynx habitat (Mladenoff no date; S. Hassett, in litt. 2003; Wisconsin Department Natural Resources, in litt. 2003). Where appropriate lynx forest types do occur in Wisconsin, historic snow conditions have not been optimal for lynx (Weiland 2002). This habitat is more appropriate for bobcats, which are common and well-distributed in northern Wisconsin (S. Hassett, in litt. 2003). As a result, no lynx habitat was mapped on U.S. Forest Service lands in Wisconsin because of a lack of appropriate habitat and snow depth to support lynx (Weiland 2002).

Verified reports of lynx in Wisconsin are limited (29 records from 1870 to 1992) (McKelvey *et al.* 2000b); 16 of these reports are associated with unprecedented cyclic highs that occurred throughout Canada in the early 1960s and 1970s. In 1992, two lynx mortalities were reported (Wydeven 1993; C. Pils, in litt. 1994). No sign of lynx has been found during extensive snow track surveys in potential lynx habitat in northern Wisconsin over the past 4 years (S. Hassett, in litt. 2003). There are no records of lynx breeding in Wisconsin.