

habitat that were greater than 100 square kilometers (km^2) (40 square miles (mi^2)) (Hoving 2001). The requirement for large areas also is demonstrated by home ranges that encompass many square miles. The size of lynx home ranges varies by the animal's gender and age, abundance of prey, season, and the density of lynx populations (Hatler 1988; Koehler 1990; Poole 1994; Slough and Mowat 1996; Aubry *et al.* 2000; Mowat *et al.* 2000). Based on a limited number of studies in southern boreal forest, the average home range for males is 151 km^2 (58 mi^2), for females it is 72 km^2 (28 mi^2) (Aubry *et al.* 2000). Recent home range estimates from Maine are 70 km^2 (27 mi^2) for males and 52 km^2 (20 mi^2) for females (G. Matula, in litt. 2003). However, documented home ranges in both the southern and northern boreal forest vary widely from 8 to 800 km^2 (3 to 300 mi^2) (Saunders 1963; Brand *et al.* 1976; Mech 1980; Parker *et al.* 1983; Koehler and Aubry 1994; Apps 2000; Mowat *et al.* 2000; Squires and Laurion 2000; Squires *et al.* 2001; G. Matula, in litt. 2003). Generally, it is believed that larger home ranges, such as have been documented in some areas in the southern extent of the species' range in the West, are a response to lower-density snowshoe hare populations (Koehler and Aubry 1994; Apps 2000; Squires and Laurion 2000).

Lynx are highly mobile and have a propensity to disperse. Long-distance movements (greater than 100 kilometers (km) (60 miles (mi))) are characteristic (Mowat *et al.* 2000). Lynx disperse primarily when snowshoe hare populations decline (Ward and Krebs 1985; Koehler and Aubry 1994; O'Donoghue *et al.* 1997; Poole 1997). Subadult lynx also disperse even when prey is abundant (Poole 1997), presumably as an innate response to establish home ranges. Lynx also make exploratory movements outside their home ranges (Squires *et al.* 2001). Lynx are capable of moving extremely long distances (greater than 500 km (300 mi)) (Mech 1977; Brainerd 1985; Washington Department of Wildlife 1993; Poole 1997; Mowat *et al.* 2000; Squires *et al.* 2001); for example, a male was documented traveling 620 km (380 mi) (Brainerd 1985). A male lynx in Wyoming made an exploratory movement of 730 km (450 mi) round trip from its home range (Squires *et al.* 2001). While it is assumed lynx would prefer to travel where there is forested cover, the literature contains many examples of lynx crossing large, unforested openings (Roe *et al.* 2000). The ability of both male and female lynx

to disperse long distances, crossing unsuitable habitats, indicates they are capable of colonizing suitable habitats and finding potential mates in areas that are isolated from source lynx populations.

Range of Lynx in the Contiguous United States

Within the contiguous United States, the lynx's range coincides with that of the southern margins of the boreal forest along the Appalachian Mountains in the Northeast, the western Great Lakes and the Rocky Mountains and Cascade Mountains in the West. In these areas, the boreal forest is at its southern limits, becoming naturally fragmented into patches of varying size as it transitions into subalpine forest in the West and deciduous temperate forest in the east (Agee 2000, Wisconsin Department Natural Resources, in litt. 2003). Because the boreal forest transitions into other forest types to the south, scientists have difficulty mapping its exact boundaries (Elliot-Fisk 1988). Therefore, precisely identifying and describing the distribution of lynx habitat also is difficult because there are several vegetation and landform classifications and descriptions that have been published for various parts of North America (U.S. Forest Service and Bureau of Land Management 1999). However, the term "boreal forest" broadly encompasses most of the vegetative descriptions of this transitional forest type that makes up lynx habitat in the contiguous U.S. (Agee 2000).

In addition to appropriate vegetation type, delineation of the range of the lynx within the contiguous United States must consider snow conditions. Lynx are at a competitive advantage over other carnivores (*e.g.*, bobcats (*Lynx rufus*) or coyotes (*Canis latrans*)) in areas that have cold winters with deep snow because of the lynx's morphological adaptations for hunting and surviving in such environments. Therefore, lynx populations may not be able to successfully compete and persist in areas with insufficient snow even if suitable forest conditions otherwise appear to be present (Ruediger *et al.* 2000; Ruggiero *et al.* 2000b; Hoving 2001; S. Hassett, Wisconsin Department Natural Resources, in litt. 2003). A consistent winter presence of bobcats indicates such areas are not of high quality for lynx.

Lynx in the contiguous United States are part of a larger metapopulation whose center is located in the northern boreal forest of central Canada; lynx populations emanate from this area (Buskirk *et al.* 2000b; McKelvey 2000a,

2000b). It appears hare populations and, as a result, lynx populations in the southern part of the range are cyclic, although the amplitude of the fluctuations in this portion of the range is not as extreme as in the center of the range (Aubry *et al.* 2000; Hodges 2000a, 2000b; Malloy 2000; McKelvey 2000b). When there is a high in the lynx population in central Canada, it acts like a wave radiating out to the margins of the lynx range (McKelvey *et al.* 2000a, 2000b). We know from historic data that the magnitude of the lynx population high emanating from the central Canadian boreal forest varies for each cycle (McKelvey *et al.* 2000a, 2000b). This wave can be produced by local populations reacting to environmental conditions, dispersers, or a combination of these (McKelvey *et al.* 2000b). Schwartz *et al.* (2002) concluded this wave is driven by dispersers, based on findings of a high level of gene flow between lynx in Alaska, Canada, and the western United States.

Lynx populations in the northeastern United States and southeastern Canada are separated from those in north-central Canada by the St. Lawrence River. There is little evidence of regular hare or lynx population cycles in this area (Hoving 2001), but wide fluctuations in lynx and snowshoe hare populations do occur. On a smaller scale, fluctuating populations in the core of this area (Quebec's Gaspé Peninsula, western New Brunswick, and northern Maine) can potentially influence lynx distribution up to several hundred miles distant.

We believe lynx dispersing during periods of population highs will occupy many patches of boreal habitat at the periphery of their range. Some patches will be suitable to maintain a long-term population and some will not. Where the boreal forest habitat patches within the contiguous United States are large, with suitable habitat, prey, and snow conditions, resident populations of lynx are able to survive throughout the low period of the approximately 10-year cycle. Most likely the influx of lynx from populations in Canada at the high point of the cycle augments these resident populations. It is likely that some of these habitat patches within the contiguous United States are able to act as sources of lynx (where recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey *et al.* 2000a).

In other areas, the lynx that remain in an area after a cyclic population high may be so few or in naturally marginal habitat that they are not able to persist or establish local populations, although some reproduction may occur. Such