

accurate than in the 1999 biological assessment (U.S. Forest Service and Bureau of Land Management 1999; S. Gniadek, in litt. 2003; E. Johnston, in litt. 2003; J. Whitney, Bureau of Land Management, in litt. 2003). Refined calculations for all ownerships were not provided; therefore it was not possible to recalculate the information in the biological assessment for the purposes of this remanded decision. Nonetheless, for the Southern Rocky Mountains and Northern Rocky Mountains/Cascades, we believe the proportions of lynx habitat provided in the biological assessment are still fairly accurate and useful because if the same refinements and mapping that occurred on National Forest and BLM lands were applied to non-Federal lands it would presumably result in similar adjustments. Therefore, in this analysis we will use the proportions of Federal and non-Federal lands in the Northern Rocky Mountains/Cascades and Southern Rocky Mountains, and the proportions in either developmental or non-developmental management designations for the Northern Rocky Mountains/Cascades, Southern Rocky Mountains, and Great Lakes provided in the biological assessment and used in the final rule.

In all regions where the lynx range in the contiguous United States, timber harvest and its related activities are the predominant land use affecting lynx habitat. The final rule stated that timber harvest and associated forest management can be benign, beneficial, or detrimental to lynx depending on harvest methods, spatial and temporal specifications, and the inherent vegetation potential of the site. Some timber harvest regimes can result in reduced cover, unusable forest openings, and large monotypic stands with sparse understories that are unfavorable for lynx and snowshoe hare (de Vos and Matel 1952; Harger 1965; Hatler 1988; Brittell *et al.* 1989; Koehler 1990; Hoving 2001; Homyack 2003; Mills and Griffin, in litt. 2003). Mechanical thinning (pre-commercial thinning) of densely stocked young stands to promote vigorous growth of fewer trees can reduce the stem densities required to support high numbers of snowshoe hare (U.S. Forest Service *et al.* 1999a; Homyack 2003; Mills and Griffin, in litt. 2003).

The final rule explained that forestry practices can be beneficial when the resulting understory stem densities and structure meet the forage and cover needs of snowshoe hare (Keith and Surrendi 1971; Fox 1978; Conroy *et al.* 1979; Wolff 1980; Parker *et al.* 1983; Litvaitis *et al.* 1985; Monthey 1986;

Bailey *et al.* 1986; Koehler 1990; McKelvey *et al.* 2000d). Snowshoe hare densities tend to be highest in regenerating stands with very high stem densities (Hodges 2000a, 2000b, Griffin and Mills in press, Homyack 2003). Although large openings initially may not be used by snowshoe hare and lynx, regeneration harvest units (e.g., clear-cut) in appropriate habitat types eventually (in 10 years or more depending on the type of forest) achieve early successional stages with dense understories as preferred by snowshoe hares (Monthey 1986; Quinn and Parker 1987; Koehler 1990; Koehler and Brittell 1990; Washington Department of Wildlife 1993; McKelvey *et al.* 2000c; Hoving 2001; Homyack 2003). Lynx can readily move across landscapes fragmented by commercial forestry (Squires and Laurion 2000).

The final rule suggested that large clear-cut may be detrimental to lynx because they might eliminate the mosaic forest ages and structure needed by lynx. We have learned since publication of the final rule that, in northern Maine, optimal forest conditions for lynx and snowshoe hares have been created as a result of large-scale clear cutting in the 1970s and 1980s to salvage spruce and fir stands damaged by insects. A large proportion of Maine's northern forest is currently in a stage of regeneration that provides dense understories where snowshoe hares are most abundant (Hoving 2001; Homyack 2003; Krohn 2003; G. Matula, in litt. 2003). Despite extensive clear cutting, the forests of northern Maine continue to provide a mosaic of forest ages and structure, such as required for lynx denning. As a result, Maine lynx populations are high (see "Maine" discussion above). Larger openings, such as created by clear-cut, can often more closely resemble vegetative patterns that follow natural disturbance events (e.g., fire, windthrow, and insect outbreaks) and decrease amounts of edge favorable to generalist predators (McKelvey *et al.* 2000c, Krohn 2003). We anticipate that where good snowshoe hare and lynx habitat occurs within the contiguous United States, regenerating stands that result after large clear-cut can be managed to allow regrowth of a dense understory, so that they too will provide good conditions for snowshoe hares and lynx.

Recent research in Maine and Montana measured the effects of some timber harvest regimes on snowshoe hare populations, which has implications for lynx. In Maine in 2000–2002, snowshoe hare densities were highest in unthinned, 12- to 20-year old clear-cut (1.77 hares per ha (0.72 hares

per ac)) (Homyack 2003). Pre-commercially thinned stands averaged about half the hare density (0.98 hares per ha (0.40 hares per ac)) as unthinned stands. Hare densities in mature conifer forests with sparse understories were low (0.23 hares per ha (0.09 hares per ac)). Lowest hare densities were in partial-harvest cuts (0.15 hares per ha (0.06 hares per ac)). In Montana, preliminary results of research since 1998 found that in winter snowshoe hare densities were high in mature forests with abundant understories and lowest in stands that had been pre-commercially thinned or in sparsely-regenerating clear-cut; in this study standard pre-commercial thinning had a negative effect on snowshoe hare densities in most places and times (Mills and Griffin, in litt. 2003). Furthermore, preliminary findings in Montana substantiate what scientists have generally presumed—snowshoe hares are exposed to higher predation and suffer higher mortality rates in forest stands with open understories (Mills and Griffin, in litt. 2003).

The final rule also explained that fire has an important role in forest ecology in some forest types in the United States. During the early 20th century, Federal and State agencies in the contiguous United States enacted a policy of suppressing forest fires. The effects of fire suppression, as well as timber harvest, on lynx habitat vary among the geographic regions (Agee 2000) and will be discussed separately below.

Except in the Northeast, a substantial amount of lynx habitat in the contiguous United States occurs on Federal lands, primarily National Forests and BLM lands (see Table 1). Since the listing of the lynx in 2000, Conservation Agreements the U.S. Forest Service and BLM have signed with the Service (Bureau of Land Management and U.S. Fish and Wildlife Service in litt. 2000; U.S. Forest Service and U.S. Fish and Wildlife Service in litt. 2000), and the programmatic biological opinion on National Forest and BLM land management plans (U.S. Fish and Wildlife Service 2000) committed the U.S. Forest Service and BLM to use the LCAS in determining the effects of actions on lynx (Ruediger *et al.* 2000). The final rule explained that the LCAS was developed to provide a consistent and effective approach to conserve lynx and lynx habitat on Federal lands across its range in the contiguous United States (Ruediger *et al.* 2000). The U.S. Forest Service further committed to deferring any actions not involving third parties that would adversely affect lynx until such