

Wildlife Habitat Fragmentation

BY JOHN LEHMKUHL

A primary issue in forest wildlife management is habitat fragmentation and its effects on viability, which is the "bottom line" for plant and animal species of conservation concern. Population viability is the likelihood that a population will be able to maintain itself (remain viable) over a long period of time—usually 100 years or more. Though it is true that "habitat is the key to wildlife," as bumper stickers in Washington proclaim, under the population viability framework there are two other key factors that influence viability: the species population structure and life history attributes. More on those topics later.

Habitat fragmentation has two simple components: (1) loss of habitat area; and (2) habitat isolation. The effect of habitat loss is simple: Less habitat means fewer animals that use that habitat. Habitat is temporarily lost either by conversion to some other forest condition (e.g., old forest to clearcut) or by permanent conversion to other uses like real estate development. Clearly, permanent loss of habitat is a more damaging irreversible change compared to losses from forest management practices that retain the possibilities of regeneration or restoration, or that create habitat for different species.

At some threshold of habitat loss,

the effects of isolating increasingly smaller habitat patches are added to those of habitat loss. Depending on the species, research has shown this threshold to be 40-50 percent of the landscape with habitat. At this point, the effects of habitat isolation become important as habitat patches, and the wildlife populations in them, become smaller and more isolated. Small isolated populations are more prone to extirpation from demographic, genetic or environmental influences than large well-connected populations. This habitat threshold, however, is not a hard-and-fast rule. The exact threshold for habitat isolation effects depends on the other aspects of population viability: the population characteristics and life history of the particular species.

Population characteristics and the life history of the species interact with habitat to determine how well a population persists. Species that usually have few problems are relatively abundant, can live in a variety of habitats and have the ability to move about and find, colonize and reproduce in new habitat patches created by management actions. Examples of these species are deer, most rodents and many migratory birds.

Species that are rare, that do not or cannot move much (e.g., lichens, reptiles, amphibians) or that have very narrow habitat requirements are more

negatively affected by fragmentation. Large animals generally can move long distances and are less affected by distance between habitat patches, but because of their size, a viable population might require substantial habitat area in large patch sizes to remain viable. On the other hand, small species often have difficulty moving between habitat patches, but a relatively small patch of habitat can support many small animals, such as mice or hares, that reproduce fairly quickly to maintain a viable population. In general, strive to maintain large patches of well-connected habitat to support viable populations. One way to increase connectivity is to provide dispersal habitat or habitat corridors to facilitate movements between habitat patches.

"Good" and "bad" habitat usually refers to terms related to vegetation conditions that are used (good habitat) or not used (bad habitat). In terms of population viability, good habitat more precisely describes stands or landscapes where a species can reproduce and maintain its population over time. Habitat that meets those conditions is called "source" habitat. It often yields a surplus of animals that disperse to other habitat patches where they can augment declining populations, colonize new habitat patches or recolonize patches where animals are locally extirpated. Ideally, all habitat would be source habitat.

Bad habitat, then, precisely means habitat that is used, but where conditions are inadequate to support survival or birth rates that allow for long-term persistence. Bad habitat may be inherently bad in the sense that food, water and cover are marginal, or it may be otherwise good habitat that has been degraded by outside influences, such as human disturbance. The formal term for bad habitat is "sink" habitat or habitat where a population is not sustainable.

Sink habitat can be created in sev-



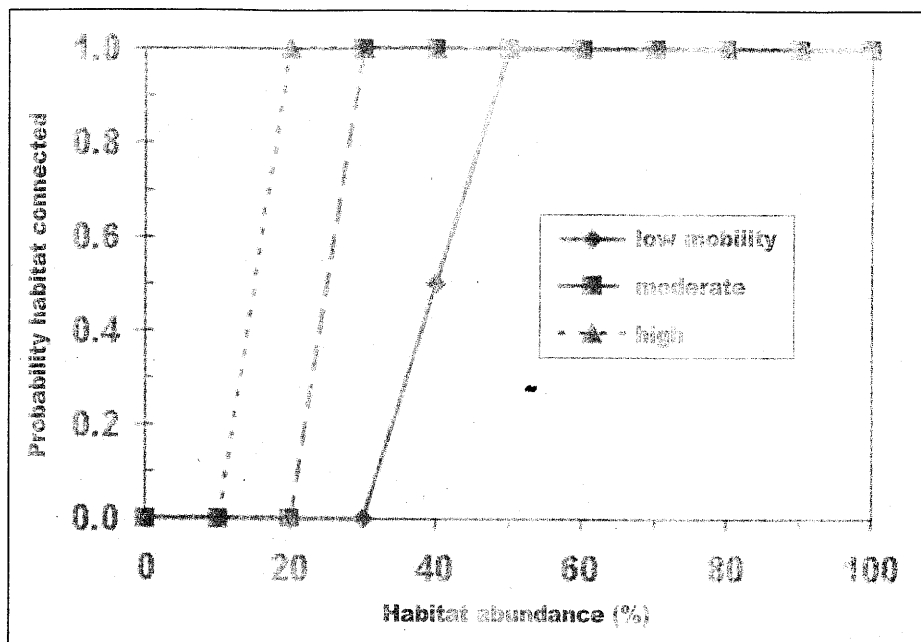
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SOURCE: FAHRIG, L. 1999

A model example of how animals with different life-history characteristics, mobility in this case, differ in landscape thresholds to habitat loss caused by fragmentation. The probability of occurrence for low-mobility species that cannot easily overcome habitat isolation caused by fragmentation declines much earlier than for high-mobility species.

eral ways. Small patches of habitat created by fragmentation might be too small to maintain a viable breeding population, i.e., the death rate is higher than the birth rate. A patch of habitat might be affected by human disturbance—for example, roads may be barriers to movement or disturbance from traffic and associate human uses (hunting, cutting snags for firewood) might lead to poor reproductive performance or elevated mortality.

A patch of sink habitat might be too isolated from similar patches of habitat to allow for immigration, so a population in trouble because of poor weather or locally poor food production could not be rescued by immigration of animals from patches of source habitat. A small patch has relatively less interior area and more edge where altered microclimate affects plant understory structure, or where high predation might limit successful reproduction in some species. Edge effects have been well documented in

the eastern U.S. for birds, but there is little evidence for edge effects on western wildlife species.

An important point is not to equate a naturally patchy forested landscape with a forest landscape fragmented by human activity. Interior Pacific Northwest forests, in particular, are inherently patchy in terms of forest composition and structure across the

landscape as a result of strong environmental gradients or disturbance regimes (e.g., fire, insects, disease). Many animals and plants in these landscapes have evolved to live in these patchy areas, and hence have mechanisms to cope at some level with further isolation, or fragmentation, of habitat by humans. The habitat loss component of fragmentation will always be an issue regardless of location.

There are several key things to remember about habitat fragmentation. Forest practices that alter forest composition and structure can be good, bad or neutral for wildlife. Some species might gain and some might lose habitat, with corresponding short- and long-term effects on population size and persistence. Impacts depend on the specific species; their habitat requirements, population structure and life history; and the landscape context. Landscape-level issues of habitat distribution and connectivity across ownerships usually need to be addressed through collaboration among private and government land managers, especially for wide-ranging wildlife. ♦

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