Viability as a Criterion for Critical Habitat Determination

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Viability can be defined as the chance (probability) of the survival of a species, or its recovery to a predetermined level. Thus, it is an endpoint (measure) that is imminently relevant to the purposes of designating critical habitat. Although there are other measures (such as habitat area, population size, population trend) that relate to the goals of critical habitat designation, only an overall measure such as viability can integrate the various factors that determine persistence and recovery. Habitat is only one of these factors; others include population demography (survival, reproduction, variability and density dependence in survival and reproduction) and metapopulation dynamics (spatial subdivision, dispersal and recolonization). Even the same demography and the same amount of habitat can result in different dynamics and different chances of persistence, depending on the spatial configuration of the habitat. Therefore, critical habitat determination must take into account both types of factors, and rely on measures, such as viability, that can integrate the effects of these different factors. Viability can be used as a criterion for determining critical habitat by employing habitat-based metapopulation models. These models integrate demographic models (age-, stage- and/or sex structured models of population dynamics) with habitat models (species-habitat relationships identified by statistical analyses). In using these models, the first step is characterizing the habitat requirements of the species. The end products of this step are quantitative functional relationships that describe presence of the species or its life history variables as functions of habitat variables. The second step is determining and locating the amount and configuration of habitat required for the survival or recovery of the species. In this step, habitat-based metapopulation models are used to define the spatial structure of the metapopulation (number, size, and location of the populations) based on the distribution of suitable habitat, and the demographic parameters of the model (carrying capacities, survivorships, fecundities, etc.) in terms of habitat variables in each habitat patch. For a given configuration and amount of habitat, these models can be used to determine whether the area can support a population that has a low risk of decline and/or a high probability of recovery.