

numbers of individuals and in terms of area covered by the plants. Therefore, there is probably little genetic variability in this species, making it more important to maintain as much habitat and as many of the remaining colonies as possible. Rock slides, severe storms or droughts, or other natural events could easily eliminate populations of this lichen.

In recent years the spruce-fir forests adjacent to the high-elevation cliffs and rock outcrops occupied by this rare lichen have suffered dramatic declines due, at least in part, to airborne pollution and the impacts of an exotic insect, the balsam wooly adelgid. The impacts of this forest decline on *Gymnoderma lineare* cannot be accurately assessed at this time. Even though rock gnome lichen often grows in exposed places, the drastic decline of adjacent high-elevation forests may result in excessive desiccation of the moist sites required by the species. This theory would seem to be supported by the fact that *Geum radiatum* (spreading avens), already federally listed as endangered, is showing drastic declines at many of the same sites. With all but seven of the remaining populations of *Gymnoderma lineare* being less than 2 square meters (2.4 square yards) in size, and with this species' very slow growth rate, even relatively small declines could pose a significant threat to the long-term survival and recovery of the species.

In addition to the indirect effects of air pollution on this species' habitat, lichens are known to effectively accumulate a wide variety of pollutants washed from the atmosphere by precipitation (St. Clair 1987). Photosynthetic rates, respiration rates, and the membrane integrity of lichens have all been found to be very sensitive to a wide range of common air pollutants, including sulfur dioxide. St. Clair (1987) states, "Indeed lichen physiological processes appear to provide an indication of pollution damage long before any visible thallus necrosis or changes in community structure can be detected." A field study conducted by Pearson and Rodgers (1982) showed that membrane integrity in lichens is severely impacted following exposure to sulfur dioxide. Lawrey (1987) found that increasing levels of sulfur dioxide pollution had resulted in the elimination of some species of lichens in an area just north of the range of *Gymnoderma lineare*. Heavy metals and ozone also have been found to negatively affect lichens' potassium efflux, chlorophyll content, and photosynthetic rates (Puckett 1976, Nash and Sigal 1979, Sigal and Taylor

1979). Several observers have already noted declines in populations of *Gymnoderma lineare* that cannot be directly attributed to physical disturbance of the habitat (Weakley, personal communication, 1992; DePriest, personal communication, 1992; Shawn Oakley, The Nature Conservancy, North Carolina Field Office, personal communication, 1992). Given the extremely small size of most of the remaining populations, declines of just a few centimeters a year could result in the imminent extirpation of all but three of the remaining populations of this species.

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by this species in determining to make this rule final. Based on this evaluation, the preferred action is to list *Gymnoderma lineare* as endangered. With 14 percent of the known populations having been completely extirpated and all the remaining populations subject to some form of threat, this species warrants protection under the Act. With the small number of individuals and area covered by the remaining populations, and with significant declines having been documented in many of these, this species is in danger of extinction throughout all or a significant portion of its range and therefore qualifies as an endangered species under the Act. Critical habitat is not being designated for the reasons discussed below.

#### Critical Habitat

Section 4(a)(3) of the Act, as amended, requires that, to the maximum extent prudent and determinable, the Secretary propose critical habitat at the time the species is proposed to be endangered or threatened. The Service finds that designation of critical habitat is not presently prudent for *Gymnoderma lineare*. Publication of critical habitat descriptions and maps would increase public interest and possibly lead to additional threats for this species from collecting and vandalism (see threat factor "B" above). The species has already been subjected to excessive collecting by scientific collectors at several sites. Increased publicity and a provision of specific location information associated with critical habitat designation could result in increased collection from the remaining wild populations. Although taking of endangered plants from lands under Federal jurisdiction (and from privately owned lands under certain circumstances—see "Available Conservation Measures" section) and reduction to possession is prohibited by

the Act, taking provisions are difficult to enforce. Publication of critical habitat descriptions would make *Gymnoderma lineare* more vulnerable and would increase enforcement problems for the U.S. Forest Service and the National Park Service. Also, the populations on private lands would be more vulnerable to taking. Increased visits to population locations stimulated by critical habitat designation, even without collection of plants, could adversely affect the species due to the associated increase in trampling of the fragile habitat occupied by this lichen. The lichen is easily scraped off its rocky substrate, and denuded habitat is not quickly recolonized. The Federal and State agencies and landowners involved in managing the habitat of this species have been informed of the plant's locations and of the importance of protection; therefore, it would not be prudent and no additional benefit would result from a determination of critical habitat.

#### Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies, groups, and individuals. The Act provides for possible land acquisition and cooperation with the States and requires that recovery actions be carried out for all listed species. Such actions are initiated by the Service following listing. The protection required of Federal agencies and the prohibitions against taking are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

The U.S. Forest Service and the National Park Service have jurisdiction