Wolves Will Not Provide Small-scale Ecological Restoration

Licht and colleagues (*BioScience* 60: 147–153) proposed a paradigm shift in wolf management to include the introductions of small, highly manipulated groups of wolves (*Canis lupus*) to confined natural areas to facilitate ecosystem recovery. Certainly, reductions or losses of apex predators from many regions worldwide have had profound effects on ecosystem characteristics (Soulé et al. 2003). Numerous efforts to restore or enhance predator populations through policy change or reintroductions have occurred, often with the intent to restore ecosystem function (Breitenmoser et al. 2001). However, in addition to the gargantuan technological and political challenges inherent in Licht and colleagues' proposal, we contend that intensively managed wolves will not restore natural ecosystem processes given the disparity in scale between these proposed actions and the ecosystem processes that wolves foster. Further, we note that predator-prey relationships are more complex than Licht suggested.

Licht and colleagues described using "a functioning wolf pack" as the basic unit for small-scale introductions (p. 149), but wolf packs function naturally only in the context of a wolf population applying social and demographic forces on wolves at the pack level (Mech and Boitani 2003). Further, recruitment of young into a wolf population is a primary role for a wolf pack; this function must be removed or closely controlled under Licht's scenario. Consequently, wolves introduced to small fenced areas would not be expected to behave naturally or impart natural processes on degraded ecosystems. Viable free-ranging wolf populations generally function at numeric and spatial scales much greater than the pack level. Thus, the goal of using wolves for "restoring naturally functioning ecosystems within natural areas" (Licht et al. 2010, p. 151) is not tenable at the spatial extent proposed.

The introduction of wolves may not have the population-level effects on ungulates or ecosystem recovery desired by Licht and colleagues, either. For example, on Isle Royale, in spite of decades of wolf predation, the moose (*Alces alces*) population there has generally existed at very high densities (Messier 1994), and the primary winter forage for moose, balsam fir (*Abies balsamea*), is declining across the island (McLaren and Peterson 1994). At Yellowstone, elk numbers have declined on the northern range, but those declines have been driven predominantly by hunter harvest and severe weather events (Vucetich et al. 2005, White and Garrott 2005). Further, Yellowstone wolf recovery has occurred with extant populations of other large predators; combined effects of more than one large predator species are much more likely to limit ungulate densities (Mech and Peterson 2003). Thus, introducing wolves into small natural areas with overabundant ungulate populations would not guarantee marked reductions in ungulate populations and associated improvements in ecosystem health.

The goal of ecological restoration is to reestablish structure and function to degraded ecosystems (Society for Ecological Restoration International 2008), necessitating that species and associated processes occur at appropriate ecological scales. Although small-scale introductions of wolves in natural areas to reduce ungulate populations may cause ecological change, such change does not necessarily constitute ecosystem recovery to a more natural state.

JERROLD L. BELANT
LAYNE G. ADAMS

Jerrold L. Belant (jbelant@cfr.msstate.edu) is with the Carnivore Ecology Laboratory Forest, and Wildlife Research Center at Mississippi State University. Layne G. Adams (ladams@usgs.gov) is with the US Geological Survey Alaska Science Center in Anchorage.

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Restricting Wolves Risks Escapes

Implementing the proposal set forth by Licht and colleagues (*BioScience* 60: 147–153) requires restricting wolves to tiny "islands," areas that are magnitudes smaller than the ranges of most wolf populations. Wolves naturally have large ranges; restricting their spatial needs increases the risk of wolves escaping, exacerbating public relations and political and legal problems.

These problems would not be solved by (a) scaring back straying radioed wolves; (b) controlling reproduction; or (c) the use of physical, virtual, or biological barriers. The problem is not wolves breeding; it is wolves killing livestock and pets, or at least people fearing they will. Standard wolf-proof barriers are 10-feet-high, chain-link fences with a 4-foot apron buried 2-feet below ground. Virtual fences, shock-collars with electrodes continually touching the skin, and frequent battery replacement are all problematic, even for captive wolves (Shivik et al. 2002). Scent-marking and howling, controls suggested by Licht and colleagues, can affect wolf movements,