Restricting Wolves Risks Escapes

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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.

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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,

but our research demonstrates that trespass is common (Mech 1994).

The prospects for public tolerance of such costly and intensive management seems dim anytime soon.

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Fences are More than an Issue of Aesthetics

Licht and colleagues (*BioScience* 60: 147–153) identify South Africa's pioneering efforts to reintroduce top predators to small, fenced protected areas as a conservation model America might be wise to follow. However, South African success at large predator reintroduction is largely the result of ubiquitous fencing that generally prevents predator conflict with people and livestock (see Gusset et al. 2008).

The consequences of applying a similar paradigm in America are not only aesthetic, as implied by Licht, but could also compromise the long-term success of biodiversity conservation. A recent review of fencing for conservation concluded that fencing is an acknowledgment that we are failing to coexist with and successfully conserve biodiversity, and that the costs—economic and ecological—generally far exceed the benefits (Hayward and Kerley 2009). Ecological costs include fence-line mortalities, influences on natural behavior, impingement on natural mechanisms of population control, restriction of animal movements in response to environmental changes (e.g., fires, climate change, drought), limitation of migration and genetic flow, and impediment to recolonization and source–sink population dynamics.

Licht and colleagues stated that there are relatively few concerns in South Africa about the fence around Kruger National Park. This is incorrect—there are serious ecological concerns including extinction debt and species persistence of many iconic herbivores, even though the park covers nearly 20,000 square kilometers (Nicholls et al. 1996, Ogutu and Owen-Smith 2003). Fences around smaller protected areas can be even more problematic.

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Looking to the Past for the Future: Using Wolves to Restore Ecosystems (Response To Belant, Mech, and Trimble)

Several authors have highlighted their issues with our suggestion that small groups of wolves could facilitate ecosystem restoration in select areas (Licht et al. 2010). They expressed concerns, based on their experiences, about the complexities and uncertainties surrounding the proposal—concerns that we acknowledge. However, their focus on issues that have been addressed with large carnivore reintroduction elsewhere, in addition to their failure to consider the potential value of nontraditional restoration opportunities, unintentionally reinforces our broader contention that new thinking about the role of wolves in ecosystem conservation is needed.

Trimble and van Aarde and Belant and Adams note that fencing for conservation creates a host of problems. We concur that there are logistical, ecological, and aesthetic challenges, and that such an approach should be considered only after other options have been dismissed. However, the model is successfully and routinely used in other countries to restore large predators, species richness, and ecosystem processes. Decades of experience in places such as South Africa have exposed some issues, but they have also demonstrated substantial economic and ecologic benefits. Furthermore, many of the potential negative aspects of fencing that Trimble and van Aarde listed would also apply to island situations; although wolves at Isle Royale do not become entangled in boundary fences, they do regularly drown or fall through thin ice in Lake Superior. Yet after 60 years, wolf establishment at Isle Royale stands unchallenged as a conservation success story.

Based on previous experience with wolf conservation, Mech and colleagues raise many similar concerns about the feasibility of ideas presented in our research, citing excessive cost, high likelihood of escape, and increased conflict in surrounding areas. These constraints are largely