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OPEN PEER COMMENTARY

Don't Give up Just Yet: Maintaining Species, Services, and Systems in a Changing World

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Sandler's paper, 'Climate change and ecosystem management' (2013), takes a clear-eyed and sober look at conservation via static reserves and ecosystem restoration in the context of climate change. It is a necessary discussion; while following traditional management practices is, in some ways, comforting and simple, the consequences of climate change throw those practices into a questionable light. Climate change makes achievement of their objectives extremely unlikely, and so their goals must change—losing their species-protection emphasis and falling back on more general goals of human interdependence, natural settings, and the like. We must revisit the goals of ecosystem management, better align our planning with the reality of climate change, and decide how interventionist our management should be. This paper is an excellent contribution, and this commentary (and its somewhat devil's advocate approach) is offered in the spirit of debate.

Sandler's thesis is that species-specific or restoration oriented reserve planning goals are not justified, and therefore those goals must change. This lack of justification follows from the inherent difficulty of preserving species—it is not practical in a changing climate—and a shifting ecological context which decreases the value of those species. This commentary will address the practical and valuation argument, and then talk about some limitations of this approach—namely that ecosystem processes and services are not contingent on species in the first place, leading to some overly bleak conclusions.

Practicability

In compelling language, Sandler argues that place-based species preservation is already 'decreasingly viable' due to shifting species ranges, climate conditions, and human pressures, and things will only get worse as climatic shifts increase. This is fairly uncontroversial (Loarie et al., 2009). Moreover, ecological restoration is somewhat of a moot point, as ecological communities probably cannot exist in their historical form in a non-historical climate. This is also fairly uncontroversial in the scientific literature (for example, Harris et al., 2006).

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Valuation

In terms of species-focused preservation, Sandler correctly notes that species are best understood in their ecological context. Then he makes the claim that species values are *dependent* upon their ecological context: ‘...even if a species is preserved through assisted colonization, the value of the species is not.’ This is questionable for two reasons. First, many people would likely disagree that species lose value in isolation; species, and the diversity of species, have intrinsic value for many (he admits as much for certain species). Second, it is limiting. While species may indeed lose their ecological connections via translocation and movement, they may create new ones. The loss of *current* context does not imply a lack of *future* context.

Is there any value to be preserved via restoration (to historical conditions)? Sandler makes the point that what are considered ‘historical reference conditions’ are merely coincident species ranges overlapping due to climatic and community-driven dynamics, transient by nature. In this light, valuing the historical reference condition seems more nostalgic than rational. Yet there is something to be said for historical communities—they worked. Human-created ecosystems are seldom as successful by a variety of measures, such as resiliency, diversity, responsiveness and so forth. Restoration of historical communities is valued not just for the community itself, but also for the ecological lessons learned when restoration succeeds or fails (deemed the ‘acid test’ by Bradshaw, 1983). Going forward, ecosystems will go through a number of fundamental changes as species respond differentially to changing climates, dispersal limitations, community composition shifts, and other factors. To the extent that science understands how communities function, assemble, and fail, management of that transition—from current ecosystems to novel, future ones—becomes possible. So the value in restoration is not just in the end goal, but in the process itself.

Novel Communities, the Same Services

Finally, the picture may not be as bleak as implied by Sandler, for some things at least. Sandler (2013) writes that ‘Because ecosystems... are coming apart, the environmental goods and values tied to them cannot be preserved by protecting the places where they currently are (or have historically been).’ This is a misunderstanding of ecosystem services. In many cases, ecosystem services are emergent properties of their communities, rather than dependent upon a single species. While species may be lost, ecosystem services are a different story. For example, timber production is an ecosystem service provided by forests. The specific species that provide timber (and other forest-associated ecosystem services, such as wildlife habitat, hydrologic regulation, etc.) may be threatened. However, many of those services are not species-specific—the introduction (natural or human-assisted) of other tree species can serve to maintain those services in the future. To the extent that a *system* can be preserved through natural or assisted migration, planting, or other activities, ecosystem services may be preserved (Millar et al., 2007; Seddon, 2010). Think of preserving a forest, rather than a *specific* forest.

Preserving Species and New Communities

To return to the valuation argument, species may have value in the future, just in a different context than they have now. Future climatic contexts and future communities—

novel assemblages of species as they may be—could provide the same ecosystem goods and values, as well as preserving individual species, albeit in a new ecological community/context. Loss of a species means the loss of a unique puzzle piece that may be used in the creation of novel ecosystems. Services may be maintained if the appropriate species are introduced, naturally or human-assisted. This sort of ecological planning requires extensive knowledge of community dynamics (Bradshaw, 1983; Choi, 2004), which restoration can inform, and active experimentation (see Chapin et al., 2007).

Preservation of particular species is then a matter of including them in the planning—and potentially moving them there via assisted colonization (Seddon, 2010). There are many germane and serious arguments against assisted colonization, in addition to that which Sandler cites (McLachlan, Hellmann, & Schwartz, 2007). The complexities of ecological systems means unexpected outcomes are common. For this reason (and others), many communities will likely take Sandler's approach. This is understandable, although 'naturally' adapting ecosystems may not be qualitatively better than 'planned' ecosystems (some naturally adapting ecosystems may be dominated by invasive species and altered disturbance regimes, and may contain less biodiversity, less resilience, and less value than comparable 'assisted transition' ecosystems). In addition, the arguments against inaction are just as strong (and also well described by Sandler); the pace of climate change makes continued existence of many species nearly impossible by any other means (Loarie et al., 2009).

Conclusions

Sandler is correct: our perspective on preservation must change. Yet there are multiple options. Sandler's new justification for reserves amounts to a lowered set of expectations, from species preservation to simply being of 'comparatively higher' ecological value (relative to non-preserved areas), which the reserves presumably already are. Another option is attempting to save systems, rather than specific ecosystems; maintenance of a forest, rather than a specific forest, as a goal. Species-preservation plans can be incorporated into these goals, and assisted colonization should be considered in a careful, nuanced, and deliberate fashion. These two goals are very different, non-interventionist versus interventionist, but not mutually exclusive (Harris et al., 2006). Some locations are likely to be more suitable to one or the other, for ecological or local (human) values. Deciding what to pursue, and where, will require a frank assessment of the probabilities of success, likelihood of unexpected results, and options available (Choi, 2004; Seddon, 2010). This will require more research, both theoretically and locally, as well as expert and practical knowledge (Seastedt, Hobbs, & Suding, 2008). In a restoration context, Bradshaw (1983) called this planning 'creative ecology,' but that term should apply to climate adaptation more generally. Let us not abandon species because their natural setting is being lost. We should acknowledge that 'natural settings' rarely exist anymore anyway; climate change means all settings are impacted by human activity. Do not be so quick to abandon species because their ecological context is changing. If possible, find them a new one.

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