PERSPECTIVE

# Wolf Reintroduction: Ecological Management and the Substitution Problem

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## ABSTRACT

Elk overgrazing in Rocky Mountain National Park (RMNP), understood largely to be a consequence of wolf extirpation, poses not only a practical problem, but also several conceptual hurdles for park managers. The current RMNP ecosystem management plan addresses overgrazing by culling elk and fencing off riparian environments. This "functionalist" view effectively substitutes the role of wolves in the ecosystem with human intervention, and implicitly conflates the role or function of wolves with wolves themselves. In this paper, we argue that such substitution logic presents a conceptual problem for restoration. Seeking a resolution for this "substitution problem," we distinguish between "reparative restoration" and "replacement restoration." Where reparative restoration seeks to repair damage, replacement restoration seeks more aptly to replace the function of one ecological component with another. We suggest that in many cases reparative restoration is preferable to replacement restoration, and when characterized as such, may serve to better justify wolf reintroduction.

**Keywords:** environmental ethics, reparative restoration, replacement restoration, Rocky Mountain elk, Rocky Mountain National Park.

The very same year that Woodrow Wilson established Rocky Mountain National Park (RMNP) in Colorado's high country, the federal government began subsidizing predator control on federal lands. In Colorado in 1915, this meant, among other things, the extermination of wolves (*Canis lupus irremotus*), a practice that was exceptionally effective (NPS 2012a). By the mid-1930s, wolves were nearly eradicated from the state (CPW 2012). The irony of establishing a park and then proceeding to exterminate some of its core predators is rich, but all the richer due to the circumstances that predated the extermination of the wolf. The wolves were widely seen as a threat to livestock and game, yet Colorado's population of Rocky Mountain elk (*Cervus canadensis nelsoni*) had been wiped out sixty years before, in the mid-1870s, by overhunting (NPS 2007). Only two years before RMNP was given the designation by which we refer to it today, land managers sought to reintroduce the elk into their native habitat, thereby spawning the effort that eventually galvanized support for the park among the public. All at once, this added fodder to the case that wolves, the other major predator of elk, should be exterminated. Thus, the restoration shell game between hunters, elk, and wolves began.

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A century later, elk overpopulation in RMNP threatens the park's ecosystem. As the elk population has risen, unchecked by natural predators for decades, the elk have grazed some park vegetation nearly out of existence. Stemming in part from the 1963 Leopold Report, management policies for U.S. national parks required for a time that "natural" conditions, as well as ecological and physical processes, be maintained and/or restored as much as possible (Slack 1994, NPS 2006). Recent recommendations revisited the Leopold Report to turn more directly to environmental health and integrity, acknowledging potential confusions regarding the more naturalistic approach (NPS 2012b). To combat the "unnatural" effects of too many elk, National Park Service [NPS] rangers now act as surrogate predators, culling the ungulates and building fences around riparian zones to keep the elk out, the same way predation by and fear of wolves once did.

In this paper we argue that such practices confuse two discrete but overlapping objectives: management and restoration. Park elk management practices seek to restore the ecosystem by substituting wolves with careful human interventions. Such strategies implicitly conflate the value of the wolves to the ecosystem with the function of those wolves in the ecosystem. This position introduces what we call, following Eric Katz, the "Substitution Problem": if the value of wolves is established or determined by their function, as some argue, then any surrogate component that serves the same function can reasonably restore value to that ecosystem (Katz 1985, Katz 2000). The problem is that the rigid functionalism that gives rise to the Substitution Problem, which engenders real practical implications for many conservation professionals, is too limiting. In this paper we seek to show why this is so; and more pressingly, we defend a solution to the problem.

If wolf reintroduction is argued on functional grounds, as it often is (Licht et al. 2010, Sandom et al. 2012), but the relevant functional value of wolves is challenged or questioned (e.g., Mech 2012), then functional arguments alone may not be a useful tool for wolf reintroduction. Instead, one must seek ecological repair through other channels: by returning the ecosystem as near as possible back to its original composition. To be sure, functional arguments can be employed to support park management practices, but we seek to distinguish reparative restoration from replacement restoration, and claim that reparative restoration offers motivation for wolf reintroduction.

There are many familiar arguments against functionalism, of course, such as claims against the notion that things in the world have no intrinsic teleology, purpose or function (Brennan 1984). Another argument lodges a claim against the completeness of models (Fujimura 2011). As many modelers will acknowledge, models are simplifications of the world, and thus cannot be sufficient to describe the world in all its nuance or complexity. Our argument includes, and then expands upon, these two arguments against functionalism. We offer below yet a third argument against functionalism: that even if the core functionalist premises are correct, they are sufficient only as a crude tool for ecosystem management, not ecosystem restoration. As ours is primarily an ethical argument, operating within the philosophical tradition, we approach the question of wolf reintroduction conceptually.

## Elk Overpopulation and Ecosystem Health

With the decline or extirpation of a top-level predator from an ecosystem, top-down trophic cascades may "release" species at lower trophic levels to spur population growth. For instance, long-term studies on Isle Royale suggest that moose populations increase with the decline of wolf numbers (McLaren and Peterson 1994). The reintroduction of wolves to Yellowstone National Park and surrounding areas also offers guidance about the impacts of wolves on ecosystems. In Yellowstone, elk are the primary prey species for wolves (Smith et al. 2003). Wolf reintroduction has had indirect effects on other species interactions—for example, coyote density has decreased, with a subsequent increase in pronghorn (*Antilocapra americana*) fawn survival (Berger et al. 2008). Scavengers, such as ravens (*Corvus corax*), magpies (*Pica hudsonia*), eagles (genus *Aquila*), coyotes (*Canis latrans*), and even grizzly bears (*Ursus arctos horribilis*), also benefit from prey killed by wolves, suggesting perhaps that providing food for the scavenger guild may also help preserve biodiversity (Wilmers et al. 2003). Other research has found evidence of non-consumptive effects of predation, such as the return of vegetative communities due to changes in elk behavior because of the presence of wolves (e.g., Ripple and Beschta 2006), although the results of this work have been challenged. Subsequent work suggests that "wolves' consumption of elk, rather than a 'landscape of fear', is the more likely pathway for cascading effects" (Middleton et al. 2013). Though the non-consumptive effects may be under review, there is little doubt that the presence of wolves on the landscape directly impacts elk populations.

Arguably the biggest issue resulting from elk overpopulation is damage to plant communities and the aforementioned loss of biodiversity (Seager et al. 2013). For example, elk herbivory in RMNP has been documented as a major factor inhibiting aspen (*Populus tremuloides*) regeneration (Baker et al. 1997). Other concerns include the risk of greater damage and danger from increased human-elk interactions (Fix et al. 2010) and the threat of spreading chronic wasting disease (Monello et al. 2014). In response to these concerns, the park has developed an extensive "Elk and Vegetation Management Plan" (hereafter EVMP) (NPS 2007). The goals of this plan for the next 20 to 50 years include (NPS 2007, p.12):

- "Restore and/or maintain the elk population to what would be expected under natural conditions to the extent possible.
- Redistribute elk to disperse high densities of elk.
- Restore and/or maintain the natural range of variation in vegetation conditions on the elk range, to the extent possible.
- Recognize the natural, social, cultural, and economic significance of the elk population."

These goals express various objectives and values, but all share the same fundamental approach: reduce the number of elk. Five methods for reducing the elk population are listed in the EVMP:

- Culling inside the park
- Hunting outside of the park
- Fertility control
- Fencing (certain areas of vegetation within RMNP)
- Release of wolves

The first four of these methods plainly involve human intervention and require continued monitoring and management. The fifth relies on wild animals and natural processes to restore the ecosystem. Indeed, given that park management policies require that the park "restore biological processes and maintain natural conditions," only this last option seems to accord with this principle.

Reintroducing wolves to RMNP would allow the park to address directly the threat of trophic downgrading, and thus better meet its mandates and preserve natural conditions and processes (Edward 2009).

This argument for reintroducing wolves to RMNP is primarily ecological: elk overpopulation is degrading the park ecosystem and reintroducing wolves may help control the elk. Control will occur primarily through predation. Though somewhat disputed in the literature (Mech 2012, Middleton et al. 2013), wolves may also impact elk behavior through the threat of predation, or "the ecology of fear" (Brown et al. 1999, Ripple and Beschta 2004). "Ecologies of fear" describe how the threat of predation may affect animal behavior (Laundré et al. 2001, Ripple and Beschta 2004). For example, with wolves around, elk may be less likely to feed in riparian areas, such as those that are confined and slippery, thus allowing willow and other riverside species to regenerate. Much of the research concerning fear and its effects on trophic cascades has been conducted in and around Yellowstone National Park, and so outcomes could certainly be different in the context of RNMP.

The benefits of direct predation by wolves as a means to reduce elk populations are only one reason among many that weigh in favor of reintroduction, of course. Wolf reintroduction may be required by more fundamental obligations, for instance, obligations to restore the RMNP ecosystem to compositional integrity (Hettinger and Throop 1999). Importantly, such obligations needn't rest on any particular moral commitment. They may derive from various sources: obligations under which we placed ourselves upon creating the national parks (and as specified above in the Park Service mandate); obligations deriving from an inability to justify the initial extirpation and continued absence of the wolf; obligations stemming from the observation that wolves are essential to healthy (and therefore valuable) ecosystems, and so on. Despite these various sources of obligation to restore RMNP, park managers have frequently argued against the reintroduction of the wolf, often for expressly non-ecological reasons.

Almost all of the arguments that RMNP managers offer against returning wolves are rooted in the legal liability, and arguably moral culpability, that RMNP would assume if wolves were to prey upon livestock or humans. The significance of this concern about liability and culpability is reflected in RMNP's ostensibly contradictory position on self re-establishment: that if wolves return to the park of their own accord, say by dispersing south from Wyoming, then the managers of RMNP may in fact welcome them (Baker 2009). In other words, wolves are welcome into the park if they disperse naturally, but the park cannot initiate this re-establishment, lest RMNP be strictly liable for negative outcomes following from the wolves' reintroduction. This position is held despite the fairly universal acknowledgment that the presence of wolves will likely improve ecosystem health and/or restore the park to a more "natural" state. The irony here is that if the wolves do establish a population within the park, individuals will likely be descendants of wolves that had been reintroduced to Wyoming and Idaho nearly two decades ago.

More general arguments against reintroduction are legion throughout the mountain West, and include risks to the safety and security of surrounding communities, threats to livestock, the intensive management necessary to deal with wolves that disperse outside the park, as well as the relatively small size of suitable habitat within the park (Baker 2009, Reading 2009). On this last point, plenty of suitable habitat surrounds the park, but much of it is managed by the US National Forest Service or state agencies, which often have different management mandates than the Park Service. This arrangement "often poses complications in situations where parks border other federal lands and where animals move in and out of the parks" (Wright 1999). All issues relate fundamentally to the control RMNP feels they would have to retain over wolves if they were to reintroduce, and thus take responsibility for them.

## Functionalism and the Substitution Problem

Apart from the above concerns, and partly due to the aforementioned political considerations, there is a common argument that seeks to sidestep wolves altogether. This argument proposes that ecosystem health can be restored by replacing wolves with their functional equivalents and may offer a quick response to those who think that restoring wolves is too risky. We call this the Function Argument (FA). It rests on two premises:

1. **The Model Premise (MP):** Ecosystem health can be ascertained by evaluating how well components of an ecosystem function together.
2. **The Primary Function Premise (PFP):** The value of primary predators (such as wolves) is determined by their important function in the ecosystem, namely to control prey (such as elk).

Neither of the premises of the FA are particularly controversial. There are, however, a few observations to draw. First, it is reasonable to conclude that elk overpopulation can at least in part be explained because the elk's primary predator, wolves, are missing and other mechanisms to control population (mountain lions, human hunters outside the park) are not enough to limit the population. If primary predators are removed and other mechanisms are not strong enough to serve the function of population control, prey will overpopulate. Second and more importantly, it follows naturally from this line of reasoning that if one seeks to control elk overpopulation (and thus to restore ecosystem health), it is not the primary predators themselves, but the function of the primary predators that must be reinstalled.

The function of the primary predators can be reasonably well accomplished by introducing any of several management strategies, such as culling, fertility control, and fences. It would appear from these observations that if one aims also to restore ecosystem health then one need put into place one or more of many possible population control measures.

Generally speaking, this is the standard ecological puzzle for wolf reintroduction: to try to establish the role or primary function of wolves in the promotion of ecosystem health. What function do they really serve? Are they critical to ecosystem health or are they predatory meat-eating machines? Ecologists have spent significant time investigating a variety of theories exploring what the primary function of wolves is. In this manner, the PFP has a normative valence, suggesting that the value of the wolves can be established by appeal to their primary function. If wolves serve X, Y, and Z functions with regard to the health of the ecosystem, then this captures their value, in some respects. That is what wolves are "good for."

But just as much as it is important for explanatory reasons to identify primary function, it is equally important to note that the PFP, when deployed in the service of restoration, is propped up by reliance on the MP: that ecosystem health can be ascertained by evaluating how well components of an ecosystem function together. Whereas the PFP makes a value claim, the MP makes a claim about the role of models in understanding the relations between the components of an ecosystem. In turn, then, the two premises work together in the FA to imply something much more controversial about "direction of fit": that not only can an ecosystem model help explain the "right" relationship between components of an ecosystem, but that model can also be used to reconstitute that ecosystem. To understand the complications here it will help perhaps to think more carefully about the Model Premise, as Eric Katz has done (though he does not title the premise in this manner) (Katz 2000).

Wildlife management models are designed using approximations such as population estimates, formulas describing species interactions, and ecological theories. By characterizing ecosystem relationships in quantitative terms, such as carrying capacity, thresholds, population dynamics, and so on, models aim to gain insight into the mechanisms by which ecosystems function (for example, see Hilborn and Mangel 1997). Given the right conditions, these models are helpful, and even essential for practicing conservation and restoration. They help us understand complex ecosystems so that we can act in the ecosystem's interest. But these models are limited in what service they offer. Since they are primarily quantitative, oriented toward characterizing natural relationships in terms of quantities and purposes, they tend to factor out ostensibly irrelevant qualitative considerations such as aesthetic features (beauty, ugliness, starkness), experiential features (wonder, fear, amazement), and interrelational features (control, wildness, identity, uniqueness).

Sometimes models attempt to quantify these qualitative aspects, as with literature on the ecology of fear (Ripple and Beschta 2004). In so doing, however, they reduce the qualitative into the quantitative and invariably factor out further ineffable qualitative features. This tendency is complicated by the increasing refinement of models, which may well describe the world but will never be capable of doing so perfectly, as with Borges' famous 'perfect' map (Borges 2002). Conservation efforts obviously depend on these models, and for good reason: models assist both in understanding and in managing ecosystems.

But this presents challenges stemming from the substitution problem that we mention above. Namely, the MP is asymmetrically applicable to the world. Where it may be reasonable in many instances to characterize and thus understand the world through the lens of functional models, it is a much less comfortable fit to manage or restore nature by appeal to these models. In other words, one can no more reconstruct the world by appeal to a model than one can reconstruct a human body by appeal to anatomy texts. Still, in many cases, of course, management by appeal to functional models makes good sense and appears to work.

Many conservationists are cognizant of the asymmetry between ecosystem models and the world (Pielou 1981, Pickett et al. 2007). Indeed, many have objected in the past to ecosystem management plans that purport to substitute one ecosystem function for another (Edward 2009). To our knowledge, however, few have isolated the conceptual conflict in terms of direction of fit; and we are optimistic that thinking of the conflict in this way can assist modelers and managers in moving forward. We believe that it will help to introduce a distinction.

## Restoration or Re-creation?

Consider again the effectiveness of restoration solutions. According to the Functional Argument, the most effective restoration projects will be those that most closely replicate the function of the components of an ecosystem. In a world unconstrained by resources and abundant in sophisticated technologies, it is not unreasonable to claim that predation could be replicated more perfectly. Appealing to the same functional arguments that authorize sharpshooting, one could equally well identify a novel technology that would serve the same function more efficiently. Perhaps a more technically sophisticated solution would introduce military drones in lieu of sharpshooters. Or perhaps more fantastically, one could create automated elk killing machines, perhaps robotic drone wolves, that might serve the same purpose as living animals but would not share an interest in livestock or children. Perhaps they could be made aesthetically indistinguishable from real wolves, eliminating aesthetic concerns of lost naturalness. In this case, according to the PFP, drone wolves might even be posited to be more valuable than sharpshooters. In a world of plentiful resources, we should substitute in the more valuable component and replace sharpshooters, inefficient and inaccurate, with drone wolves. Indeed, it could even be argued that carbon-based wolves fulfill the function of elk predation less efficiently than silicon-based wolves. Even the original wolves could be swapped out with more efficient killing machines. Perhaps.

So far so good, but this all starts to look mighty ridiculous if one takes it to its logical extremes. If such fantastical substitutions with regard to the wolf are in order, why stop there? There are certainly other components of the ecosystem that are deleterious in some ways to ecosystem health. The elk are inefficient landscape managers, for instance. If replacing carbon-based wolves with silicon-based wolves is a reasonable course of action, then according to the same logic, so would be replacing elk with robotic elk-like foragers. So too could one replace scavengers, turkey vultures say, with robotic look-a-likes. With sufficient technology, any issue of degradation could be addressed simply by mechanizing the missing or failing function and thus "restoring" the system. The prospect of such a replacement strategy accomplishing the goal of ecosystem health, and thus 'restoring' the ecosystem, is clearly ridiculous if not dangerous.

Of course, nobody but Walt Disney would propose such a thing, but perhaps not for the reasons that one might think. On its face, this appears to be a classic *reductio ad absurdum*. But it is more than that. Even if just one or two ecological functions were replaced by robotic flora and fauna, and even if the robotics were so advanced that one could not tell the difference, it is clear that what we are describing is not restoration. It is re-creation. By contrast, nature is self-reconstituting. When environmental restoration is in order, the only possible mechanism for restoration is to permit or facilitate this self-reconstitution. The argument that we offer above illustrates precisely why functionalism generates the Substitution Problem.

The reason for this failure is that ecosystem models are only that: models. They are an imperfect method of better understanding how the components of an ecosystem work together. They are excellent at helping us understand how the world works, but when run in reverse, they are woefully insufficient for reconstituting the world. Much akin to reconstituting a natural environment from a topographic map or a photograph, restoring an environment based on limited descriptive pictures invariably leaves out vital details. It may serve as a useful shorthand to speak of predators as regulating prey, but this is just a manner of speaking, not the identification of an actual embedded purpose or function (Brennan 1984). Restoring an aesthetically healthy ecosystem with a different suite of species would again be a re-creation, albeit of a different sort. The relationships we see are merely descriptive.

It is tempting at this juncture to respond by observing that function accurately describes real relationships in the natural world and cannot be discounted. This much is true. Relationships can be described in functional terms, just as a man or a woman can be described in terms of the role they play for their family. But such functional descriptions always underdetermine the full extent of such relationships. The observation that functional descriptions underdetermine relationships may seem trivially true or painfully obvious, but it has profound implications for ecosystem management and restoration, since it is precisely on these functional grounds that many ecosystem restoration projects proceed.

It is also tempting to conclude that what fails about each of the above solutions is that none of them is particularly effective. Certainly this is a key concern for conservationists (Mangel et al. 1996, Ehrenfeld 2001). Will the intervention work? Is there a way to improve the strategy? Notably, this emphasis on effectiveness misconstrues restoration projects as primarily logistical challenges. This approach fails. There is always an argument to be made that, at least on functionalist grounds, robotic wolves may offer improvements over biological wolves. Perhaps a safer park is a better one. Wolves could easily be programmed not to attack small children, or to walk nearby and up to campsites, but not to bother campers. A RMNP free of wayward wolves is more compatible with nearby ranching livelihoods. If this can be accepted, then the Substitution Problem is resolved by substituting in robotic wolves for the real thing.

It would be similarly easy to think that what fails about each of these solutions is that none of them is particularly natural, or that they take away from the park as a "wild" area. Certainly this is also a key concern for some conservationists (Hettinger and Throop 1999). If the intervention detracts from the naturalness or the wildness of the park, this could undercut restoration that is justified in the name of creating or conserving wild spaces. Perhaps a similar solution here is not to improve the effectiveness of the effort, but rather to improve the alleged "naturalness" of the interventions. What is unique here is that the naturalness solution has slightly wider applicability. As we mention above, the naturalness solution, when filtered through the FA, rapidly transforms into the effectiveness solution. If this is true, then it suffers from the same complication: that it transforms restoration projects from a problem of reparation to a logistical challenge. All of which brings us back around to our original question: what really ought we aim to do to restore RMNP?

## Reparative and Replacement Restoration

In light of this conversation, wolf reintroduction could be seen as a more holistic means of restoring not just the Rocky Mountain wolves or overgrazed streams, but the Rocky Mountain ecosystem more broadly. The Rocky Mountain Elk Vegetation Management Plan seeks to address a current issue of degradation: elk overgrazing, but with management of the degradation rather than restoration.

This emphasis on loss as characteristic of environmental degradation gives rise to a divide within the conservation community that has been characterized elsewhere as a division between functionalists and compositionalists (Callicott et al. 1999). Functionalists tend to emphasis the processes of an ecosystem and value ecosystem health, where compositionalists tend to focus on the components of an ecosystem and value the integrity of the ecosystem. In this paper we aim our critique at the functionalist variant of the Substitution Problem. Elsewhere, we discuss issues with the Substitution Problem for compositionalists (Hale et al. 2014).

What gets lost in this conversation between functionalists and compositionalists, however, is the small matter of what motivates management and justifies restoration in the first place. Fundamentally, restoration aims to repair some past incidence of degradation. It is a response to degradation. This historical dimension is the root source of all restoration projects. Without history, there is no system to restore. Without history, wolf reintroduction is merely wolf introduction, a question of what kind of world to build. While the Substitution Problem, broadly construed, concerns the reduction of value in an ecosystem, when applied to restoration we can see how the idea of reparation helps reorient the problem.

Permit us, then, to distinguish between two rough categories of restoration: "Reparative Restoration," which operates under the premise that the degraded object can be repaired or healed, and "Replacement Restoration," which operates under a presumption that there is no return to the past. Where reparative restoration seeks to repair damage, replacement restoration seeks more aptly to replace the function of one ecological component with another.

The possibility of reparative restoration presents a significant obstacle to justifying replacement restoration, as reparative restoration has ethical priority over replacement restoration. Analogously, a wounded soldier's leg that is fully able to heal with proper medical care would be difficult to justify amputating. A hasty amputation could not easily be justified by the fact that prosthetics are available, even if such prosthetics were somehow an improvement over the soldier's human limb. Of course, a working prosthetic would likely greatly improve the life of the soldier if it were the case that his leg needed to be amputated, but a determination of the need for this prosthetic would likely only follow after it was determined that the leg could certainly not heal. Indeed such justification may at times be impossible. A stronger prosthetic still does not trump a fully functional leg—at least not without the informed consent of the soldier.

The foregoing is as true for restoring degraded ecosystems as it is for injured human bodies. Many degraded ecosystems, if given adequate time, space, freedom, and raw materials, maintain the capacity to heal and self-reconstitute. Replacement restoration in nature is often thought to require the continual presence, work, and impact of humans and artifacts of humanity, whereas since nature is self-reconstituting, reparative restoration can start with human help but continue without continual intervention. But this is not necessarily true. Sometimes, reparative reparation may require more intervention and management than replacement restoration. The important point, however, is that the ease or difficulty of the restoration project is not alone sufficient to determine how an obligation to restore ought to be discharged. Just as one cannot presume in the case of the soldier that the easier path—amputation, say—is therefore the authorized path, so too can one not presume this about ecological restoration. Wolf reintroduction is one example of potential reparative restoration, which is still possible in RMNP, since the subspecies of wolf that was extirpated still exists.

The question ecosystem managers must be asking is not whether ecosystem function can be restored. Surely, some functions can be restored, however managers ought to interrogate and make a case as to whether or not healing and reparation are possible, whether they are desirable, and whether they are likely. These are the first arguments that ought to be considered in the service of wolf reintroduction because the functionalist arguments cannot go through without first considering the reparation argument. More importantly, questions about whether the RMNP ecosystem can be reparatively restored cannot be answered solely by appeal to ecosystem health or any such cognate notion. Ecosystem health itself is a teleological matter, tightly bound up in functionalist models (Braithwaite 1946, Callicott et al. 1999, Callicott and Mumford 2002). In order to know whether an ecosystem is healthy, we must know what it is for that ecosystem to function well.

Restoration questions must instead be answered by appeal first to reparation: can it be done? Can reparative restoration be accomplished? This is largely an empirical matter, guided normatively by whatever it is that we are responsible to do. If we are on the hook to restore the ecosystem, that is, if restoration is something that we ought to do, then we are by virtue of this obligation also on the hook to assist in the self-reconstitution of the ecosystem in question, which in the case of RMNP may well involve reintroducing the wolf.

The functionalist view of ecosystems is primarily a descriptive view, dependent on isolating some salient or valuable feature of the ecosystem that makes it worth restoring, and as such, is normatively empty. Inasmuch as the Functionalist Argument for restoration hinges on the injection of normative presuppositions, it cannot get off the ground without specifying what about the ecosystem makes it worth restoring. One must at some point provide an argument for what one aims to restore and why. We are surrounded by functional ecosystems, any of which could be improved upon or ought to be restored. Some of these are natural ecosystems but many are mostly artificial ecosystems. In all cases, the argument for restoration must appeal to some normative feature of each of these ecosystems: what is good about them.

## Conclusions

Our solution approaches the Substitution Problem in terms of degrees of difficulty of justification. Many of the arguments against returning wolves to RMNP are neither functional nor ecological, but instead social and political (Baker 2009). In this respect, such arguments tacitly rely on the Substitution Problem by suggesting that ecosystem restoration can be achieved in a socio-politically copacetic manner. Indeed, such arguments may be applicable in many circumstances, but it is important to note that whatever management strategies are taken in response to such concerns cannot straightforwardly be understood as 'restoration'. Perhaps elk need to be controlled carefully in some areas where land and foliage management is warranted. Perhaps wolves are not appropriate for crowded residential areas. National parks, however, do not clearly fall into these categories.

Elk culling practices seek not to preserve, conserve or restore, but rather to manage the health and functioning of the ecosystem. We have very specific goals for national parks: keep them as natural as possible given our knowledge of current and historical conditions. RMNP's naturalness, and historical continuity, are both threatened by its lack of wolves. Wolf reintroduction will be hard to justify in many other places, but RMNP is one of few potential havens.

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