Making the Transition to the Third Era of Natural Resources Management

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We are entering the third era of National Park Service (NPS) natural resources management—an era defined by rapid and unprecedented global changes. This third era promises to overturn not only some of our most fundamental assumptions about parks and protected areas, but also many of the ideals we currently hold dear. A common initial reaction to the diverse challenges of this transition is to feel overwhelmed and adrift; I have certainly had such feelings myself. But these feelings carry the risk of reducing our effectiveness as resource stewards right when we can least afford to be less effective: during a transition that is demanding us to be particularly clear-headed and far-seeing.

Here I briefly examine some of the challenges of this new era, focusing on those that can most often elicit feelings of discouragement. When we examine the challenges individually, they begin to lose some of their ability to cast gloom—especially when we consider them in the light of lessons from an earlier fundamental transition in NPS natural resources management, beginning a half-century ago.

My perspective is shaped by my 35 years as a place-based scientist stationed in a large national park (Sequoia and Kings Canyon), and by my passion for national parks in general. While the discussion that follows is most relevant to large national parks set aside primarily for their natural features, several of the ideas are also relevant to other park units.

The three eras

By defining three eras of NPS natural resources management, I greatly simplify a rich and nuanced history.[1] But by defining these eras I can highlight what I consider to be the two most profound shifts in thought and action in the history of natural resources management in NPS. Lessons from the transition from the first to the second era can help us navigate our current transition from the second to the third era.

The first era—beginning with the birth of NPS in 1916—can be thought of as the era of spectacles.[2] To survive and thrive, the young National Park Service attracted public support by encouraging recreational tourism, which often focused on scenery and a handful of char-

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ismatic natural resource spectacles, including staged spectacles such as bison stampedes in Yellowstone, firefalls in Yosemite, and public bear-feeding in several national parks.[3] But an emphasis on staged natural resource spectacles was already in decline by the transition to the second era of natural resources management—the Leopold era.

The Leopold era—referring to the influential 1963 report *Wildlife Management in the National Parks*, also known as the "Leopold report"[4]—saw a gradual shift away from an emphasis on recreation, spectacles, and a corresponding handful of charismatic plant and animal species, and toward ecological management of entire ecosystems. To understand the dramatic nature of this shift, one needs only to consider the example of fire management. Fire management went from a policy of aggressive suppression of all fires—in part meant to preserve perceived scenic values—to prescribed fires and managed wildfires, meant to restore and maintain naturally functioning ecosystems.

In addition to its emphasis on whole ecosystems and natural processes, management during the Leopold era usually had its gaze fixed firmly on the past, as reflected in the Leopold report's recommendation that a national park should represent "a vignette of primitive America."[5] Of course, management targets continued to shift during the Leopold era, such as from static snapshots of the past to motion pictures of the past (the latter being defined by historical range of variability). But planning and implementation were virtually always underlain by the implicit or explicit assumption that national parks in the future would look something like they did in the past.

Our nascent transition into the third era of natural resources management is being driven by the recognition that rapid, unprecedented global changes—particularly climatic changes—preclude key aspects of the Leopold vision, most notably the maintenance of natural resources in conditions that resemble those of the past. I will not repeat the arguments outlining the need for NPS to make this transition, which can be found elsewhere.[6] But of particular note is Colwell et al.'s 2012 report, *Revisiting Leopold*. While only hindsight will tell us which ideas and ideals will ultimately define the third era of NPS natural resources management, the ideas and ideals expressed in *Revisiting Leopold* will almost certainly be among them. They mark the start of our transition from managing for vignettes of primitive America to managing for ecological integrity.

Letting go of Leopold

As we leave the Leopold era, we will likely retain some of its ideals while discarding others. For example, we will surely retain an emphasis on management based on ecological principles, and retain a whole-ecosystem perspective. However, of necessity, we must let go of the ideal of consistently recreating or maintaining a semblance of primitive America "in the condition that prevailed when the area was first visited by the white man."[7]

This letting go of the past, and the ideals it symbolizes, can cause particular distress—distress that should not be underestimated. As has been well articulated by Richard Hobbs,[8] as natural resource managers let go, many of them will need to go through a significant period of grieving. While each person's struggle is likely to be different, here I briefly outline my own experience. Early in my career the Leopold era was hitting its stride, and I passionately

embraced its ideals. My research focused mainly on stressors that could disrupt the Leopold ideal—particularly altered fire regimes and rapid climatic changes. But in spite of the mounting evidence at my fingertips, for the first decade and a half of my career I remained firm in my belief that we could restore and maintain ecosystems so that they would continue to fall within their historical range of variability. The effect of climatic change in particular—even though it was one of my study topics—seemed like a rather distant abstraction.

But rather abruptly, like flipping a light switch, the mounting evidence broke through my idealistic barriers. I can say without exaggeration that I was thrown into a multi-year period of moderate despair—even depression—about the viability of the NPS mission, at least as I knew it. The despair I felt at letting go of ideals I held so dear was compounded by my feeling of being adrift: I had lost the safe harbor of management targets that fell within the historical range of variability, and no other mooring was in sight.

Recovery from this despair was gradual, with no flipping of light switches. Rather than abrupt epiphanies, I started to slowly piece together some possible new visions of the future of natural resources management in national parks. I eventually came to accept the loss of some of the ideals of the Leopold era, and began replacing them with new ideals that were better aligned to an era of rapid global changes.

Similar personal struggles likely occurred a half century ago, during the transition from the era of spectacles to the Leopold era. There was often substantial resistance within the NPS to such changes as the reintroduction of fire and the cessation of pesticide use to control forest insects.[9] It is not far-fetched to imagine that at least some of the resistance was accompanied by an initial sense of despair at letting go of some of the ideals of the era of spectacles.[10] Perhaps we can take comfort in knowing that we are not the first generation of natural resource managers to undergo a difficult transition.

Finding a new mooring

Letting go of the Leopold era can be particularly difficult when it appears we will be cast adrift, having no clear ideological bearing. Indeed, just as during the transition from the era of spectacles to the Leopold era, there is little doubt that it will take us years—even decades—to fill in the details within the broad outlines of a post-Leopold vision of NPS natural resources management. But the broad outlines of such a vision are already emerging.

Instead of looking to the past for our management targets, *Revisiting Leopold* suggests we manage for ecological integrity.[11] (It is worth noting that Parks Canada has been managing for ecological integrity for many years, and much can be learned from their experience.) Certainly, the term "ecological integrity" is less evocative and poetic than "vignettes of primitive America," but it does serve as a useful shorthand for more tangible concepts. Based on my own experience and my reading of *Revisiting Leopold* I offer the following thoughts about what does and does not fall within a practical concept of ecological integrity.

Ecological integrity does not demand that species be found in the same locations, or in the same abundances, as they were in the past. In the face of rapid global changes, species will move. Some will increase in abundance, and some will decline in abundance. Additionally, ecological integrity does not demand that "natural" communities (combinations of species)

be maintained. One of the great lessons of ecology is that most species behave individualistically, responding to environmental changes by leaving some of their neighboring species behind and then reassembling in new combinations.

But ecological integrity does include, to the extent possible, maintenance of regional native biodiversity. Even though native species may not occur at the same locations or in the same abundances as they did in the past, they are still present within the broader region. Some species may migrate northward out of a park and onto adjacent lands, while others migrate into the park from the south (perhaps even by assisted migration). The net result is that the broader region in which the park is embedded maintains most of its native biodiversity. As parts of broader landscapes, parks will continue to play a critical role in maintaining native biodiversity.

Ecological integrity also includes maintenance of key ecosystem functions. For example, some of the key functions of forests are hydrologic regulation, carbon storage, and providing food and shelter for myriad forest-dependent species. While forests of the future may not occur in precisely the same locations they do today, if ecological integrity is to be maintained forests must still occur somewhere on the regional landscape, providing their key ecosystem functions.

Acting in spite of uncertainty

A hallmark of the new era of natural resources management is that, even though we know that unprecedented changes are in store, their exact nature is uncertain. For example, roughly half of the climate projections for my home park in California's Sierra Nevada predict a warmer, wetter future, while the other half predict a warmer, drier future. And even though all models predict a warmer future, the pace of the predicted warming differs among models by a factor of three.

For those of us accustomed to managing for a relatively specific desired future condition—usually based on historical range of variability—the level of uncertainty we now face can feel disabling, even paralyzing. But it is useful to remember that we all have a good deal of experience planning and taking action in the face of uncertainty—namely, in our personal lives. We monitor our health for unexpected changes with regular physical examinations, we buy insurance against unexpected events, we hedge our retirement investments across a broad array of stocks and bonds, and so on. Similar principles can be used in natural resources management. In particular, well-developed tools (such as scenario planning[12]) are available for planning in the face of uncertainty, and already have a long history of being used effectively by large corporations, the Department of Defense, and others. In no way does uncertainty preclude our ability to plan and act; it just changes how we do it.[13]

Deciding to intervene

The Leopold era has been characterized by a tendency to rely, when possible, on natural processes to shape ecosystems. Accordingly, among NPS natural resource managers there is now often a strong, and appropriate, reluctance to intervene in ecosystems. But if, as suggested by *Revisiting Leopold*, ecological integrity is to become our new mooring in the era of rapid

global changes, we can expect increasing impetus to intervene. The thought that human intervention in parks will only increase is quite discomfiting for many people.

I usually hear three classes of argument against intervention: legal, ethical, and unintended consequences. Among legal constraints on intervention, the Wilderness Act is known for setting an especially high bar, making it a particularly good example to consider. But the Wilderness Act certainly allows for intervention, and we have several examples of successful intervention in wilderness by natural resource managers, ranging from mechanical forest thinning to additions of limestone sand to counteract acidic deposition.[14] Additionally, a recent legal review of climate change adaptation in the context of the Wilderness Act concluded that while the act "place[s] a thumb on the scale in favor of restraint," natural resource managers can be confident that "the vast majority of management options are available … for climate change adaptation" in legally designated wilderness.[15] Existing law does not preclude our ability to intervene.

It is not my role or desire to debate ethical arguments against intervention—such arguments reflect values, which are personal. But at the foundation of many ethical arguments I have heard is the fear that all natural areas will become managed gardens, with the utter loss of wild, self-willed nature. But such a future is profoundly unlikely. First, as a part of hedging bets in the face of an uncertain future, we are likely to explicitly designate some non-intervention areas. Second, at least in larger national parks, limited management capacity will mean that intervention only occurs on relatively small, strategically chosen parts of the landscape. Thus, by default, all areas within park boundaries will be subjected to unintended human intervention in the form of boundary-transcending global changes, while some limited areas will additionally experience intentional human intervention aimed at maintaining ecological integrity in the face of those global changes.

The final class of argument against intervention can be called the unintended consequences argument: humans should not intervene for the simple reason that intervention too often makes things worse. In its extreme form, I simply do not buy this argument. Certainly, interventions aimed at restoring or maintaining natural ecosystems have sometimes gone bad, becoming the stuff of headlines. But for each of those headlines I suspect there are dozens, if not hundreds, of success stories. In my home park alone, we have recently restored a large wet meadow that had been damaged by decades of culvert-induced downcutting; removed nearly 300 buildings from a giant sequoia grove and revegetated the scars; restored habitat for two endangered frog species, watching as the frogs recolonized those areas; controlled populations of several noxious, non-native invasive species; and continued our managed reintroduction of fire as a keystone process. It is always possible that, for reasons we currently cannot imagine, natural resource managers of the future might look back at one or more of these actions with regret. But I suspect it is more likely that they will be grateful—or, at worst, indifferent—that we took the actions.

To be clear, the very real risk of unintended consequences means that intervention should never be taken lightly. Additionally, as we enter the third era we are likely to consider unfamiliar forms of intervention—like assisted species migration—that could carry novel risks. Intervention remains a last resort that should be approached with great caution and

forethought. But good reasons to intervene seem sure to increase in the current era of rapid and unprecedented global changes.

Starting small ... but starting

A common feeling I have heard expressed during climate change education and planning workshops is that the sheer scale of the challenge before us is overwhelming. When virtually all park ecosystems, spanning vast landscapes and seascapes, stand to change in complex ways that we cannot fully understand or predict, how can we possibly manage? Taking a lesson from the dawn of the Leopold era, I suggest that we do not need to begin with entire landscapes. Rather, we can start small—in time, space, and topic area—and learn as we go.

In the 1960s, Sequoia and Kings Canyon national parks conducted some small, experimental prescribed burns, and funded parallel studies on the burns' ecological effects. Old photos show fire engines, hoses, and a number of firefighters surrounding a smoldering area measuring just a few hundred feet on a side. But the operational and ecological lessons from this small start were immediate. Park staff learned that they could overcome logistical hurdles and conduct safe controlled burns, and could also navigate any policy issues associated with the burns. Howard Shellhammer (one of the fire ecologists, then of San Jose State University) has told me of a particularly important ecological epiphany. When the researchers returned to the sites of the first experimental burns, they were greeted with carpets of giant sequoia seedlings—in an abundance they had never seen before, anywhere. The tight link between fire and profuse giant sequoia regeneration was made immediately clear. Small-scale experiments can make the abstract real, quickly propelling us to greater understanding.

Just as small experiments helped usher in the Leopold era, they can help us make the transition to the post-Leopold era. For example, we could potentially learn much from small, carefully conceived assisted migration experiments. Assisted migration experiments could initially be limited to those that could easily be undone, such as with tree seedlings (if needed, the trees could be removed well before they reach reproductive age). Any assisted migration experiment would be at least as much a social science experiment as an ecological experiment. How do NPS employees react to such proposals at the park, regional, and national levels? Are there policy roadblocks? How do the press and public react? At worst, planning for such experiments would help make the abstract real, and thus could open critical discussions within and between NPS and the public. Even if the main lesson is that large parts of the public are not comfortable with assisted migrations in national parks, this is valuable information.

Another critical lesson of the Leopold era is that to do good things, we do not need to do all things. For example, constraints imposed by air quality regulations, weather, safety, staffing, and funds have meant that Sequoia and Kings Canyon national parks have never met their original goal of restoring historical fire regimes across a large majority of the park landscape. Yet few would disagree that ecological conditions are better today as a result of the fire management program, with its careful, strategic choices about when and where to apply fire.

Science is necessary, but not sufficient

As we make the transition into the third era of natural resources management, it seems espe-

cially important to maintain a sharp distinction between the differing (but complementary) roles of science and values. At its best, science can inform decision-making. For example, it is science that is telling us that some of the key ideals of the Leopold era will be impossible to achieve in the future. Science is thus helping drive us into the third era of NPS natural resources management, and will become ever more important as we navigate that era. But even though science can suggest what is possible and what is impossible for natural resources managers to achieve, it simply cannot tell us what we want—that is, it cannot determine our values.

Even as we use science to help us manage for ecological integrity, key decisions will need to be guided by values. For example, as we abandon the ideal of maintaining entire park landscapes as vignettes of primitive America, should we still try to maintain a few small areas in something resembling their original condition—effectively as small ecosystem museums?[16] If so, which areas? How much effort, if any, should we devote to maintaining scenery, and where? With a limited capacity to intervene, how do we decide where to intervene? Where should we not intervene?

To understand the possible future interplay of science and values, we again might take some lessons from the reintroduction of fire early in the Leopold era. Like *Revisiting Leopold*, the original Leopold report painted a rather broad vision of NPS goals, without filling in details. Some "early adopter" parks began to use prescribed fire, and were almost immediately confronted with specific values-related questions: Given limited capacity, where should we burn? Should certain high-visitation areas remain unburned? How much value should be placed on maintaining green scenery in certain places, versus reintroducing a keystone process in those same places? The lessons learned and ideas generated by the early-adopter parks helped shape NPS fire policy at the national level, which in turn then fed back to those same parks, and also to those parks that were just beginning their own prescribed fire programs. The latter parks then generated their own lessons and ideas, and so on. The continuous feedback cycle among learning, ideas, and policy was more evolutionary than revolutionary.

A similar evolutionary process, perhaps kick-started by some early-adopter parks, may play out as we enter the third era of NPS natural resources management. The process may seem messy and less satisfying than having precise, detailed guidance from the start. But the fact remains that we do not have detailed guidance, and must create it ourselves as we go. To start answering our questions about the interplay of science and values, we will likely need to start small, and to get started sooner rather than later.

Getting past the tyranny of the urgent

Time—or, rather, the lack thereof—has the potential to be one of the biggest impediments and sources of frustration during our transition to the third era. Most of us now spend a greater proportion of our time than ever responding to "the tyranny of the urgent"—issues that demand our immediate attention—at the expense of devoting time to shaping a new long view.

A successful and timely transition to the third era will almost certainly require a critical mass of people—spanning all NPS organizational levels and regions, and likely assisted by

forward thinkers outside of the agency—regularly devoting quality time to deep thought, discussion, planning, and experimentation. I know of no way to accomplish this except through deliberate reprioritization, in which planning for the third era rises on our lists, displacing some tasks that may be urgent but less important to the long-term viability of national parks. I am encouraged that a few parks have formed lunchtime discussion groups devoted to climate change or other critical management issues. Actions like these leave me optimistic that we will rise to the challenge.

Conclusion

It is normal to feel overwhelmed, at least initially, at the prospect of managing national parks and their natural resources in an era of rapid and unprecedented global changes. At a personal level, many of us need to grieve the passing of the Leopold era and the loss of some of its ideals, and then become secure in knowing that the broad outlines of a new vision are beginning to emerge. Indeed, each of us can contribute to the evolution of this new vision. We do not need to figure everything out at once; we can start with small experimental steps, learning as we go.

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Endnotes

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