Why Natural Areas?

By Douglas Ladd

Perspectives on Natural Areas Conservation

In the following three essays, veteran field ecologists Douglas Ladd, Paul W. Nelson and Justin Thomas share their thoughts on designated natural areas and natural community conservation in the 21st century.

Introduction

Missouri's Natural Areas system showcases some of the best of our state's natural heritage, with a legacy of on-the-ground results. Considered a model for other states, the program is based on dispassionate scientific criteria and robust administrative collaboration towards explicit common goals.

Some critics have recently suggested such programs are outdated or doomed to ultimate failure. Supporting arguments for this position are often cast in light of drastic impacts (climate change, invasives, fragmentation) from which the systems will not recover, or, perversely, on glib predictions of ultimate resiliency. Another view posits the inevitability of functional ecosystems of some type to develop regardless of impacts, minimizing the importance of natural area conservation. There is also an increasingly utilitarian and simplistic view of nature as something to be curated and supported to the extent that it is a direct provider of immediate (typically economically quantifiable) services to benefit humans.

These fads in contemporary thought result in perceptions that conservation of natural areas is not essential. In this view, natural areas programs are regarded as noble but doomed efforts, or as an ineffective use of resources, or as an antiquated, somewhat quaint approach not suited for the magnitude and scope of ecological stresses in the modern world. Another criticism is that natural areas programs preserve static, historical artifacts of little relevance in a changing world.

Discussions about conservation and natural areas occur within a global society that is increasingly disconnected from the natural world, focused on technology, and collectively ever less cognizant of human dependence on healthy, functional ecosystems for our quality of life. There is a real danger that our gadget-focused society increasingly views ecosystem health, including natural areas, as irrelevant or something that can be quickly repaired by modern technology if and when needed.

Here I discuss why natural areas are more than ever critically relevant to both ecosystems and human society. We'll explore some problems with our current thinking about natural areas, and how we can re-think key concepts to ensure a vibrant, viable, and broadly supported system of natural areas.

Importance of Natural Areas

As a species chronically encumbered with a strong focus on the present, we humans tend to lose sight of the extreme recency of North America's modern biological landscape. Barring some brief and ill-fated Norse attempts at colonization, Euro-settlement and its still unspooling ecological consequences began a mere 27,000 weeks ago. Here in the Midwest, large-scale impacts commenced less than 10,000 weeks ago. Having grown up with them, we take for granted the draconian habitat losses and alterations of the continent's natural landscape. In a genetic and evolutionary sense, these ecological concussions occurred mere moments ago. Our native systems and their component biota are still reeling from a series of impacts that have no antecedents in their evolutionary history.

Each taxon of our native biota represents a genetic algorithm for success, building on countless previous evolutionary tests, and reflecting millions to billions of years of adaptation and selection for the unique combination of conditions and processes at a specific locus on Earth. In the interactive self-replicating arrays that constituted our post-glacial natural systems, this biota encompasses the astounding diversity and collective power and adaptability of life itself. Only by sustaining representative examples of these original systems can we sustain this ancient legacy of biological resources and their cumulative genetic knowledge.

Without this, we doom the planet and our society to permanent loss, or at the least, millions of years of diminished potential and opportunity. This is a foundational reaffirmation of the importance of natural areas. Only in a landscape with robust natural areas, properly configured and stewarded, do we have an opportunity to sustain irreplaceable functional representations of the biological fabric that defines place and culture. Ancestors of this biota initially rendered the planet habitable for aerobic life, and its modern expression provides a panoply of attributes enhancing human society and quality of life. As part of an integrated conservation ethos, natural areas contain the collective biotic libraries and patterns for system function and resiliency in all its expressions.

A current focus on 'novel ecosystems' and their inevitability and role in the Anthropocene is based largely on poorly defined criteria or theorizations unconstrained by reality. Novel combinations of biota are common in the modern landscape, consisting of biotic assemblages that have never occurred previously, but to consider them functional ecosystems is a stretch. These may indeed be the start of future functional, stable ecosystems, but only through millennia of evolutionary and ecological cycles. Current examples are unstable, unpredictable, tend to change rapidly, have little resiliency, impaired ecological function (and consequent limited ecological services), and depressed biodiversity as compared with their native congeners. Given what we know about succession and evolutionary biology, most of these systems are destined to fail as diverse, resilient, or stable entities. Maintaining the highest functioning aspects of our landscapes and communities requires maintaining the diverse biological fabric providing this, of which natural areas are the most critical component.

Beyond this compelling biological need for natural areas are equally compelling human needs. As recent products of the four billion year history of life on earth, humans have been a part of nature in the most visceral sense since their origin. Recent studies increasingly reinforce the link between personal connections to nature and human health, quality of life and even mortality rates. We depend on healthy ecosystems for a multitude of benefits and essential needs ranging from food production, pollinators, climate mitigation, soil productivity, erosion and flood control, and clean water to recreation and aesthetics. Natural areas are an essential component of a spectrum of landscape conditions enabling this. Natural areas also contribute to a profound cultural connection to place and history, serving as a living legacy to regional and local character, culture, and heritage. They are a lens to our humanity.

Challenges with Current Approaches to Natural Areas

While our current natural areas system has created an invaluable foundation, I believe there are problems with our approach to natural areas and conservation. Here I discuss four issues that must be addressed to sustain an effective natural areas program and conservation framework: 1) resiliency fallacies and the decline of organismal expertise; 2) rigid models and preconceptions; 3) counterproductive time frames and endpoints; and 4) successional myths.

1. Resiliency fallacies and the decline of organismal biology

Several recent articles[1] propose that natural systems are highly resilient and self-recoverable, and the futility of sustaining historic systems in the face of overwhelming climate change and other factors. This line of thinking holds that, because nature is enduringly resilient, too much angst and effort is expended in counterproductive attempts at conservation of "historic" systems such as natural areas. Such efforts are often characterized as misguided attempts to retain static artifacts of the past. Supporting examples typically involve heart-warming cases emphasizing rapid recovery and adaptability of specific organisms — almost invariably invertebrates with fast life cycles.

I think perceptions of resiliency are inversely related to the level of biological knowledge of the system, which tends to be directly linked to levels of organismal and field familiarity with specific natural systems and their biota. It is easy for a theoretician — seeing the natural world as an un-

1 e.g., Kareiva, P. and E, Fuller. 2016. Beyond resilience: how to better prepare for the profound disruption of the Anthropocene. Global Policy 7 (suppl. S1): 107-118.

differentiated green blur — to blithely pontificate on nature's resiliency or the superfluousness of maintaining intact site and process legacies. Thus, perceptions of ecosystem irreplaceability and significance of native diversity are directly linked to a deep understanding of the biota comprising these systems.

This highlights another critical issue: the expungement of field-based organismal biology from contemporary education, and perceptions of its irrelevance in the modern world. As our educational and research institutions increasingly focus on mathematical models and molecular technologies, we risk losing a critical knowledge base essential to human well-being. This knowledge in its subtleties and complexities requires an interactive human learning tradition rendering it extremely fragile — once lost it is not easily regained.[2] As we cumulatively lose ever more people who can identify and understand the complexities and interrelationships of living things in their environment, we lose the ability to appreciate, or even distinguish, the value and function of healthy, diverse systems versus anemic and unpredictable replacements. Without these insights, one green blur simply replaces another, and by the time the losses of diversity and function are finally comprehended, it is too late.

A compelling rebuttal for Pollyannas trumpeting the overwhelming resilience of nature is captured in a single observation: the loss of virtually all the fertile, deep-soil tallgrass prairies in the Midwest, and our frustrating inability to restore anything resembling their original biodiversity and function despite more than a half century of increasingly successful restoration projects.

2. Rigid models and preconceptions

Superficial thinking about resiliency and replaceability of natural systems combined with the constraints of traditional ecological classification systems also ignores the uniquity of nature and our knowledge limits. We derive explicit structural models of how healthy natural systems "should" appear and function, despite appalling lack of knowledge of their organismal composition or pre-Eurosettlement structure and function. We develop broad categorizations of necessity, but these obscure real differences, and are further constrained by limits of our language and taxonomic concepts. Managing towards these preconceived outcomes risks system degradation and diversity losses.

Every spot on the Earth is measurably unique in terms of physical conditions, biotic history, and process regimes. This uniquity is reflected in the biota which, as discussed previously, reflect thousands of generations of adaptation to and selection for the ability to thrive under the unique combination of specific biotic and abiotic conditions that characterize each locus on Earth. The ancient Roman concept of genius loci, or Spirit of the Place, should be explicitly recognized and accommodated in our natural areas and land management, lest we degrade and impoverish our ecosystems in a headlong rush to derive universal models or 'exportable' management and restoration prescriptions.

Part of this is recognizing that ecological and taxonomic classification systems and hierarchies are models — useful tools but coarse and incapable of fully reflecting ecological reality. We must always be attuned to the actual system and its vagaries, lest we cause harm in slavish devotion to models and preconceptions. There is a danger of irreplaceable losses and impoverishment of the wondrous diversity of our natural systems if we don't acknowledge the limits of our classifications and language, and the complexity of nature, both at the genetic level within organisms, even of the same 'species,' and within the systems which these organisms comprise.

3. Counterproductive time frames and endpoints

Natural systems are not accommodated by human timelines or the compartmentalized goals driving today's society. This has fundamentally skewed our connections with the natural world, reinforced — albeit with the best of intentions — by those of us working in conservation. We have created the impression that natural areas can be

2 This is compellingly described in David Ehrenfeld's classic essay, *Vanishing Knowledge* in the March 1996 issue of Harper's magazine.

managed by implementing various time-delimited projects with specific outcomes and short-term goals. In the process, we have lost the ongoing human interventionist connectivity that shaped nature from the end of the last glacial period to Euro-settlement.

This ongoing, interventionist tradition is essential to ecosystem health and biotic diversity. Natural area managers, and all citizens, should embrace this ongoing stewardship responsibility and sacred privilege of interaction to sustain the unique biological systems that characterize each locus on Earth and shape human history, culture, and economy. There is no end game in conservation, but rather an enduring, interactive, carefully configured interventionist relationship necessary to sustain natural systems. This may dismay philosophical purists schooled in humans as despoilers of nature, but in reality is an empowering opportunity to achieve essential reconnections.

A related issue impeding our appreciation and management of natural areas is the enduring myth that natural systems are infinitely dynamic. As demonstrated by millions of examples in the contemporary landscape, natural systems are far from stochastic or infinitely dynamic, but terribly fragile and sensitive to perturbations to which there is no antecedent in their organismal lineage. Today, this fragility is exploited by a host of non-native biota adapted to these novel perturbations, permanently reducing system diversity, function and resilience.

Management protocols based on meeting other organizational priorities, or aimed at "diversifying" management for its own sake risks permanent and irreplaceable damage. Management of natural areas should be configured to maximize system resilience and diversity, emphasizing the most sensitive biota in the context of functional systems. This is the only enduring measure of ecological success.

We must adopt an ecological model of constrained dynamism, and zealously sustain or emulate process regimes within the range to which the system is accustomed, thus allowing opportunity for change and adaptation to occur on evolutionary time scales. Constellations of native biota remain functional and viable only where site history, landscape context, and process regimes have remained within the constrained range to which the biota of the system has collective genetic memory through thousands of years of selection and adaptation. Often, this limited range of dynamism must be further constrained by the realities of the current environment, with abnormal and unprecedented levels of habitat fragmentation, invasive species, and altered process regimes.

The goal is not to create a static, rigid artifact of the past, but to use the enlightening knowledge of original site context, biota, and processes to sustain the most resilient and adaptable system, with the best chance of adaptability in the face of daunting changes facing the planet today.

4. Successional Myths

One problem that has beset our concept of natural areas throughout the tenure of the program in Missouri, as well as elsewhere, is a simplistic and flawed concept of succession based on classical ecological theory.

This classic model of ecological succession, a repeating predictable sequence of seral stages, devolved from the pioneering work of Henry Chandler Cowles in the Indiana Dunes in the late 19TH century. Cowles' astute observations of processes, dynamism, and vegetation patterns were conceptually perverted by Frederic Clements into a more rigidly deterministic model focused on a pre-ordained end state that continues to influence thinking about succession.

By failing to recognize that succession in pre-Eurosettlement North America is nothing like contemporary successional sequences and patterns, we subconsciously assume that 'succession' of disturbed states implies system recovery, culminating in a return to a high-quality prairie, woodland, glade or other natural community. Reality differs starkly: contemporary successional seres, in our fragmented landscapes with drastically altered process regimes and abundant non-native species adapted to these ecologically novel perturbations, do not resemble the original successional patterns that prevailed for millennia after the last glacial period.

Even the successional patterns of a century ago, although severely altered, more closely resembled the original post-glacial successional patterns, as evidenced by what seem to us today to be astound-

ing levels of resilience and recovery in severely impacted systems from the early and mid-1900's. Examples include the rich and diverse suite of conservative native species associated with some old artificial ponds, none of which colonize modern pond constructions, or the passive recovery to prairie of some previously cropped lands from that era. When the surrounding landscape was imbued with sufficient diversity and connectivity, there were pathways for at least partial system recovery. Such is not the case today.

This misinterpretation of succession as a single unchanging process afflicts not only ecological theory and practice, but also more applied fields. For instance, wildlife biologists, foresters, and land mangers frequently refer to 'early successional' habitat and its importance in holistic management concepts, despite lack of guaranteed system recoverability. In the contemporary landscape, this all-too-often results in irreparable impacts, including recruitment of invasive species, biodiversity loss — particularly among the most sensitive and least replaceable elements of the system — and ultimate declines in system function and resiliency. Our misinterpretation of contemporary ecological succession has seduced us into believing that systems regularly cycle through depressed levels of organismal diversity, despite the lack of data for local terrestrial systems depauperizing themselves as part of an intact synecological cycle.

Prairie managers in particular should take note, lest we succumb to the successional fallacy of "calendar prairie" as merely a charismatic phase of a fungible grassland complex, rather than the remnant healthy expressions of a largely degraded system. While this concept may apply in the more resilient grassland systems on the Great Plains, it is not applicable in the wetter, more fertile eastern tallgrass biome. I find it interesting that we appropriately never refer to other highly diverse communities as "calendar glades" or "calendar fens," but instead regard occurrences with depressed diversity and floristic expression as degraded.

Re-visioning a Future for Nature and People Through Natural Areas

Fortunately, we live in a state that had the foresight to lay a sound conservation foundation, an essential part of which is an exemplary natural areas system. As the threats matrix of our world intensifies, natural area management must be focused on managing to sustain site integrity, process regimes, biodiversity, and landscape context.

To remain relevant, sustainable, and diverse, natural areas must be fully integrated into the social and cultural fabric, with a stewardship ethos that exemplifies the enduring and ongoing connections between humans and nature that are essential to both. This human reconnection with nature must transcend socio-cultural and economic divisions and suffuse the fabric of humanity. We can succeed only when all people relate to and take pride in this relationship, which in turn requires an ecological and conceptual continuum of ongoing conservation actions extending from small native garden and green space programs in the most urban environments to large-scale habitat conservation and natural area initiatives.

Only when our natural world is treated spatially and temporally as a whole, one that has an ongoing need for human actions, will we enable conditions for long term success. Ensuring this will require a new relationship with our natural environment — not one of strictly budget-driven immediate pragmatics, but instead a human relationship and understanding of the natural world akin to that of a loving family, based on enduring interaction, stewardship, and appreciation.

Natural areas will never be static, and in today's world of increasing stresses and impacts, it is sad but inevitable that many will undergo declines in diversity and function. Only by dedicated efforts to sustain our natural systems and their ecological context and processes will we maximize diversity and resilience, maximizing the potential for successful adaptation. These are the most irreplaceable aspects of our natural heritage, and a critical part of sustaining the healthy, functional natural systems on which humanity ultimately depends — the most important legacy we can provide to future generations.

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Acknowledgments: Thanks to Paul Nelson, Mike Skinner, Allison Vaughn, and Gerry Wilhelm for discussion and input.