



Photo by Eugene Vale

Missouri Department of Natural Resources staff conducting prescribed fire at Morris State Park, Campbell, MO.

## Ecologically Appropriate Fire in the Missouri Landscape: A 35 Year Reflection

By Doug Ladd

When I started working in Missouri in 1980, there was growing acceptance of the concept of fire as a beneficial management tool for prairie. Beyond this, there was almost no consideration of the role of fire in other native systems, especially timbered systems, other than as a negative process with destructive consequences to both human society and ecosystems.

This prevailing dogma existed despite several insightful but long overlooked or disparaged studies documenting fire as a regular process fundamental to the development and perpetuation of Missouri's post-glacial systems<sup>1</sup>. Scorched by the damaging impacts of intense slash-enhanced fires in the post-logging era, and lulled by the comforting creed of Smokey Bear, Missouri resource

1. Biemann, A.P. and L. G. Brenner. 1951. "The Recent intrusion of forests in the Ozarks", *Annals of the Missouri Botanical Garden* 38: 261-282; Pyne, S.J. 1982. *Fire in America*, Princeton University Press; Stewart, O.C. 2002. *Forgotten Fires*, University of Oklahoma Press.

managers cleaved to a convention largely dictated by the unquestioning mantra of early twentieth century forestry and the comforting shibboleth of the "Eastern Deciduous Forest."

Some inconvenient truths remained difficult to reconcile. Early accounts of Missouri display a compelling consistency in their depiction of open woodlands with minimal understory and well-developed ground layer vegetation with a prominent graminoid component and a visually striking diversity of forbs. These accounts are all the more convincing because of their thematic commonality, despite originating from authors with a diversity of nationalities, intents, and educational backgrounds. Associated with these accounts is a robust collection of narratives mentioning Native American fire, often expressly linking aboriginal fire practices and vegetation character. Since these observations did not fit the paradigm *de jour*, they were dismissed as "unscientific" or simply ignored. Even now, this historical and cultural context is often missing from fire research.

Today, thanks to diverse, mutually reinforcing

analysis by historians, biologists, and anthropologists, the scientific community is largely in consensus on the broad issue: the Missouri landscape, like most of the Midwest and eastern North America south of the transition zone, has been shaped by a regime of pervasive, frequent, generally low intensity fires since the closing of the last glacial period. This fire regime was overwhelmingly from aboriginal ignitions, and these ignitions were deliberate, enduring cultural practices derived from a sophisticated comprehension of the landscape, its biota, and their response to management.

I think our collective discomfort with the concept of beneficial woodland fire stems from a combination of factors, including preconceptions. We have all vicariously experienced one of the most destructive fires in history – Walt Disney’s celluloid conflagration that nearly killed Bambi’s father. Given fire’s potentially powerful destructive impacts to us and our infrastructure, we appropriately have an aversion to uncontrolled fire, even as we embrace controlled fire with our fireplaces, chimineas, and celebratory bonfires. Another factor influencing perception of fire is the potential for landscape fire, even when ecologically appropriate, to have deleterious consequences for specific management outcomes such as damaging valuable hardwood timber. Unfortunately, as a species we appear to be culturally attuned to seeking comfort in simplicity and absolutes, under which the reality that some fire is bad leads to demonizing all fire.

Given the rich and varied documentation of pervasive and deliberate aboriginal fire as a major factor influencing the North American landscape for thousands of years, it is surprising, and frankly disheartening<sup>2</sup>, that there continues to be debate in Missouri about fire as an ecological process fundamental to the health of our natural systems and their component biodiversity. This debate encompasses not only the degree to which society should ensure ecologically appropriate fire

2. It also puzzles me that there is a dangerous assumption that the default condition in our landscape is the unburned state. In light of all available evidence, the ecologically appropriate default assumption should be that fire was a part of the system, and justifications and studies should be applied before deviating from a process known to be essential to the ecological health of the system. All the more disturbing are the lack of any data correlating fire-free management with retention of native diversity or aggregate conservatism.

across some portion of the landscape, but even as to whether fire was ever really a major part of the pre-European settlement landscape. This latter argument is subconsciously reinforced by the stubborn persistence of the Ozark forest myth.

We contrive semantic dances around the issue here in Missouri, but the stark reality is that forest, in the traditional sense of a system characterized by a dense canopy and understory and shade-tolerant ground layer with minimal fire influence, was a rare element of the pre-European settlement landscape. True forests in this sense were probably largely restricted to the Missouri River bottoms (where hydrology and a highly dynamic channel precluded frequent fire regimes) and some highly dissected valley systems in the Ozarks. Just as elsewhere in the Midwest, we need to explicitly acknowledge that the majority of Missouri timberlands, including most of the Ozarks, was some variant of a more open woodland system, and that this system was as dependent on the aboriginal fire regime as it was on local rainfall patterns. One approach would be to expand our concept of “forest” to include a broad array of timbered habitats, including those influenced by a long-standing regime of frequent, low-intensity fires.

There has been significant progress in fire management, including major on-the-ground accomplishments and effective application of fire to restore ecological health by state, federal, and private agencies and organizations. A series of data sets are emerging from fire management and restoration activities, some covering several decades. As with the convergence of the early accounts of the Missouri landscape, a clear consensus emerges from these data: restoration of ecologically appropriate fire to Missouri habitats with remnant biotic integrity increases native plant diversity and herbaceous ground cover. These increases are typically accompanied by decreases in ground layer woody vegetation (seedlings and sprouts), and often by increased relative frequency and cover among graminoid taxa. Both aggregate cover and per-unit-area diversity increase, often by large degrees.

Data for the effects of fire on conservative floristic elements and aggregate floristic quality are more variable and seem to depend on the degree of remnant integrity of the site, which is a direct reflection of past management history. Overall,



Photo by Allison J. Vaughn

Land management agencies implement prescribed fire in Ozark woodlands.

however, the prevailing trend at the landscape scale across all terrestrial habitat types (including woodlands, prairies, glades, fens) is that mean conservatism of a site's vegetation is difficult to increase. This directly reinforces the concept of conservative taxa as those which, once removed from a system, are least able to become reestablished. What is heartening is that those conservative taxa present in a system under fire management tend to increase in abundance and relative dominance, thereby increasing mean conservatism and floristic quality at the plot level. These data are buttressed by accounts of dramatic increases in populations of various plants of conservation concern with the advent of a fire regime, such as the flourishing of previously unknown snake-mouth orchids (*Pogonia ophioglossoides*) under a frequent fire regime at Shut-In Mountain Fens in Shannon County.

An encouraging generality that has emerged from analysis of vegetation response to restoration of ecologically appropriate fire regimes is that these increases in plant diversity and cover occur without significant depression of mean floristic conservatism; that is, the increases are not the result of recruitment of a suite of opportunistic taxa indicative of system destabilization. Another general trend associated with ecologically appropriate

fire regimes in Missouri landscapes is a reduction in the abundance, cover, and diversity of non-native taxa. While a few introduced weeds (notably *Lespedeza cuneata*) are fire-adapted, the majority of our allochthonous flora is not.

Our local biota are the distillation of thousands of generations of selection for the process regimes, site conditions, and biotic and abiotic interactions that prevailed in the post-glacial period. Aboriginal fire was a consistent factor in this regard, and our modern pre-European settlement natural systems reflect an adaptation to – and need for – fire to sustain them. Data consistently reveal that removal of fire results in an inexorable loss of vegetative diversity, cover, and aggregate floristic quality. It stands to reason that these losses reverberate across other biotic groups, reducing system resiliency and integrity, and increasing vulnerability to invasive species establishment.

While less data exist regarding fire regime effects on non-vascular biota, it is well known that fire-induced increases in ground layer diversity and abundance create what land managers refer to as “more groceries on the ground.” This increased diversity and abundance of forage, fruits, seeds, rhizomes, etc. provides resources for a diverse suite of other organisms, which in turn provide resources for their predators and dependent spe-

cies. Appropriate fire management in Midwestern woodland systems also provides critical structural attributes for wildlife, including a guild of woodland and savanna birds that, not surprisingly, are among the most endangered of our avian diversity.

Fire management is subject to the whims and trends of the day, and careful attention must be paid to ensuring that these practices, however well-intentioned, are not ultimately deleterious to system integrity. For instance, little data exist to indicate that growing season fires were a significant part of the presettlement landscape, yet there is growing use of these as a management tool. While application of occasional growing season fires has direct management benefits (such as increased control of invasive woody vegetation in degraded sites), there is little antecedent for this process in the genetic memory of the biota. This should give us pause, and at the very least trigger a robust assessment process to ensure that there are no irreversible impacts to pollinators and other biota. While the general pattern of frequent fire in shaping and maintaining the landscape and its incredible organismal diversity is clear, even if not fully acknowledged, many unknowns and uncertainties remain. Among these are information regarding patterns of heterogeneity of fire behavior and coverage, feedback loops with browsers and grazers, the extent and duration of fire-free intervals, and other information.

All too often it seems that there is a trend to diversify management treatments – fire timing, frequency, or other factors – simply from an assumption that a diversity of treatments is good because ecosystems are “dynamic.” This shallow thinking poses grave risks to system integrity, and courts irreversible degradation. In reality, our contemporary biological systems are the distillation of thousands of generations of selection for a discrete range of site conditions and process regimes – the direct legacy of the post-glacial environment, including its aboriginal influences. Maintaining or emulating this constrained dynamism must be the operative concept for managers, or the result will be inevitable loss of conservative biotic elements and cascading loss of system resiliency and function. The sacred responsibility of managing our Missouri landscape to sustain its full array of diversity and function must include consideration of pre-European settlement composition, struc-

ture, and function – not from some misplaced fantasy of recreating a static utopian artifact, but in order to ensure that we are not exceeding the amplitudes of the constrained dynamism to which the system is attuned.

Existing knowledge gaps are exacerbated by the realities of the contemporary environment. The fact that a certain pattern of fire prevailed in presettlement times does not guarantee that it will have the same effects in today’s fragmented landscape, subject to influences of allochthonous biota, altered hydrology, and changing climate patterns. We need a robust and ongoing culture of documentation and investigation, learning and adapting as we progress, enfranchising careful application of fire to nurture the healthy, diverse landscape upon which we as a society are ultimately dependent.

We need to change default conceptions across a broad segment of society. An unburned, fire-starved, overstocked woodland should not invoke notions of a sylvan paradise but instead be seen for what it is: a stressed, degraded, biotically depauperized system. This system no longer has the resiliency to sustain the wondrous diversity and function inherent in our post-glacial systems – one that no longer effectively infiltrates rain and recharges groundwater, reduces flood impacts, nurtures healthy, carbon-rich soils, supports diverse wildlife populations across broad organismal spectra, or provides the myriad other functions and services upon which local watersheds and human communities depend.

We have inherited the responsibility and consequences of managing the land from the Native Americans displaced by our ancestors. Our cultural practices will determine, for better or worse, the extent to which future generations will have healthy, diverse, resilient ecological systems to sustain their quality of life. Our legacy should be to ensure that at a landscape level we retain sufficient integrity, diversity, and functionality to make this possible. 🌱

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