

# Fire Ecology: Issues, Management, Policy, and Opinions

A forum for the Association for Fire Ecology

## The Element That Isn't

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How should we think about fire? An answer is not obvious. It is testimony to the immense significance of fire that humanity has for so long chosen not only to anthropomorphize it but to grant it a substantive identity it does not deserve. Early philosophers considered it a god, or at least theophany, the manifestation of a god-like presence and power. The Aztecs called it Huehuetēōtl (or Dios viejo, the Old God), and the Hindus, Agni, along with Indus the most venerable of their pantheon. The Ancient Greeks, and the ancient Chinese, labeled it an element. For Western civilization it then morphed into a declination of lesser substances such as phlogiston and caloric before ending as a subservient chemical reaction, the rapid oxidation, usually accompanied by flame, of other substances. Today it no longer claims reality as an autonomous substance. Rather, fire is a phenomenon that derives from its circumstances. It is what results

when heat, fuel, and oxygen combine under suitable conditions. It is a reaction, a process. It has no reality apart from the physical circumstances that make it possible. It synthesizes its surroundings. And that, in brief, is equally the lesson of its intellectual history. Fire's definition has changed with its cultural circumstances. It takes its character from its context.

In this way, fire enters many subjects, yet claims none uniquely as its own. The other "elements" - air, water, earth, even wood - have a hard materiality. Although they also have a chemistry and are compounds of many substances, one can pick them up, carry them to another setting, push and plunge and pummel them. One can inflate a football with air and kick it. One can fill a bucket with water and haul it to a field. One can dig up earth and dump it elsewhere. One can leave them alone, untended, or seal them off, and find them

again later. But one cannot pick up fire, as fire. You carry its fuels, upon which it glows or flames - you pick up embers, smoldering branches, a flaming matchstick. Remove that fuel, and the fire dies. Shut off its air or cool it, and the fire will go out. The other ancient "elements" have intellectual disciplines and academic departments to study them. Fire does not. (The only fire department in universities is the one that sends emergency vehicles when an alarm sounds.) Fire is, in truth, not an element at all except that its unblinking importance makes it elemental to human life.

Yet it must go somewhere. In popular consciousness it retains a substantive identity. In most of daily life for industrial peoples fire has vanished into, at most, ceremonial vestiges. For urbanites, who make up most of the human world, it remains real largely because it continues to burn and threaten cities and has led to institutions to prevent or control it. An institution committed to the ultimate extinction of fire, however, may not be an ideal place to nurture its identity. The goal of urban fire services is to abolish flame.

Instead, since the 18th century, for Western civilization, the study of open burning has lodged in forestry. Others were interested; chemists, physicists, agronomists, technologists. But the discovery of oxygen destroyed fire's claim to independent identity for chemists, the laws of thermodynamics undermined it for physicists, agronomists struggled furiously to find alternatives to fire's role in fertilizing and fumigating, and technologists segregated fire's heat and light from its standing as a free-burning process. Only foresters had to confront fire as fire. A historical accident - the fusion of silviculture with state-sponsored

reclamation, and then an imperial outburst that reserved vast colonial estates as forests - left fire among foresters. As always its circumstances determined its character.

How did forestry view fire? It viewed it as a disturbance. It saw something that threatened trees, degraded soils, destabilized rivers and climates. It saw a social, and perhaps political, failure because, for temperate Europeans, fire existed on the land only because people chose to put it there. It saw fire as unnatural and utilitarian. If there was a place for fire, that role existed because fire behaved much as foresters did - planting, pruning, harvesting. It was a technique to a shared end. All in all, however, wild fires were viewed as an index of social disorder, or of nature in riot or revolt, often with human accomplices. Forestry saw a stubborn problem that begged for proper engineering.

Recent decades have reversed the particulars. Hammered by wilderness legislation, inspired by biocentric philosophies, moved by a management vision that expanded from lumber to landscapes, and penitential over past failures, American forestry, especially, has proposed complements to its earlier conclusions. Fire is now natural, as well as unnatural; it is a tool that can be used to advance management goals as well as to destroy biotas; and, as fire, it binds forestry to other professions. Fire has become a common cause for wildlife, wilderness, biodiversity, range management, ecological restoration, and urban fire services. But the deeper vision of utilitarian flame remains. Fire exists as something to start or to suppress. It is a tool to use or a transcendental ecological event to leave alone. People can slash, burn, quench, or stand aside.

The time has come to recenter fire. For one thing, it is clear that lighting and fighting fire are not, by themselves, a sufficient basis for handling fire in wildlands. In fire-prone landscapes, fire control has proved self-defeating and ecologically unsustainable. But simply reversing the history of fire exclusion and ramming controlled burns into the land will not reverse a legacy of fire-starvation automatically. Switching polarities may transmit electricity, it does not manage fire. Fire binges and fire busts lead only to an anorexic biota. Again, fire synthesizes its surroundings: messed-up forests yield messed-up flames. Flame is not ecological pixie dust that can convert, by itself, the ugly and overgrown into the beautiful and healthy. For another, the proliferating number of professions and disciplines with at least a casual interest in fire suggest that forestry, even inflated by interdisciplinary cross-links, cannot hold it all together. The prospect of an autonomous department of fire studies is improbable. The simplest solution is to relocate fire science to a more catholic discipline, biology being the most likely candidate.

The reason is simple: fire is a creature of the living world. Life created the oxygen fire craves, life stocks and shapes the fuels that feed it, and, in the guise of humanity, life progressively oversees the kindling that sparks it into existence. The chemistry of combustion is a core chemistry of life: combustion only takes apart what photosynthesis brings together. When that reaction occurs within cells, it's called respiration. When it happens among organisms, it's called fire.

Life's organizing hand follows fire everywhere it goes. The biomass that fire consumes is not inert carbon bullion. It is (or was) alive, and subject to evolutionary

selection, ecological checks-and-balances, and considerations of scale, which range from the deconstruction of carbohydrates in mitochondria to the cycling of carbon on Earth. This hierarchy of biological organization sustains a hierarchy of fire behaviors and outcomes. Fire follows the combustibles that feed it through a trophic chain. Fire is what it eats - and only what it eats and how it eats it. Flame has no reality apart from those environs.

The human control over ignition is a stickier issue. Deep-ecology critics, especially, will quickly point out that fire predates people, that lightning and, locally, volcanoes kindle fire, that there is no reason to compromise a natural process with a human presence. Fire is natural, and people can only pervert fire's planetary purposes. But that argument misses the point precisely. One creature does possess the power to start and stop fires. If that power resided in a species of *Lepidoptera* or in a marsupial, and particularly if that creature set fires on an order of 10:1 (or better) to lightning, no one would question the nearly total biological basis for fire. We do so only because we are that creature.

Yet more is at stake than simple ignition: fire can spread only if it has fuel. This is where humanity again flexes its firepower because we can make fuel and do so plentifully. Over most of the Earth fire burns within the context of agriculture, of fire-fallow farming or fire-forage herding. (And if there isn't enough living biomass around, we excavate fossil biomass.) Fire burns, that is, because a creature creates the proper conditions. Other species bash and chew their environments into more suitable habitats for themselves. We shape our surroundings with fire, or to make fire possible. Slash-and-burn cultivation is no less biologically driven than elephants

trashing acacias or bison nibbling bunch grass and not junipers.

By far the greatest proportion of fire on the planet, and virtually all its fire regimes, result from human tinkering. This fidgeting and tweaking are ecological acts. With humans the biosphere very nearly closes the cycle of fire within itself. Not completely, because lightning still kindles fires and because, in fact, some societies have chosen to remove themselves as active agents from selected landscapes and let lightning-caused fire rule. But this self-eviction, too, results from social decisions. If we chose to compete directly with lightning, the scene would look different. We don't have to fight fire to counter lightning. It would be enough to pave the landscape into a city, for example, or plant it to genetically modified tomatoes or simply do the burning before the first dry bolts arrive. Likewise, the intellectual decision to absent ourselves as biological agents is a choice we make, not one embedded in the biosphere.

As we think about fire, so we act on it. Presently two conceptions - slogans, really - dominate discussions. One proclaims that "fire is natural." This is a truism. No one doubts that fire predates humans. No one today doubts that, in some fashion, fire belongs in nature reserves sited in historically fire-rich landscapes. A half century ago the observation was necessary to remind federal agencies that fire exclusion could have serious costs and that not all fires were the upshot of human malfeasance and hence bad. Some came from nature and hence shared the putative goodness of the wild. The purer the nature the better the fire. Fire-as-natural bonded fire management, in particular, to wilderness.

At first blush this would seem a dandy argument for a biocentric philosophy of fire. The problem is the wilderness coda, for the chant quickly slides into metaphysics and an insistence that only natural fire belongs. This belief has implications for both fire management and ecological science. The practical difficulty is that it shuts out the prospect for routine burning - for regime maintenance by fire - as distinct from a one-off burn to "restore" a "natural" order. It ignores, moreover, the likelihood that the pre-disturbed state itself was sculpted by anthropogenic burning. The conceptual difficulty is that the assertion equally hamstring ecological theory. Ecology is a historical science, much as geology is. Removing a prime cause for historical change, ourselves, does not explain why the present scene exists as it does or what we should do about it. A fire-ecology without humans can expound only on hypothetical or long-vanished biotas. The final outcome is not a more pristine model of ecology but a plaintive metaphysics. Of course models are simpler if we remove people. They would be simpler still if we removed flora or fauna.

The subtext behind fire-is-natural is the quest for a Pure Wild. To prove the existence of a natural fire regime is to prove the existence of true wilderness, a transcendent nature. The arguments supporting it eventually resemble the arguments for the existence of God, and in the end, rest equally on faith. The search for a sliver of the True Wild belongs with the quest for a splinter of the True Cross. They do not tell us how we, as uniquely fire creatures, should behave. The pressing issue before fire management is not whether fire has existed previously but in what ways - according to what regimes and by what means - and what its various presences might signify for a particular

landscape today.

The second conception is that "fire is a tool." This view would seem to satisfy the need to involve human agents. If it is a tool, however, it is an odd one, and a tool that exists only because of its setting. An ax exists in its own right: a fire does not. An ax cannot morph into something else as it moves from a carpenter's shop to a woods; a fire can. A grass fire can become a woods fire, and a burning swamp may metamorphose into a crown fire as circumstances allow. Clearly, people have "used" fire and hence it may be considered as a technology. But what kind of technology is it?

Several kinds. There is fire as a tool, fire as a tamed "species," and fire as a captured ecological process, or at least these are the most common conceptions. Consider each in turn. Tool-fire embraces "tool" in its everyday meaning. Flame sits on a candle as a claw hammer sits on a handle. It applies concentrated heat and light. Of course one has to feed it wax and assure it has ample oxygen, whereas a hammer does not consume the wood of its handle or demand air; but there are good reasons to treat such fires as a tool in the vernacular sense. What one wants is the heat and light. It is thus possible to substitute another tool for this one, to use heated coils and electric lights, for example, instead of flame; or to put the "flame" into a chamber that disaggregates it into the most elemental parts of combustion and then apply its heat to power prime movers.

Tame-fire works differently. It depends more acutely on its circumstances. Such fires operate within a domesticated, usually agricultural setting: they are the fire equivalent of domesticated species such as cows, horses, and sheep dogs. They do a

variety of tasks, much as a horse may pull a plow, draft a surrey, or carry a rider. They may burn the pruned limbs of fruit trees, the ditches around a farm, the fallow of a field. But their power is only as great as their surroundings, which are very much shaped by human contrivance. They are, in fact, fire-variants of kept creatures. They must be bred, selected, trained, nurtured, housed, harnessed to particular tasks, held on a leash. They are more difficult to substitute for. Replacing the tame fire is like substituting a tractor for a draft ox. It can be done, but the consequences ripple through the farm.

Captured-fire more resembles a caught animal such as an elephant taught to haul logs or a grizzly bear trained to dance. Its "wild" properties are what make it valuable. In this instance, its "wildland" or coarsely managed context are what define the fire and sustain it. People loose it, like those cheetahs in Mogul India trained to the hunt, and let it roam. Its success depends on timing and of course on setting. It can go feral, quickly and unexpectedly, or turn on its nominal guardian. Yet its value is unquestioned: it can challenge wildfire on its own grounds, without meticulous preparation. It can substitute a partially controlled process for an uncontrolled one. It is how, over long millennia, aboriginal economies have turned uncultivated lands to productive purpose. But as an ecological process, it is not replaced readily. No combination of chain saws, bulldozers, and woodchippers can do what it does. Although a technology, it is hardly a tool in the common sense, and attempts to characterize it as such must fail.

All of these technologies, moreover, depend not only on their environmental setting but on their relationship to humans. None of them could even exist without a

human agent. Those relationships run a gamut: tool-fire is a device, tame-fire a symbiosis, captured-fire an alliance, and there are others less prominent. Fire cannot be separated as readily from its user as the naive image of a tool suggests. It is easy to take a candle away, but less so field fires, and still less the prescribed burning of wildlands because the web of relationships increases. Subtracting fire may be as powerful as adding it. A removed hammer may mean a nail isn't struck. A removed field fire may unravel an ecosystem.

Instead, fire-as-biology, recommends another strategy. It focuses on the overall context, social as well as biological. It envisions fire as a biotic catalyst, a synthesizer of those surroundings. It argues for thinking of fire control as a variety of biological control, much like integrated pest management. It shifts attention from mechanical acts such as starting and stopping fires, and toward the interconnections that make fire possible, shape its behavior, and determine its outcomes. It forces people to accept their role as fire creatures because it is we who (nearly) close the biological cycle of

burning. We are less mechanical engineers than genial hosts - warding off the unruly fire guest, welcoming the jovial, sparking a flagging conversation, dampening a smoldering dispute.

Fire-as-tool suggests that the problem is to put fire in or take it out. The solution to unwanted fire is to shut off its air supply, remove its fuel, interrupt its chain of ignition. Fire-as-natural urges, if obliquely, that people erase themselves from their heritage as fire agents. By contrast, fire-as-biology suggests that the problem is to decide what fire's context should be, and then determine what kind of catalytic fire-induced jolt might best serve that setting. That fire is not merely a device to reduce fuel so much as combustibles are a means to get the kind of fire a biota requires. That our role as fire-keeper is more complex than that of tool-maker because it involves ecological connections as well as tasks. That fire, for humanity, is more than a problem or a process: it is a relationship. That fire, although no longer considered an element, remains elemental.

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