Collier Soil and Water Conservation District

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It's time to rethink the place of fire on Earth.

- Megafires are currently overwhelming human control, despite huge budgets and mature fire-fighting technologies.
- There is mounting evidence that, beyond immediate destruction of life and property, landscape fires have long-term effects on global carbon stocks, biodiversity, climate, world economies and human health.
- Despite fire's pervasive influence in many disciplines, there is no uniting theory or paradigm concerning the role of biomass burning in Earth science.
- Moreover, fire has not been satisfactorily considered by global change policy and ecosystem management.
- We, therefore, propose a thought experiment addressing:
  - --Whether fire would evolve where carbon-based life is present;
  - --How it would evolve, and
  - --How humans, their cultures and fire may have co-evolved.
- We must combine knowledge about biomass burning across fields to develop an integrative paradigm of 'pyrogeography' that addresses these fundamental questions.
- In a period of intensifying fire activity, our synthesis must provide crucial information that aids human adaptation.

Fire Ecology

Landscape fires affect biodiversity, human health, the global radiation budget, carbon balance and hydrological cycles.

When we are reminded of fire's potency it is often because the media frames fire as a disaster, an intrusion that upsets our versions of normality. And of course, we use fire in war. We kill with fire; we amass fire power to project political power and defend our nations from other aggressive ones. We don't like dwelling on this latent terror and I suspect we cope by trivializing firepower as a spectacle - we use pyrotechnics for amusement.

What is intellectually remarkable is that one of the most compelling forces of Earth is obscured by a cultural blind spot of modernity. Why should this be so and why does it matter? The answers to these questions remain incomplete. Indeed, holistic perspectives into fire on Earth remain embryonic. Fire's paramount place in natural philosophy and human culture was recognized as a vital elemental force but it became lost with the enlightenment and the rise of science.

Fire was defined then as an abstract physiochemical process and its effects reduced to numerous cameos in various disciplines. The enormous reach of fire, spanning from the humanities into the sciences was lost to culture as there were few intellectuals capable or interested in seeing the whole.

- When fires naturally, a vegetation mosaic of different forest types is created. This provides a greater diversity of vegetation and consequently a greater diversity of wildlife species.
- Although the common conception is that fire is a destroyer of the natural environment, the opposite is actually true, where a carefully planned prescribed burning program can be beneficial and even enhance the health of an ecosystem.
- Prescribed fires can reduce the amount of combustible fuel buildup that can cause larger more destructive fires.
- Other benefits of prescribed fire include: insect pest control, removal of undesirable plants competing for nutrients, addition of nutrients from ash, and removal of sunlight inhibiting brushy undergrowth.
- However, incorrectly managed prescribed fires can have very adverse effects causing excessive soil heating, loss of nutrients, and removal of woody debris needed to protect seedlings.
- Wildfires are suppressed in developed and high-fuel areas where intense fire could destroy a plant community or human built structures.
- Modern fire policy permits the burning of some natural fires and recognizes the use of prescribed fire as a management tool.

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Understanding fire matters because ultimately the global climate change crisis is due to unconstrained combustion. And disturbingly, fire may beget more fire.

Fire is ubiquitous on our planet. This astonishing feature of earth was not fully comprehended until satellite imagery provided striking evidence of the extent and frequency of fire some 20 years ago. Recent satellite image analysis suggests around 900 million acres of the Earth's vegetated land surface are burnt every year. Much of this burning can be considered natural in the sense it would occur whether or not humans were present. Indeed, the geological record shows that fire literally followed once life moved from the oceans onto the terrestrial environments some 420 million years ago.

The key for life occurring on the land surface was high concentrations of atmospheric oxygen. The eventual establishment of plants on the surface of the Earth created fuel, the biomass, living and dead carbon-based life. An oxygen rich atmosphere made fires inevitable given a constant background of lightning and episodes of volcanism.

The abstract and fundamental physiochemical fire triangle, that is ignitions from sufficient heat, oxygen and fuel, became an essential bio-spherical process. Fire activity through evolutionary times has waxed and waned in response to changes in oxygen levels. Fire cannot occur in atmospheres less than 13% but at around 35% even moist vegetation will burn. Thus fire becomes entangled with biogeochemical processes. For example, as oxygen built up, fire activity increased and counter-intuitively it is thought that over geological time this led to increased oxygen levels creating a feedback. This is because the charcoal from fires locks away carbon derived from carbon dioxide that was captured by photosynthesis leaving a slight residual of oxygen in the atmosphere.

One major effect of fire is a change in soil nutrients and soil temperature. Fire may be a chief factor maintaining productivity in colder soils where the lack of nutrients is a major factor limiting plant growth. Fires release nitrogen and other nutrients from woody vegetation back into the soil in the form of mineral-rich ash, which makes them readily available for new plant growth.

Plant regeneration begins almost immediately following a fire. At any given location, vegetation develops over time in orderly stages called succession. Each successive stage is determined by climate, soil conditions, available sunlight, and natural disturbances such as wildland fire. Accumulated litter and thick tree growth in the understory make these forests susceptible to fire, starting the cycle of disturbance and recovery over again.

Although fire may destroy individual trees and understory plants, the species themselves are well adapted to survive. In many cases, this is accomplished through a high regeneration capacity. For example, *Melaleuca* (*M. quinquenervia*) is not fire resistant and may be killed by a fire because of its thin bark and possesses serotinous fruits (capsules) that release many tiny seeds following fire, with conditions of reduced competition and ash-enriched soil make it perfect for establishment and rapid growth of seedlings.

Many wildlife species thrive on the occurrence of fire. The grasses, seedling shrub, and trees that reestablish burned areas provide an ideal environment for many small seed-eating mammals and birds, such as voles and sparrows. This abundance of small prey attracts predators like foxes, hawks and weasels. Burned trees provide sites for cavity nesting birds like flickers, kestrels and chickadees, while woodpeckers thrive on the insects that inhabit fire-killed trees.

We must resume our natural fire cycle through the use of prescribed fire as a management tool as a Land Development Code practice.