

Data Submitted (UTC 11): 12/16/2021 7:26:30 PM

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Comments: Randy Moore made water a priority for his agency, USFS, and the SERAL DEIS seems to downplay water in favor of infrastructure protection from fire.

Fire suppression for a century has led to remarkable changes in forest landscape, namely an overabundance of trees. We have over-fueled our forests with denser stands and denser undergrowth that has changed the nature of wildland fires.

Fire comes in shoe sizes, from more intense to less intense, and the environmental footprints differ for each.

Visible impacts occur with trees and with surfaces of white ash or black ash. Less visible are the waxy seals that repel rainfall and cause runoff or the fine-mineral white ash that plugs soil pores - good soil is 40% air pockets. Good soil has anecic worm burrows, vole and mice tunnels, not to mention nature's water engineers, gophers. The plow has been the sword in our wars against anecic worms, whose populations have been crushed in agricultural fields. In burrows lined with organic matter (duff) they drill the soil 18 inches to a yard or more, taking surface carbon into its depths.

Springtime wildfires, when the duff layer is wet, burn the litter layer of leaves, stalks and needles. More intense summer/fall fires burn the duff layer of decomposing vegetation. Catastrophic fires, made possible by climate change and a century of fire suppression, burn into the mineral soil, scarring the surface often with white ash, sterilizing the mycorrhizal fungi that make trees possible, sterilizing the subsoil and vaporizing its nutrients - in short, compromising the growing power of the soil so that less healthy forests result. Chris Maser, USFS author, talks about the role of subsoil refugia for mice - they burrow under the duff and hide. The fire burns over them, and after the fire, they emerge to poop. Their poop is fertility because it contains the spore of mycorrhizae to enable the next generation of trees - resilience! Killing the mice undoes resilience. Trees, with few exceptions do not grow in sterile soil.

Fortunately, low-intensity and moderate wildland fires and prescribed fires do not arm resilience of the soil, "mega-fires" do - they destroy the spores, the seed banks, the pyrocarbons stored in the soil. Mega-fires vaporize nutrients and the soil's organic matter, reducing hugely the soil's capacity to store water for the next forest. Essentially, megafires do in the forest - weakening tree health and making trees more vulnerable to pathogens and insects.

If SERAL purports to promote the "ecological resilience across the landscape," soil and water are of paramount concern.

In my esteem, soil and water are the primary concern in resilience, and a number of good webinars about forest soil and water are on YouTube. Here's one, by Debra Dunroese that should be viewed for its science. <https://www.youtube.com/watch?v=TXEhsonPKdE>

Fire suppression excluded a normal, even essential, disturbance from our forest ecosystems - regaining the role of fire is essential for a healthy forest, and mega-fires will not bring us up to par. Prescribed fire is good fire that can enhance the forestland, inasmuch as catastrophic mega-fires will destroy the ecological base - the soil, its microbial and macroinvertebrate life, the browsing mammals, the duff and litter layers along with the soil's subsoil cache of organic matter, pyrocarbons (biochar) and shift the mineral composition of the soil because some minerals vaporize faster than others. A prescribed fire can reset the pH of the soil, mega-fires can acidify, as do atmospheric depositions. Without fire, the USFS must battle a dozen other issues, like the changing species composition of lichens and the loss of N-sensitive lichen species. Fire can remedy by burning off nitrates that rained down.

Fires have different footprints, and getting the right footprint to perpetuate the forest on its own terms is critical. Prescribed fires can do the job, mega-fires, by the de-fault management of suppression, can be its undoing.

Restoring a more natural fire regime and a resulting more natural fuel mosaic on the ground is the goal, and certain treatments have pros and cons. For example, mechanical treatments like mastication are really only PRE-TREATMENTS, because they do not reduce the net biomass as fires do. There is no difference in the amount of fuel after mastication, merely a conversion of ladder fuel to ground fuel, in order to protect canopies

from fire. Canopy fires are harder to suppress than ground fires, so often the aim is to eliminate ladder fuels and leave an unnatural, continuous overstory of canopies.

I think what needs to be done to SERAL is the addition of purposes not well-expressed so far in the SERAL document.

I give you three:

- *increase soil water;

- *increase the soil's carbon base, both organic matter and biochar components;

- * map and/or create fire refugia;

Normal wildland fires control forest pathogens, both fungus and insects. The best example is the southern pine beetle which attacks dense stands of pine that have not had fires, and the beetle, unlike fires, kills 100% of the trees. The USFS thins stands so that wind wafts away the concentrated pheromones behind the beetles' spread.

As Dr Dumroese iterates, water storage is a matter of carbons, and both organic matter and pyrocarbons (biochar, charcoal) can do the job of procuring water and promoting late season flows in streams.

<https://www.youtube.com/watch?v=TXEhsonPKdE>

Intact riparian systems are fire refugia, and the abiding trees after a fire shade the water where fish spawn - colder water is best, and a change of water temperature, as little as two degrees, can prevent successful spawning. As part of the fire refugia program, SERAL can address beavers. A good webinar available online, SMOKEY THE BEAVER, examines the role of beavers in creating refugia for other species.

The SERAL DEIS, I thought, was well-written and covers a lot of essential ground in elucidating the purposes, but I see a few shortcomings that need correction. The focus of SERAL is focused directly trees and indirectly on protecting infrastructures like homes. Even if there were no homes in the WUI, even if there was no WUI, a century of fire suppression would necessitate treatments for excessively dense stands and overly abundant fuel - a natural fire regime would not have allowed these crises to accrue. We need fire in the forest, we need nature's management, and because we stopped nature's management of forests with fire suppression, we must go back and make ecological corrections to our former mistakes.

We must:

RE-FIRE THE FORESTS;

we must:

HARDEN HOMES.

It was a slick trick by the USFS to cast blame on people ("Only you can prevent forest fires") to cover for its mismanagement. Suppression was vogue in the early days of conservation when the cry was against waste. (Teddy Roosevelt: "I do not recognize the right of this generation to rob future generations by wasteful use.") Fire wasted timber, and forests were about timber for lumber. Wood sheltered us, it was an economic commodity. We now recognize the non-economic good from our forests: water. Clean water is our most important forest product, and the USFS is bound and obligated by law and by current policies (Randy Moore) to protect it. In some ways, I feel the SERAL EIS, good as it is, could use improvement in the many-faceted natures of soil and water.

Aldo Leopold, Yale's first graduated forester, used the euphemism "round river" for the hydrologic cycle. Trees are a part of the round-river hydrologic cycle, trees are a part of the carbon cycle as is soil. Managing soil, water and trees is what forest management is all about, and the three dictate what we must do to protect and preserve the national forest. What is a WUI without its forestland?

There will always be a call for fire suppression, and fire-fighters would like reduced stand density and fewer ladder fuels - but in an ecological context, these are secondary goals. We must manage for fire and with fire to do ecological good, and the USFS has come out with many educational videos that do just that - they educate on the intelligence that nature has built into forests. We must utilize this intelligence to perpetuate forests, to make them resilient from disturbances like pollution, flood, climate change and fire. We have learned to live with pollution to our own hurt, why can't we learn to live with fire. That what the SERAL DEIS document should tell us - fire is good for the forest, fire suppression is bad for the ecology - vice versa, fire suppression protects homes. Foolishly, the nation saw forest fires as wasting timber, taking a resource out of production, and fires were ignited by humans - and the USFS scolded Americans and told us in the 1950's to "break your matches" as if matches

not overloads of forest fuels, incinerated houses. In 1920, in California, houses were disposable, whole towns burn to ruin, and roofs of these houses were often made of hardened redwood shakes - with a natural class B fire rating. When the market switched to younger redwoods without the same fire rating, in the 1960's, the change-over sparked more rubble, house losses climbed in dollars, but we had fire insurance - and CDF (CalFire) whose policy was an engine in every yard ahead of the flames. Now insurance companies are bailing out from high-hazard WUI developments, and the rural residents are clamoring for safety. More stations, more engines, more fire-fighters won't do - fires are unstoppable in our over-fueled forests, and the remedy lies in reintroducing fire and lowering fuel loads but at what ecological costs?

It seems to me that in the long haul, the SERAL DEIS aids and abets fire suppression at the WUI scale, with less intent on improving the forest's naturalness with fire.

If the DEIS is amended, it should spell out pre-treatments, treatments and maintenance treatments, and these are alluded to, but not spelled out. If a maintenance plan is not included, the DEIS is incomplete. We need fire that do ecological work to make forests whole again, and pre-treatments, treatments and a maintenance cycle will reduce the risk of mega-fires, the worst WUI worry. Let's shore up the DEIS with an eye on soil and water and more on maintenance cycles to keep the forest healthy.