August 9, 2024

Cooke City Fuels and Forest Health Project
Custer National Forest
Gardiner Ranger District
PO Box 5
Gardiner, MT 59030

Dear Mr. Thom and Ms. Card,

These are my official comments on the Cooke City/Silver Gate Fuels Project (from [redacted].

As part of my comments, I am including all the emails I have written regarding the project since 2019 and the links and/or the hardcopies of the articles cited. In those emails I address my concerns about wildlife. My comments address mostly the proposed project as it relates to the Bannock Trail. The project is so big, I do not have time to address the impacts to all the areas proposed – I do not support any fuels/logging projects in any of the other areas either.

I will begin by urging the Forest Service to take the NO ACTION ALTERNATIVE and abandon the entire project in this sensitive area. In lieu of no action, I request the entire section of the Bannock Trail be exempt from any thinning or logging project. A worse place could not have been chosen. The area is an ecological treasure, superb wildlife habitat, including the endangered grizzly bear, and its cultural and social importance to the communities' economy cannot be overstated.

For over 6 years I have had to think about this project. This has taken a toll on my enjoyment of my property, my home and my sleep. I attended the meeting in Cooke City, in the fall of 2019, where the silvologist explained that the FS needed to remove the "over mature" trees because they were a detriment to our safety and to the forest. When the fuels proposal came out on July 12th, we were given only 30 days to comment. This is a very short time period for the public to comment on a very large and potentially damaging proposal that may put the value of our homes and property at risk, and put us in danger.

The proposed fuels reduction project does not cite any scientific information to back up the need. I will provide as much science as possible on why cutting and thinning trees does not keep people, homes, or communities safer. There is a clear body of evidence stating that thinning and logging DOES NOT KEEP ANYONE or ANY HOME safe from wildfire. Safety is stated as the reason for the project, which seems to be bogus.

In the last 40 years, the only real threat from fire came in 1988 and that was not from the YNP fires, but rather a backburn, started by the US Forest Service in anticipation of the YNP fire coming near Cooke City and Silvergate. The Forest Service tried in vain to light a "backburn" on the north facing slope of Silver Gate by throwing fire balls but to no avail. Even with the dry conditions in 1988, try as they might, they were unable to light a backburn and instead did a dozer line that is still visible today (at the beginning of the Bannock Trail and running up to the Mahnke residents just before the Wilderness area).

Across the way, on the south facing slope the FS again tried to light a back burn, however, when wind conditions changed, the fire took off from Silver Gate, went through Cooke City and burned 36 miles up into the Cooke Pass and Sunlight area. 5 or 6 homes were lost. The YNP fire never made it to Silver Gate. And I will note, the fireman on duty did what needed to be done which was to be sure that the towns were safe and that homes were protected. They monitored the fire and no lives were lost.

The proposal, especially the proposal which occurs on the length of the Bannock Trail from Silver Gate to Cooke City is arbitrary and capricious. When writing these plans a person could have taken the time to walk the forest and the road and see in-person the pristine, moist, north facing forest and evidence of multiple debris flows that are included in sections, 36, 111,37,98,112, 38, 39 and 40, one would know that thinning of any kind or logging trees of any size, would be a detriment to the health of this forest and to the safety of the property owners. The HEALTHIEST FOREST is one that stays STANDING- especially on the north facing slope on a mountainside that is known for debris flows, mud slides, and avalanches. The trees and the forest are what protect homes and property owners from harm. (See attached photos of slide area and debris from 2010 and 2012 and one that just occurred on the evening of August 4th, 2024—the worst one yet). Again, all the FS personnel would have needed to do is take a walk through these sections and note both the current debris flows and the historic debris flows. It would be extreme negligence to keep these sections as part of this fuels/logging project.

Science, and much of it from actual Forest Service scientists, have proven that thinning healthy old growth forests does nothing to protect homes, property, or people. The proposed project along the entire length of the historic Bannock Trail, puts those who own property/homes in harm's way. By thinning out healthy trees from an already extra moist, healthy forest, one is only opening the ground to excess sunlight, heat and drying winds. Fires do not mainly spread by trees being on fire, but rather by the burning embers which travel in the wind, especially in an already hot dry climate. I include the photos of the Paradise Fire in California after the burn. As you can see, there are green trees standing right beside burnt buildings. It is climate that drives a fire and not trees. The Bannock Trail has had several very large debris, mud and rock slides which have closed the road multiple times until it could be cleared. The removal of trees and ground cover of any kind may increase debris load and occurrences. And with climate change it is more important than ever to keep living, healthy forests intact.

The Bannock Trail is a very important component of why the home sites even exist on the trail. In 1937 Silver Gate was developed on mostly old mining placer claims. The vision was to have resort cabins and homes along the trail to enjoy the woods, the wildlife and the recreational opportunities the area provides. With the village situated next to Yellowstone National Park and surrounded by public lands development would occur on a limited basis. All the homes on the Bannock were built with this premise in mind. There are no local working families that live on the Bannock Trail. Those who are there choose to be there and are there for the benefits of living in a forest. Most are there during the months of May – October and that is when we get to enjoy the quiet, the wildlife, the access to the Bannock to walk, run, walk dogs, ride bikes, etc. The road is not made for any industrial type of activity and I cannot even imagine how or where logging trucks and tractors would do the proposed tree removal in the green commercial 36 section (which is the section slated for tractor logging—and is the area the large debris flow came down in 2012 & 2024—see photos)—it is baffling to think that would even be considered. For the Forest Service to say they are protecting us by cutting trees is at best false, and at worst, puts all of us and our homes in harm's way. The proposal as presented said there would be no impact to those using the Bannock for recreation, this is just untrue, the impact would be great, with traffic, hazards of large trucks and equipment, not to mention the unbelievable sound and noise impacts. Right now, the quality of silence is invaluable, people who stay at residences or at their own homes marvel in the quiet the woods offer–silence at night and in the evenings and mornings. It truly is why so many of us have invested money and time into our special places. it is an exclusive setting and not everyone gets to be here–it is part of what makes it special. Those of us who choose to live in the forest do so because we expect to "live in the forest" and do not need the Forest Service making bogus claims to protect us. On the Bannock, as stated before, there are 4 part-time residences that would be impacted greatly by this proposal with no benefit whatsoever and at an astronomical cost. And by opening up the forest, the safety of our homes when not occupied increases. Right now, there is thick cover behind our homes where the trees go up the rocky slopes toward Republic peak. Would this area then be open for anyone to wander through, directly behind all of our homes?

NOTE: I would request all new maps be provided with proper spelling and identification of the BANNOCK TRAIL.

The Bannock Trail is situated in trees and gently winds down to a trail after the Hansen's property to a non-maintained road. The length of the Bannock is used extensively by summer residents, tourists, and locals for easy access to the forest. It is a road with foot traffic, horse traffic, bike traffic, some ATV traffic, car traffic and is a place where those visiting Cooke City and Silver Gate can get out into the woods without having to travel into the more remote wilderness areas offered in the region. The Bannock Trail comes up from Yellowstone National Park as an archeological cultural historic asset and travels through the Shoshone Wilderness area before joining with the residential section of the road.

There is well documented science that proves that cutting trees DOES NOT stop catastrophic fires. 98% of money spent to do "forest management" is to cut down trees, to thin and to do "fuels projects". Only 2% is spent on educating homeowners and communities about hardening homes and creating defensible space, which is the only action that makes sense. We know that starting at the homes and working outward is what works and NOT starting in the forest and cutting all the trees to protect a home.

The proposal is proposing to do mechanical "fuels reduction" on sections 111,37,98, which is an area of the road that has 5 homes on it with part-time residents, my home, 114 Bannock Trail is one of these. One home, the [redacted], right next to Wyoming Creek towards Cooke City has been completely unoccupied for years. To cut one of the healthiest forests down for a fire that may never come—for a total of protecting 4 homes, is short-sighted at best and is extremely harmful and ludicrous at worst.

Short clip about the film "Elemental" which features Jack Cohen, retired Forest Service scientist.

https://vimeo.com/543710055.

Hour interview about the documentary film, "Elemental" about fire, defensible spaces, and the work of Forest Service Scientist Jack Cohen:

https://www.youtube.com/watch?v=QMwxXcy2RH8

This document which is the Forest Service's plan for dealing with fire and climate change specifically as it relates to Old Growth forest, came out in June 2024. It looks as though the Custer-Gallatin Forest is fast-tracking this "fuels" project, so that it beats the information that would come out after the scoping is complete on comments and guidance on old growth in the country's National Forests. It feels that the local forest service is trying to undermine new information that could be available if the scoping comment period were extended past August 12, 2024.

https://www.usda.gov/media/press-releases/2024/06/20/usda-forest-service-seeks-public-comment-draft-guidance-old-growth

Below are my copied emails I have sent to the forest service in response to the proposed fuels/logging project (articles sited are also provided as hardcopies as part of my official comments):

May 19, 2020, 3:10 PM

[redacted]

to Bill, SM.FS.CookeCityVeg, me

Dear Mr. Thom,

I would like to make some initial comments regarding the proposed thinning projects along the Bannock Trail near Cooke City and Silvergate. My husband and I attended the public meeting in Cooke City in the fall of last year.

I have lived on the Bannock Trail for just about 30 years and my husband for 45+ years.

The following are issues that concern me and that I would ask the Forest Service to consider when putting together its initial proposal.
1) The Bannock Trail is part of the ecosystem supporting YNP and its traveling wildlife. This corridor is extremely important to a variety of wildlife and they use its trail and migration paths on a regular basis and have done so for centuries. It makes no sense to disrupt this very important habitat for a possible fire event. Animals I have viewed on our half acre plot include: grizzly bears, black bears, foxes, wolves, porcupines, deer, elk, bison, moose, martens, weasels, great horned owls, rabbits, coyotes, squirrels, flying squirrels, hawks, beaver, river otters, and many rodents and variety of birds. Clearing trees and underbrush disrupts the habitat of these animals.
2) The Bannock Trail residents are second or third homeowners, there are no permanent working families who live on the Bannock Trail. There is no reason anyone on the Bannock could not vacate the area before a fire event. Most fire events happen with warning and there would be plenty of time to vacate and/or even to not reside at homes on the Bannock should the fire threat be high during any one season and a resident felt unsafe occupying their home on the Bannock.
3) Old-growth trees are critically important for forest health. They have the least chance of burning, they anchor and hold soil within their roots systems protecting against soil erosion, they protect the forest floor with shading, thus keeping the undergrowth moist. They are not "over mature". It is in the public and the Forest Service's best interest to protect the health, ecological value and the integrity of the forest and especially the primitive old growth associated with this stretch of Forest Service land.
4) Water quality, mud and landslides on the Bannock and Republic Mountain. The Bannock Trail follows the Soda Butte Creek corridor and the Soda Butte flows directly into YNP. Over the last 30 years there have been mudslide events on the Bannock, big enough to stop traffic and we had to bring in heavy equipment to remove the mud and debris. This is a very sensitive and steep area (the entire length of the Bannock Trail) which has ALREADY been prone to mudslides and debris flows during heavy rain events (and I would be happy to show FS areas where this has occurred on the Bannock). I do not see how the Forest Service would be able to justify thinning or tree

removal without severely affecting the chances of mud and debris flows--which at times have already put homeowners at risk of material harm.

5) By thinning trees and undergrowth, air spaces are opened and the forest has a much higher rate of evaporation, thus INCREASING the likelihood of burning quickly, it also adds oxygen to the fuel making it even more combustible.

6) The cultural and historic nature of the Bannock Trail has been its primitive nature and its narrow winding path through forests. The Bannock Trail is an historical and archaeological resource according to YNP. There is limited private property which abuts Forest Service lands which lends to its wild character. If any thinning occurs it should be done by hand and not with mechanized removal equipment. The road definitely does not lend itself to heavy equipment or for logging trucks and I speak for myself when I say I would be against upgrading the road in any way. And as stated above, there is no reason for seasonal residents to occupy vacation homes if they feel there is a threat of wildfire. To risk forest and wildlife health because of part-time residents' fears of fire would be incredibly short-sighted.

7) Both my husband and I were in Silver Gate during the fires of 1988. On our side of the mountain on the Bannock Trail, opposite of the side which was accidentally burned by a backburn (when the wind shifted direction and the fire burned through Cooke City and nearly 30 miles up), fire fighters and forest employees tried to ignite a fire line/back burn with torches and fire bombs and they could not light the forest. The Republic side of the valley has the benefit of shade and moisture (I attach photos taken in July of our deck and our roof, showing the amount of moist moss growing on buildings).

8) I have regard for our local volunteer fire service and understand local fire fighters would be considering people's homes as top priority during any wildland fire event, and Forest Service firefighters would be dispatched to any wilderness or forest service fire situation.

9) Lastly, I want to share a couple of articles about wildfire management. Very good information here. I also attach a letter you may find of interest.

http://www.thewildlifenews.com/2020/05/15/bozeman-watershed-project-spills-bad-blood/

All large (high severity) fires are driven by weather-not fuel. Unless you have a fuel-free zone like a Safeway parking lot, the fire can spread—and the recent blaze in Paradise, California, even burned up the Safeway despite the parking lot. Even the mile-wide Columbia River in Oregon could not stop the Eagle Creek fire from jumping across the entire waterway to spread into Washington. If a parking lot or a major river won't stop a blaze, does anyone sincerely believe removing just some of the forest will halt a fire?

Large blazes occur under extreme fire weather conditions—these conditions include drought, low humidity, high temperatures, and, most importantly, high winds. If you have these conditions, you have a blaze that cannot be stopped (until the weather changes). If you don't have these conditions, fires do not burn much. They are often self-extinguished.

For instance, in a 2017 letter to Congress, more than 250 scientists opined that logging and thinning were ineffective. To quote from their message: "Thinning is most often proposed to reduce fire risk and lower fire intensity…However, as the climate changes, most of our fires will occur during extreme fire-weather (high winds and temperatures, low humidity, low vegetation moisture). These fires, like the ones burning in the West this summer, will affect large landscapes, regardless of thinning, and, in some cases, burn hundreds or thousands of acres in just a few days."[ii]

Many researchers question the idea that fuel reduction from logging/thinning or even prescribed burning is effective. This is a representative sample from scientists at the Missoula Fire Lab. "Extreme environmental conditions. . overwhelmed most fuel treatment effects. . . This included almost all treatment methods, including prescribed burning and thinning ... Suppression efforts had little benefit from fuel modifications."[iii]

This view was echoed by the Congressional Research Service (CRS), which states in a report to Congress "From a quantitative perspective, the CRS study indicates a very weak relationship between acres logged and the extent and severity of forest fires. ... the data indicate that fewer acres burned in areas where logging activity was limited.[iv]

https://www.lagrandeobserver.com/opinion/letters/my-voice-science-reducing-fuel-load-in-forests-has-little/article_fd326a58-e91f-11e9-9b4f-830ba164da63.html

https://bitterrootstar.com/2020/03/darby-lumber-timber-sale-phase-2-is-trojan-horse/

https://www.frames.gov/documents/behaveplus/publications/Schroeder_and_Buck_1970_PMS-425-1_NFES-1174_Fire_Wx_all.pdf

Thank you for the opportunity to share my concerns.

Sincerely,

[redacted]

More reasons to NOT log Bannock

[redacted]

Tue, Sep 27, 2022, 9:22 AM

[redacted] <[redacted]>

to Michael, Ashley, Bill, Clint, Steve

Hi Mike,

Here is a good article written by George Wuerthner. Again, making the point that logging does NOT prevent catastrophic wildfires and protecting homes and working OUT from homes is the only sensible form of preventing harm from fires.

Investing in our excellent volunteer fire department to assure they have what they need to protect homes (not fighting wildland wildfires.....) and providing homeowners with small grants or other incentives for fire-proofing their homes, if they wish, would make more sense for the Forest Service.

Again, the Bannock is on the shaded side of the mountain, is moist year-round and is part of a varied old growth forest which is desirable to keep standing as it has a variety of types of vegetation, a variety of ages of trees, and is shaded and the trees provide for holding soil and trees in place on a side of Republic known for its water and debris flows.

There are many more reasons not to log the Bannock Trail, but I'll save those for another time.

Thank you, I hope you find it informative.

[redacted]

No logging for fire supression

[redacted]

[redacted] <[redacted]>

Thu, Oct 5, 2023, 9:33 AM

to Michael, Ashley, Clint, Michael

Please read. Excellent article on why logging projects for fire prevention make no sense.

https://trib.com/opinion/column/wuerthner-sprawling-into-disaster/article_4e543e82-62bd-11ee-90d8-8bac611356bf.html

I am against any logging projects on the Bannock Trail between Silver Gate and Cooke City.

The Forest Service's own science has proven that logging does nothing to prevent structures from burning and in many cases makes the spread of wildfire WORSE.

The Forest Service should put resources in the hands of the homeowners to fire-wise their homes should they decide to, and also could invest in the excellent volunteer fire department in Cooke City and Silver Gate.

Thank you,
[redacted]

Misinformation about wildfire from UC Davis

[redacted]

Wed, Jan 25, 2023, 11:11 AM

[redacted]

to Ashley, Michael, mstory, Clint, Bill

A very good article.

https://open.substack.com/pub/georgewuerthner/p/misinformation-about-wildfire-from?utm_campaign=post&utm_medium=web

--

Respectfully submitted,
[redacted]
and
[redacted]

Attachments to official comments:
PHOTOS:
Debris Flow on [redacted] property, [redacted] August 5, 2024 (7 photos)
Debris Flow on [redacted] property , August 2012 (2 photos)
Debris Flow on [redacted] property, [redacted], August 10, 2010 (2 photos)
Photos of debris flow as seen from across Republic Mountain and from historic debris flows
Before the August 5, 2024 debris flow (6 photos)
Photo of moss growing on cabin roof at [redacted] (1 photo)

Photos of grizzly bear and cubs walking down Bannock Trail near [redacted] property just east of Republic Creek bridge.

Photos of Paradise CA and Denton MT (4 photos)

ARTICLES/Publications:

"Misinformation about wildfire from UC Davis", George Wuerthner, Jan. 24, 2023.

"Guest Column: Harden communities, don't log to protect against wildfire", George Wuerthner

"Deshutes National Forest is currently engaged in prescribed burning and thinning", George Wuerthner.

"Darby Lumber Timber Sale Phase 2 is Trojan Horse", George Wuerthner, March 17, 2020

"My Voice: Science: Reducing fuel load in forests has little effect on wildfires", George Wuerthner, Oct. 7, 2019.

"What is a healthy forest?", George Wuerthner, July 12, 2024.

"A bigger hammer won't stop large wildfires", George Wuerthner, September 11, 2022.

"Wuerthner: Sprawling into disaster", George Wuerthner, October 4, 2023.

"The Case Against Commercial Logging in Wildfire-Prone Forests", New York Times, July 30, 2022, Dr. Chad Hanson, Research Ecologist with the John Muir Project, a subsidiary of Earth Island Institute, and Dr. Michael Dorsey, director and Chair of the Rob and Melani Walton Sustainability Solutions Service at Arizona State University.

"GEOS Institute, RE: Oregon Governor's Wildfire Council: Feedback on September 12, 2029 Mitigation Committee Report (with footnotes)".

"Working from the Home Outward: Lessons from California for Federal Wildfire Policy", Douglas Bevington, PhD, Forest Program Director, Environment Now, May 5, 2021.

https://johnmuirproject.org/wp-content/uploads/2021/11/ScientistLetterOpposingLoggingProvisionsInBBB_BIF4Nov21.pdf

"Open Letter to President Biden and Members of Congress from Scientists: It is essential to Remove Climate-Harming Logging and Fossil Fuel Provisions from Reconciliation and Infrastructure Bills"

Not included in these comments, but another reference of good information against logging, is "Wild Fire – A Century of Failed Fire Policy", George Wuerthner.

CC personal files

August 5, 2024
Looking up gully
coming from Republic
Mtn.

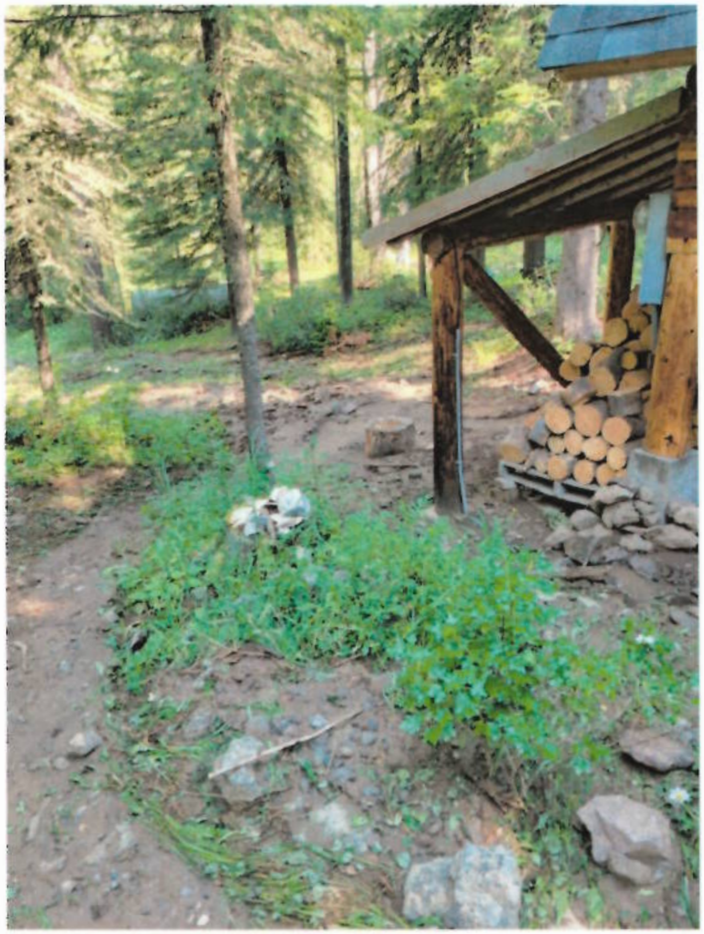
August 5, 2024
Debris flow on
property [redacted] Bannock Trl.

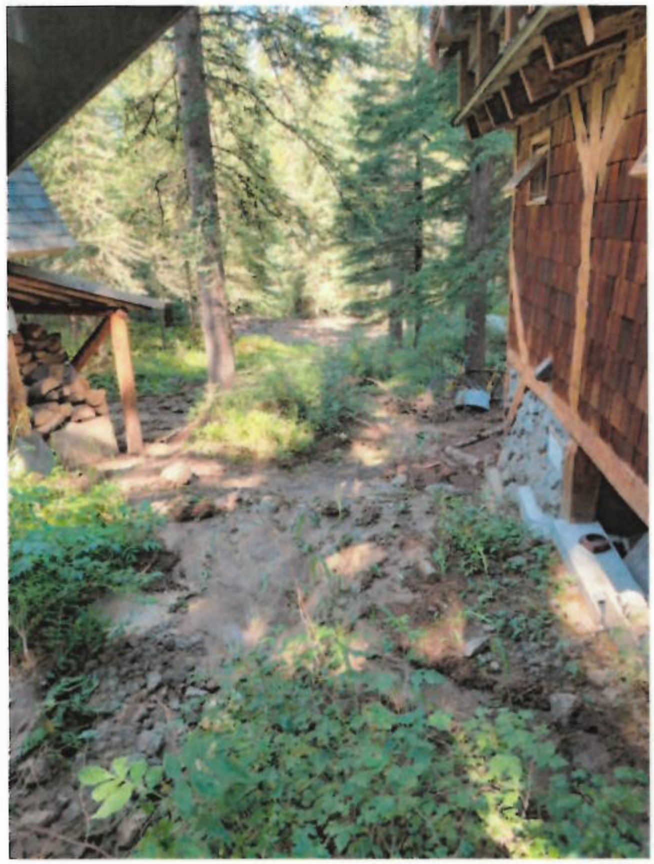
August 5, 2024
Debris flow on property
at [redacted] Bannock Trail

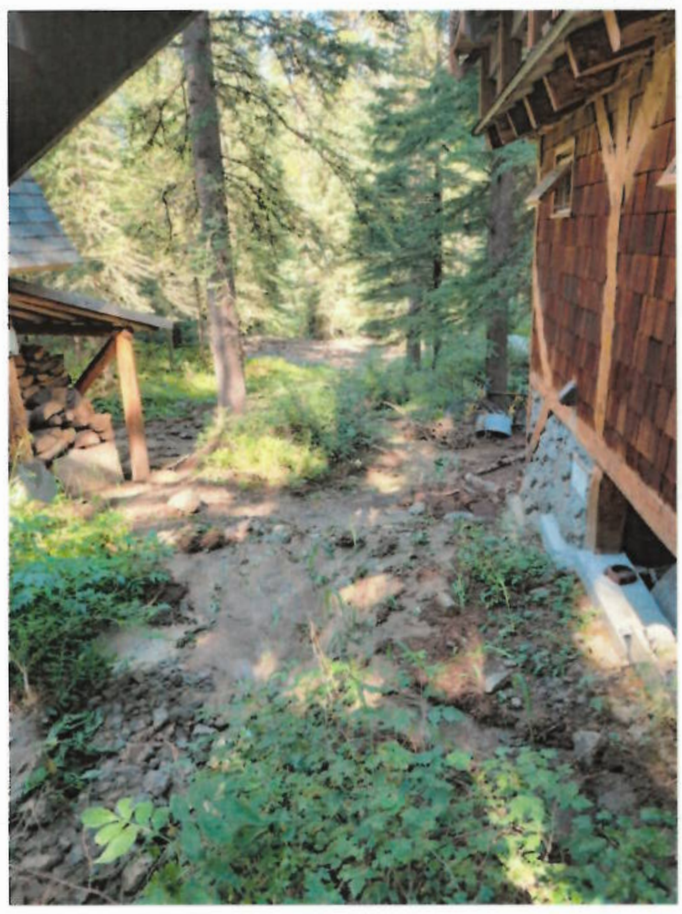
August 5, 2024
Deloris flow onto
Bannock Trail at [redacted]

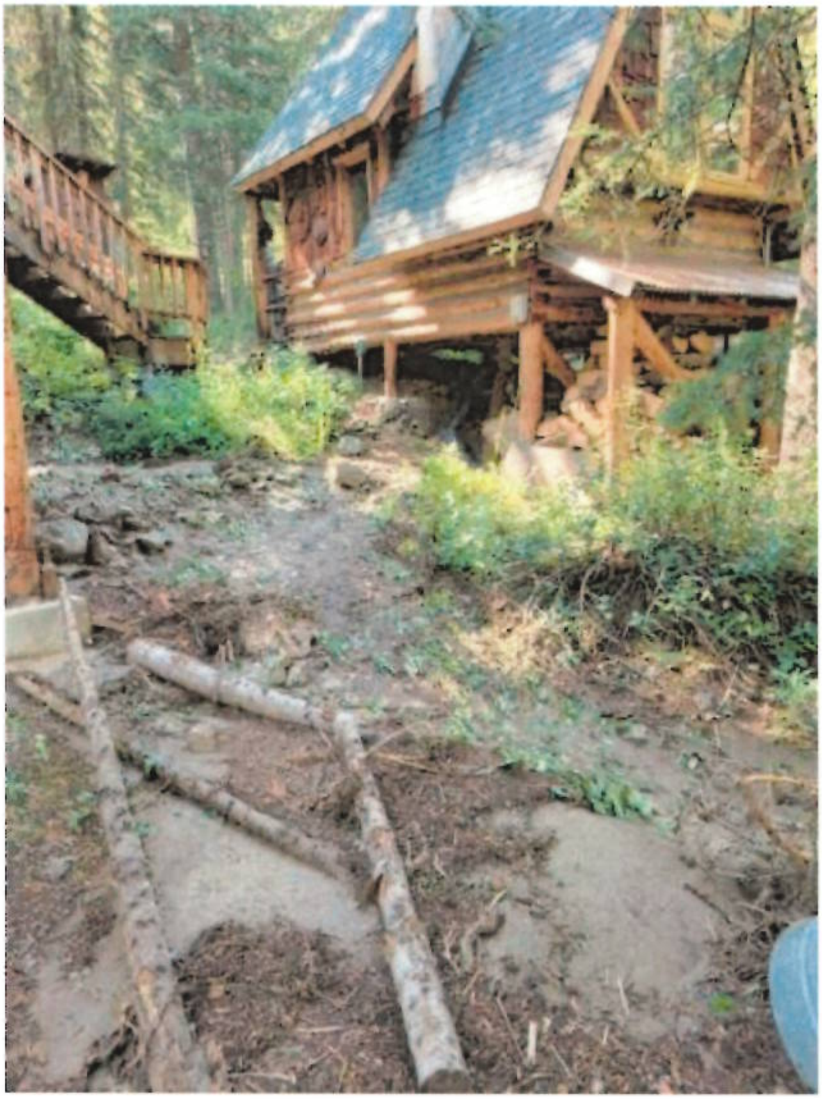
August 5, 2024
Debris flow in proximity
to propane tank:
[redacted] Bannock Trail

Debris Flow August 5, 2024
[redacted] Bannock Trail









Debris Flow
August 5, 2024
[redacted] Bannock Trail

(Removing Debris 2012 from Bannock Trail) #31

Debris flow at Sloan Cabin on Bannock Trail #31 near section 36

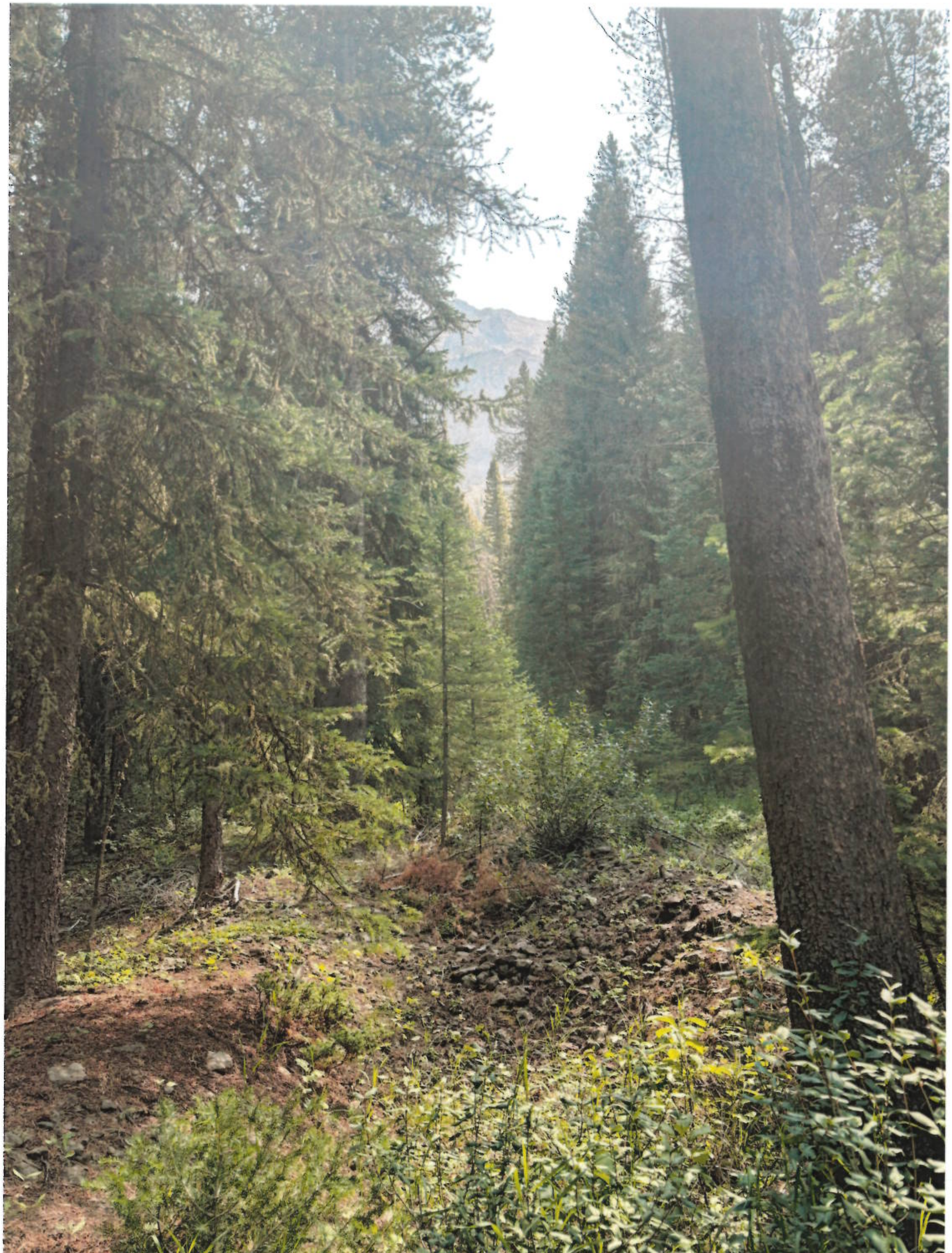
August 2010 Debris Flow at [redacted] Bannock Trail

August 2010 Debris flow after road was cleared, at [redacted] Bannock Trail

This is directly behind homes in area

* directly above proposed thinning * note slide areas

* Slide area - directly above proposed tree removal



Rock slide debris on property at [redacted] Bannock Trail, slide occured 2010

Berm on property at 114 Bannock Trail from debris flow of 2010 [redacted] Bannock Trail home site

X Proximity of rock slide berm from 2010 - Note the home is about 10 feet from debris flow

* Section 111-37 on maps

* 2010 Debris flow as it exited our property and had to be cleared from the Bannock Trail by heavy equipment.

* moss on home at [redacted] Bannock Trail - northfacing slope

Grizzly + cubs on Bannock Trail at the [redacted] lane just east of Wyoming creek bridge. Photo credit: [redacted]
Fall 2023

2018 Paradise CA - note standing trees adjacent to burnt structures

2018 Paradise CA – note standing green trees adjacent to burnt structures

* Denton, MT Dec 2021
* note standing green trees next to burnt structures

* Denton, MT December 2021
Note green trees next to burnt structures

Misinformation about wildfire from UC Davis

Are fires in Sierra Nevada really "unprecedented"?

GEORGE WUERTHNER

JAN 24, 2023

1

Share

High-severity blazes are critical to healthy forest ecosystems. Photo George Wuerthner

I read yet another study circulated by UC Davis and doggedly promoted by the national media, encouraging more prescribed burning, thinning, and forest manipulation to reduce large high-severity blazes characterized as "bad."

The headline from UC Davis proclaims that scientists have documented, "Unprecedented levels of high severity fire burn Sierra Nevada Forests." With a sub-title: The "Wrong Kind of Fire Is Burning Compared to Historical Patterns."

The paper reports that compared to the pre-1850s, there appear to be far more high-severity blazes in the Sierra Nevada today than in the past.

The 2013 high-severity Rim Fire in California burned more than 200,000 acres and created numerous snags and down logs critical to healthy forest ecosystems. Photo George Wuerthner

That finding may not be inaccurate—though some researchers would question that assertion.

However, since the climate varies over centuries, when in the past you use for your comparison makes a big difference in how you view whether wildfires are "unprecedented" or the "wrong kind of fire."

The article goes on to suggest that the proportion of "good" fire (low severity where few trees are killed) to "bad" fire (high severity where the majority of trees are killed) is "out of balance." These statements are human-centric values, and do not reflect evolutionary or ecological perspectives.

Like numerous others I see all the time, the problem with this research and press release is how researchers and the media attribute the observed changes in fire behavior to a host of factors, most of which are insignificant.

The article says: "These modern changes have been driven largely by anthropogenic factors, for example, halting of Native American burning, adoption of fire suppression policies, timber extraction, and forest management practices, changing ignition patterns, and climate change, that have altered the way fire interacts with forests,"

Wind driven fire seen here. Climatic conditions like drought, high temperatures, and high wind are the major factors that drive large wildfires not fire suppression, forest practices or lack of Native American burning. Photo George Wuerthner

Yet climate change alone probably accounts for 95% of the variation in fire behavior!! By treating the minor influences of forest practices, suppression, and Native American burning as significant drivers, they set up support for greater forest manipulation, including prescribed burning and timber cutting everywhere.

The biggest problem is that "historical patterns" used as the "control" in the study (pre-1850s) depended on a specific climatic condition that no longer exists today. The climate in the pre-1850s was influenced by the Little Ice Age, which span the time from 1300-1850. The Little Ice Age was a particularly wet and cool period. Cold and wet conditions tend to reduce ignitions and limit fire spread.

California is experiencing the worst drought in 1200 years. This fact alone explains the majority of fire behavior. Photo George Wuerthner

The climate we are experiencing today has no recent precedent. California, for instance, is experiencing the worst drought in over 1200 years. The average temperatures are also reaching record highs. Severe drought characterizes most of the western U.S. at present.

The nearest comparative climatic conditions to today were during the Medieval Warm Spell, which occurred between 800-1300 AD. During this time, there was more fire than today. As one of the authors of this study noted: "This is one line of evidence that it was very fiery on the western slopes of the Sierra Nevada – and there's a very strong relationship between drought and fire."

During that warm, dry period, there were massive wildfires around the West. It is also why the Anasazi Indians abandoned their cliff dwellings, and Greenland was settled by the Vikings (because it was greener in 900 AD).

So, comparing the fire regime of today with a time of glacial formation during the Little Ice Age is comparing apples and oranges.

The press release is full of "pejorative" language that is not ecologically based but rather represents the Industrial Forestry Paradigm that anything that kills trees other than chainsaws is "out of balance" and "bad."

First, given the climatic conditions associated with global warming, the increase in high-severity blazes may not be "out of balance" at all. On the contrary, more high-severity fires are precisely what you would expect under current weather/climatic conditions.

The greater number of high-severity fires is an example of Nature in "balance" with the current climatic conditions.

The 2021 Dixie Fire burned more than 900,000 acres including many higher elevation fir forests. Photo George Wuerthner

The paper and press release first acknowledge that fire behavior differs in various plant communities but then gives the impression that the same fire regimes apply to all forest types.

For example, fire rotation in dry pine forests tends to be more frequent than high elevation forest types like lodgepole pine, fir and spruce forests, and aspen, among others which experience long, often hundreds of years, between significant fire events.

These higher-elevation, moister forest types may not experience significant wildfires for hundreds of years because they require specific climatic conditions of extensive drought, warm temperatures, low humidity, and high winds before they are dry enough to burn. These climatic/weather conditions seldom occur in any location along with an ignition source. When these all align, you get high-severity blazes.

The idea that high-severity fires are "bad" is another example of the derogatory wording in the press release and original research. High-severity fires are always relatively infrequent but tend to be the "norm" for higher-elevation or moister forests.

Research in Sierra Nevada forests suggests that high-severity fire rotations varied between The high-severity fire rotation was 281 years in the northern and 354 years in the southern Sierra.

Since global warming has increased the prerequisite conditions of droughts, high temperatures, low humidity, and wind, we are seeing precisely what you would expect-more higher elevation forests burning. These wildfire fires are not "out of balance" but completely in balance with the prevailing climate conditions.

Furthermore, other research shows that these high-severity blazes are critical to healthy forest ecosystems. Numerous plants and animals depend on the down logs, snags, and decaying wood that high-severity blazes produce.

This is evolutionary evidence that contradicts the proclamation that we see the "wrong kind of fire."

Logs that fall into stream create good fish habitat. The main source of logs for most drainages comes from high severity blazes. Photo George Wuerthner

Some studies suggest more plants and animals depend on high-severity blazes for their habitat than low-severity fires. For instance, down logs improve fish habitat. In addition, studies have shown that the more logs in a stream, the more fish. Yet most logs that fall into streams may result from one sizeable high-severity blaze that may only occur once in a couple of hundred years in any drainage.

The input of down wood is episodic, not regular. So you may only have 1-4 such high-severity fires every thousand years.

Beyond these problematic temporal and spatial scale issues, we find that the preferred cure of more prescribed burning and thinning are ineffective because they do not influence the primary driver of significant fires-climate change.

Forest that was thinned six months previous to the 2007 Angora Fire at Lake Tahoe. California that burned at high severity.

Instead, logging appears to increase the occurrence of high-severity fires by opening up the forest to greater wind penetration and solar drying—both conditions that favor fire spread.

Once again, the forestry industry propaganda is being spewed forth by unwitting media with little scientific ability to judge the nuances in the science.

The bottom line is that high-severity fires are not "out of balance" given the on-going climatic conditions, nor are they "bad" from an ecological perspective. Wildfire, bark beetles, drought, and other sources of mortality is moving the Sierra Nevada vegetation community in balance with the existing and future climatic conditions.

1 Comment

Write a comment...

[redacted] Jan 24, 2023

Exactly. Thank you, George!!

LIKE REPLY SHARE

Guest Column: Harden communities, don't log to protect against wildfire

- BY GEORGE WUERTHNER

Editor's Note
Do you have a point you'd like to make or an issue you feel strongly about? Submit a letter to the editor or a guest column.

A recent article in The Bulletin proclaimed that millions of federal dollars are coming to Central Oregon to "restore" forest health and "reduce" the risk of large-scale wildfire.

These assertions by Forest Service representatives demonstrate the ignorance or malfeasance of the agency.

First, large scale wildfires are the result of climate/weather conditions, not fuels. Climate change is fueling the larger blazes. Nearly all the acreage burned annually occurs during the relatively few weather conditions that promote fire spread. If you don't have these conditions, nearly all fires self-extinguish or are easily suppressed.

We have numerous examples of where fuel reductions failed to stop a fire under extreme fire weather. For example, the Holiday Farm Blaze that raced down the McKenzie River burned through enormous clearcuts which failed to halt the blaze.

Second, the agency doesn't count the trees it kills with chainsaws as a loss. But research has shown that in many instances, if you add in the trees removed to "save" the forest to any ultimately lost to insects, disease or fire, the total is greater than any of these natural processes would kill.

Third, thinning and prescribed burning are not benign. They often require roads (which incidentally is one of the major places for human ignitions) that disturb wildlife, causing sedimentation in streams.

Prescribed burning often increases the growth of fine fuels like grasses and shrubs that carry fires. In order to preclude them from being a means of fire spread, prescribed burns must be repeated every few years. To be effective such burns should be immediately adjacent to communities and maintained *forever*.

Fourth, keep in mind the bias of the timber industry, forestry schools and the Forest Service, they are all committed to logging the forests. Their assessment that large high-severity fires are undesirable merely demonstrates their bias.

These wildfires which are ultimately rare events. Of the 1.5 million wildfires that have burned since 2000, only 2% are considered "large" though they contribute to the bulk of the acreage charred. These large blazes are essential to maintaining healthy forest ecosystems. The snag forests that result from such blazes are critical to numerous plants and animals who live in mortal fear of green forests.

These snag forests support more mushrooms, bees, wildflowers, many bird species, small mammals, and even fish (when the logs fall into creeks) than so-called "healthy" forests.

Fifth, while it is accurate to say that all the forest types in central Oregon periodically burned, what is not said is that most of the plant communities in the region only burned at long fire rotations of many decades to hundreds of years. They are not "unhealthy" nor do they require "fuel reductions." This includes sagebrush, juniper, spruce-fir, aspen, and all other plant types. The only exception are dry forest of ponderosa pine, however, even in these forests, occasional high severity blazes occurred, so are not “unnatural”.

Even dead trees killed by wildfire or insects store carbon. While logging removes the carbon from the site and releases it immediately into the atmosphere contributing to climate warming which is driving large wildfires. In Oregon logging contributes more to greenhouse gas emissions than transportation.

Protecting all public lands from logging is the most cost-effective means of reducing large wildfires. The Biden administration's recent effort to protect old growth forests is a step in the right direction, but we also need to protect mature forests which ultimately transition to old growth over time.

Finally, the best way to protect communities is not to log the forest but to harden them and prepare for evacuations. Home hardening means removing pine needles from roofs and gutters, keeping flammable vegetation away from home foundations, and installing devices like roof sprinklers. These and other methods are proven to work even with high-severity blazes.

The Deschutes National Forest is currently engaged in prescribed burning and thinning the forest.

They assert that our forests are unhealthy and too dense, thus requiring human ignition and logging to keep the forests healthy.

At the same time it promotes chainsaw medicine and human manipulation, it conveniently asserts that natural evolutionary sources of mortality like disease, wildfire, drought, and insects are "signs" that the forests are unhealthy.

There are a couple of observations that one should consider.

1. Ponderosa pine has existed as a species for 55 million years. Humans have only been in North America for perhaps 15,000 years or so. One must ask how did ponderosa pine survive all those millions of years before humans were here to "manage" the forest? Gosh, before humans arrived, these forests must have been an ecological mess.

2. While ponderosa pine has adaptations to survive low-severity fire, like a thick bark, self-pruning, and other adaptations, it is one of the few species adapted to low severity-high frequency fire and even among ponderosa pine the occasional mixed to high severity is a natural event.

By contrast, nearly all plant communities in the West including sagebrush, juniper, fir, spruce, aspen, and numerous others typically experience long fire-free intervals of many decades to hundreds of years. And when they burn, they tend to experience high-severity blazes where a good percentage of plants and trees are killed.

3. Assertions that thinning and prescribed burns will preclude large fires is delusional. Large high-severity fires are

climate/weather-driven events. Under such conditions, thinning/logging and prescribed burns have little influence on the fire spread. All high-severity blazes are driven by high winds, typically under drought conditions. .

Under such conditions, high winds transport embers a mile or two ahead of the main firefront, starting new blazes. This means the fires jump over and around "fuel treatments. "It also limits helicopters and air tankers. And no fire boss will put his crew in front of a wind-driven blaze.

Such wildfires do not come under "control" until nature changes the conditions that promote such blazes, like strong wind and high temperatures.

Witness the Holiday Farm Fire along the McKenzie River that burned through miles of industrial clear-cuts. If clear-cuts won't stop a wind-driven blaze, suggesting some forest thinning/logging or even a prescribed burn will stop a fire is delusional.

4. Natural processes like wildfire, drought, insects, and other sources of mortality remove trees that are not adapted to current climatic conditions. A logger with a paint gun marking trees for removal has no idea which trees are genetically adapted to the new environment. Therefore thinning, by randomly removing trees, degrades our forests and makes them less healthy.

5. The solution to wind-driven blazes is to harden homes and work from the structure outward. A recent report from California found that removing burnable materials five feet from the base of the house, and fire-resistance roofs, can reduce home losses by up to 50 percent. To the degree that prescribed burn and thinning is implemented it should be located immediately around communities and buildings and must be maintained. I have seen numerous

prescribed burn areas where vegetation grew back within a few years, often more vigorously than what existed before treatment. And logging the forest can open up the stand to more wind penetration and drying — both conditions that favor fire spread.

6. Of course, the ultimate cause of all of these forest issues is not fuels but climate. The human contribution of CO_2 is warming the planet, and plant communities are responding and adapting to the new conditions.

George Wuerthner is an ecologist who has published several books on wildfire. He lives in Bend.

Darby Lumber Timber Sale Phase 2 is Trojan Horse

MARCH 17, 2020 BY **GUEST POST**

By George Wuerthner, Livingston

The proposed Darby Lumber Timber Sale Phase Two on the Bitterroot National Forest is a Trojan Horse being implemented under the guise of "forest health" based on numerous false assumptions. The proposal displays the Forest Service's Industrial Forestry bias and its subterfuge of science.

The Friends of the Bitterroot is litigating the sale because it would compromise elk security cover and road densities.

The public no longer gives the agency a "social license" to simply give away public logs to private timber companies like Pyramid Lumber in Seeley Lake at a loss to taxpayers, so both the Forest Service and the owners of lumber mills have to come up with another excuse for logging. They now disguise the purpose of logging by suggesting the cutting of trees will "improve" forest health.

A complete ecological accounting would demonstrate that logging always impoverishes the forest ecosystem. It's just the agency ignores most of the real environmental costs and exaggerates the public benefits.

The FS asserts that the forest is "unhealthy" and at risk of death from wildfires and bark beetles. That is like saying that an elk herd is unhealthy because wolves kill some of the animals. Bark beetles are "keystone" species that research demonstrates increases biodiversity in the forest. Similarly, wildfires are among the most important natural processes creating and enhancing wildlife habitat in our forests.

Live trees, particularly in a drought when fires occur, are more incendiary than dead trees because they have the fine fuels of flammable, resin-packed needles and branches, which are what burns in a blaze. That is why most wildfires occur in green forests and also why you have snags after a fire-the main tree bole typically does not burn well.

This is not hidden science.

For instance, when I Google bark beetles and wildfire, the very first article that comes up says: "We review the literature on the efficacy of silvicultural practices to control outbreaks and on fire risk following bark beetle outbreaks in several forest types,.. to date, most available evidence indicates that bark beetle outbreaks do not substantially increase wildfires ..."

The second Google article listed says: "Another new study published by the Ecological Society of America titled "Does wildfire likelihood increase following insect outbreaks in conifer forests?" by Garrett Meigs and co-authors conclude that bark beetle outbreaks do not lead to greater likelihood of fires."

Besides, even more, research shows that high-severity blazes typically occur under extreme fire weather, where research again suggests, logging and other "vegetation treatments" like prescribed burning are ineffective at halting wind-driven fires.

The Forest Service displays its Industrial Forestry bias when it asserts that some trees are "slow" growing and that logging will increase "vigor." Ecologically speaking, slow-growing trees have denser wood, which means they rot slower, and last long after they die. This means they function longer in the forest ecosystem providing wildlife habitat, storing carbon and providing the slow release of nutrients into soils. Thus slow-growing trees are more valuable to "healthy" forest ecosystem.

Many plants and animals live in mortal fear of green forests. Dead trees are essential habitat for many species of wildlife. Some 45% of birds use down wood or snags at some point in their lives. A recent study by Dick Hutto at the U of Montana found that many bird species occur at higher densities and numbers in severity burnt forests.

When snags fall into streams, they create essential aquatic habitat for insects and fish. Down wood hides small mammals and amphibians, is home to insects like native bees that are critical pollinators, and sustain nutrient and carbon storage. Removal of trees also can reduce hiding and thermal cover for elk. Logging disturbance contributes to the spread of weeds and loss of genetic diversity in forest stands

Logging roads, even "temporary" roads provide increased access for ORVs and dirt bikes, further decreasing wildlife security. And the FS does not "restore" road contours or road lens, which results in increased soil erosion, clogging streams with more sediment.

Logging destroys all of these critical attributes and much more hence impoverishes the forest.

Pyramid Lumber's Gordy Sanders believes the lawsuit is an examples of "how the courts are being used not to manage our forests." Apparently, Sanders thinks it's OK for the Forest Service to violate the law and ecological science if it sends more publicly subsidized logs to his mill.

Instead of hiding behind the false assertion that they are improving forest health, the agency would be far more honest if it merely said it was going to cut trees to appease uninformed politician demands, as well as subsidize local timber mill owner bank accounts. Of course, the public might not support logging forests to enrich timber mill owners and their shareholders, especially at the expense of the forest ecosystem.

George Wuerthner is an ecologist who has published numerous books on environmental issues including "Wildfire: A Century of Failed Forest Policy." He lives in Livingston.

https://www.lagrandeobserver.com/opinion/columns/my-voice-science-reducing-fuel-load-in-forests-has-little-effect-on-wildfires/article_fd326a58-e91f-11e9-9b4f-830ba164da63.html

My Voice: Science: Reducing fuel load in forests has little effect on wildfires

George Wuerthner of Bend
Oct 7, 2019

The Wallowa-Whitman National Forest is proposing to log the Lostine Wild and Scenic River corridor. The basic justification is to reduce the potential for large wildfires.

Yet according to the Oregon Department of Forestry, in 2019 only 16,868 acres burned in the state, compared to 846,411 acres burned last year. Why the big difference? Is there that much less fuel? If fuel is the reason we are seeing large acreages burn, then why so little this past year?

The obvious reason and what the research shows is that climate/weather is the dominant factor in all large wildfires. If you have drought, low humidity, high temperatures and high winds, you get large fires — regardless of the fuel load. That is why even though the Oregon Coast forests have some of the highest "fuel loadings" in the nation, they seldom burn.

Yet the Forest Service and its lackeys from the Oregon State Forestry School (which gets funding from the timber industry) continues to "sell" the myth that fuels are the problem and logging our forests is the solution.

The Forest Service continues to ignore the growing science that calls into question the efficiency and effectiveness of fuel reductions.

For instance, in a paper that looked at thinning and ponderosa pine forest, Rhodes and Baker found a very low probability of a thinned site encountering a fire during the narrow window when tree density is lowest.

Another review paper by fire specialists at the Missoula, Montana, Fire Lab about fuel reductions concluded: "The majority of acreage burned by wildfire in the U.S. occurs in very few wildfires under extreme conditions. Under these extreme conditions, suppression efforts are largely ineffective."

The authors go on to suggest: "Extreme environmental conditions ... overwhelmed most fuel treatment effects. This included almost all treatment methods including prescribed burning and thinning. Suppression efforts had little benefit from fuel modifications."

The Congressional Research Service found that: "From a quantitative perspective, the CRS study indicates a very weak relationship between acres logged and the extent and severity of forest fires. The data indicate that fewer acres burned in areas where logging activity was limited."

Another review paper published in 2017 found: "Managing forest fuels are often invoked in policy discussions as a means of minimizing the growing threat of wildfire to ecosystems and wildland-urban interface communities across the West. However, the effectiveness of this approach at broad scales is limited.... Regionally, the area treated has little relationship to trends in the area burned, which is influenced primarily by patterns of drought and warming."

Chat

Dr. Jack Cohen, who recently retired from the Forest Service Fire Lab in Missoula, Montana, has written extensively about fires and home protection and concluded that: "Wildland fuel reduction may be inefficient and ineffective for reducing home losses, for extensive wildland fuel reduction on public lands does not effectively reduce home ignitability on private lands."

In a 2018 letter to Congress, more than 200 scientists questioned the fuel reduction strategy. To quote from the scientists' letter: "Thinning is most often proposed to reduce fire risk and lower fire intensity.... However, as the climate changes, most of our fires will occur during extreme fire-weather — high winds and temperatures, low humidity, low vegetation moisture. These fires, like the ones burning in the West this summer, will affect large landscapes, regardless of thinning, and, in some cases, burn hundreds or thousands of acres in just a few days."

This is only a small sampling of the science that calls into question the effectiveness of fuel reductions.

Nevertheless, the Forest Service will degrade the forest and scenic corridor largely to provide fodder for the timber industry.

* include w/ [redacted] official comments

George Wuerthner

Chat

Bio Box

George Wuerthner, of Bend, is an ecologist and author. He has published 38 books on environmental and natural history subjects and has worked as a university instructor, Alaska wilderness guide and BLM botanist, and more recently as the Tompkins Conservation Ecological Projects director.

* include w/ [redacted] official comments

What is a healthy forest?

I just received a notice from the Custer Gallatin National Forest CGNF) that they plan to do a Fuels and Forest Health Project in Cooke City, Montana. The Forest Service says the project aims to mitigate wildland fire risks and enhance forest conditions surrounding Cooke City and Silver Gate, Montana. Among the usual claims, the project's primary objective is to reduce fuels and thus reduce wildfires by "fortifying forest resilience against insects and disease."

We continuously hear from the Forest Service and others that logging creates a healthy forest. The main parameters defining a "healthy" forest are low mortality from natural agents like drought, insects, and disease, high-severity blazes, and rapid tree growth.

Of course, foresters define what constitutes a healthy forest, and by happy coincidence, the Industrial Forest Industry supports all the above criteria.

Such a definition demonstrates that most foresters and agency personnel fail to see the forest through the trees. They want green trees that grow fast because that is what the timber industry demands. But that is not what constitutes a healthy forest ecosystem.

The distinction between a "healthy forest" and a healthy forest ecosystem lies in the realization that an ecosystem is more than just green trees. Tree mortality and occasional episodic forest death are crucial components.

Dead trees serve as homes, food, and shelter for a myriad of species, from bacteria and fungi to insects and amphibians, for birds, and even for the largest mammals like bears. This understanding not only enlightens us about the complexity of forest health but also empowers us with a more holistic perspective.

However, when loggers cut down trees it disrupts the forest's natural balance and significantly reduces carbon storage.

When they suggest that this is protecting the trees from fire or other calamities, they never count the trees they have killed by thinning as a loss. This should be a cause for concern, as it directly impacts on our fight against climate change.

Logging is not a benign activity. Logging often requires roads, a major vector for spreading exotic weeds like cheatgrass. Logging roads are a chronic source of sedimentation in streams. Logging activities can disturb sensitive wildlife, forcing them into other areas where they may not have good habitat. Logging roads provide access to the forest for hunters, recreationalists, and other humans that can further disrupt or disturb wildlife. Logging removes the physical biomass of tree boles, thus reducing the potential habitat for hundreds of species that may depend on dead wood or snags. Removing trees can even influence fisheries since logs falling into a stream provide a significant aquatic habitat for finny residents. But it can also impact more than fish and

*include w/ [redacted] official comments aquatic insects. Studies have shown that more logs in a stream provide more habitat for aquatic insects, providing greater insect activity in the air above streams that birds and bats exploit.

Logging removal of a significant portion of the trees may influence the forest's genetic adaptations by removing individual trees with specific alleles that may provide long-term survival to the forest stand.

For instance, some trees may have a greater resistance to some mortality factors like insects, drought, cold, wildfire, and disease. These adaptations may only manifest if the stand experiences one of these agents. Since one can't tell which trees have any particular genetic adaptation, logging may reduce the "resilience" of the forest.

Rajora et al. (2000) compared genetic diversity between pre-harvest pristine and post-harvest residual gene pools of two adjacent, old-growth stands of Eastern White Pine in Ontario. The conclusion was that logging reduced genetic diversity in the post-harvest residual gene pools of the two old-growth stands. Also, all of the genetic losses were low-frequency or rare alleles, which may compromise the integrity of locally adapted gene pools and the ability of Eastern White Pine to respond to changing environmental conditions.

Such losses are seldom considered those advocating logging to promote forest "resistance." Logging reduces the ability of a forest stand to survive.

Logging sanitizes a forest. Rather than creating a "healthy forest ecosystem," it creates a degraded one.

Bio: George Wuerthner is an ecologist who has published numerous books including Wildfire A Century of Failed Forest Policy

** include w/ [redacted] official comments

Sunday September 11, 2022 – Missoulian

GUEST VIEW

A bigger hammer won't stop large wildfires

In an Aug. 29 letter to Agriculture Secretary Tom Vilsack and Interior Secretary Deb Haaland, lawmakers — mostly from California — said they're worried about reports the Forest Service remains short-staffed on wildfire crews. They urged officials to attack fires rapidly. But unfortunately, these same politicians also support more logging of our forests to "reduce" fuels which they believe will stem fire spread.

GEORGE WUERTHNER

It is not surprising that many politicians still latch on to the idea that more firefighters and logging could modify the increase in wildfires around the West. There is a universal tendency to use a bigger hammer to pound a nail if a smaller one is failing. But sometimes, a bigger hammer isn't the right solution.

Yet over and over, lawmakers and others continue to believe that they can control wildfires by "reducing" fuels through logging or prescribed burning and ramping up firefighting.

What they are ignoring are the factors that drive large wildfires. For example, you cannot stop a blaze with extreme fire conditions of high temperatures, low humidity, severe drought, and especially high winds. Only 1-2% of all wildfires burn under these conditions, but they are the exact fires everyone is trying to control.

Instead of recognizing that a bigger hammer will not significantly influence wildfire behavior, we need to readjust our thinking and adopt a new paradigm. For example, maybe the old model of trying to control wildfires worked when climate warming was not a significant factor in wildfire ignitions and spread.

Given today's climate realities, the old way of doing things is like throwing dollar bills into the fire – it doesn't stop the blazes and, in many cases, actually increases the fire spread.

Science does not support the idea that logging the forest in the backcountry will save homes. On the contrary, opening the canopy through logging can increase fire spread by drying fuels and creating more wind penetration.

Attempting to halt or slow a wildfire under extreme weather conditions is like trying to stop a Category Five hurricane. You can't. All you can do is batten down the hatches and hope to survive the storm.

There is a universal tendency to use a bigger hammer to pound a nail if a smaller one is failing. But sometimes, a bigger hammer isn't the right solution.

Just because we cannot stop these extreme weather fires does not mean we must accept the loss of homes and people. Just as it's possible to construct houses to survive a major hurricane, It is possible to site and harden homes, so they have an excellent chance of surviving an extreme fire event.

This includes precluding home construction in fire-prone landscapes through zoning, just as we zone against home construction in flood areas along rivers.

Home hardening offers a partial solution for homes with built-in fire-vulnerable areas. If one modifies the home's flammability, it will likely survive a major wildfire. Studies have shown that reducing fuels no more than 100 feet from home can achieve remarkable results.

Modifying home construction materials is another way to reduce home losses. For example, home construction with steel instead of wood offers an alternative that is less likely to ignite.

The irony of the advocates of "log it" or lose it to a fire is that logging releases far more carbon into the atmosphere than a wildfire. Even the snags left after a high severity blaze store carbon for decades.

Rather than spending more significant amounts of tax dollars subsidizing the logging of our forests, we should be preserving all public forests as carbon reserves. With the money saved by forgoing logging, we could assist homeowners in retrofitting homes to withstand the inevitable fires.

Finally, the United States and the rest of the world must get serious about reducing carbon to slow and perhaps even reverse climate warming. No amount of money and resources will alter the current course of the planetary readjustment to growing drought and climate change unless carbon emissions are reduced.

George Wuerthner is an ecologist who has published several books on fire ecology issues.

GUEST VIEW

Real reform will clean up corruption

Ryan Zinke just announced that his first act in Congress would be a law he is calling the "FEAR Act," which

disincentivize good people from entering public service and will fire experts whose knowledge and talents are needed

Montana.

Zinke's FEAR Act would reverse all that. Make no mistake about it: Zinke is proposing to

he recommended reducing the Bears Ears Monument by 85% so that oil, gas, and coal drilling could occur on sacred and

EDITOR'S PICK

Wuerthner: Sprawling into disaster

George Wuerthner
Oct 4, 2023

One of the most significant factors in wildfire home losses is unrestricted development outside of communities. The attitude that it's my land, and I can do whatever I want with it dominates Western land use philosophy and policies.

Resistance to land use planning and zoning has complicated effective community protection.

Inappropriate development in the hinterlands, in turn, drives federal logging programs. Traditional fire risk reduction almost invariably relies upon fire suppression and hazardous fuel reduction (euphemism for logging) as the primary mechanisms for safeguarding communities.

The problem with logging as a community safety strategy is that one cannot predict where a fire may start, and wildfires seldom encounter most "fuel reductions" during the period when they might potentially slow a blaze. In some cases, logging even enhances fire spread by opening the forest to greater drying and wind penetration, which promotes fire spread.

Despite the huge investment of federal dollars in fuel reductions, wildfires continue to burn individual homes and even entire communities. The Camp Fire, which reduced to rubble 19,000 structures in Paradise, California, is a case in point.

The forestlands surrounding Paradise had been commercially logged, including "hazardous fuel reductions," which still failed to slow the Camp Fire propelled by hurricane-force winds. Most structures destroyed by wildfire result from embers lofted over logged areas, prescribed burns,

and other fuel reductions.
As Dr. Jack Cohen explains, wildfires and extreme fire conditions are inevitable, but losing homes to wildfire is not. Cohen's research suggests that fuel reductions of more than 100 feet from a house provide no additional benefit.

Nevertheless, Congress has embraced the logging juggernaut. The Infrastructure and Inflation Reduction bills devote substantial funding to prioritize logging as the dominant wildfire policy. Oregon Senator Jeff Merkley has gone further and introduced into Congress the "Wildfire Resilient Communities Act," which allots $30 billion to fuel reductions.

In the end, the public gets no benefit from logging projects but gets all the negatives, which include disruption of wildlife, spread of weeds, sedimentation into streams from logging roads, loss of biomass, reduction in carbon storage, and numerous other impacts, not to mention most Forest Service timber sales lose money.

One of the most cost-effective ways to reduce home losses is to limit house construction in what is known as the Wildlands Urban Interface (WUI). Houses built in low-density areas along the border of woodlands or even grasslands are difficult for firefighters to defend and are most vulnerable to human-ignitions which are the primary source of fire starts.

One study found that of the three major ways residential development occurs—infill, expansion, or leapfrog— Infill offered the best and most cost-effective means of reducing vulnerability to wildfires. Infill drives development towards vacant land within existing urban areas. Not only does this reduce the costs of providing services to scattered subdivisions and isolated homes, but infill lowers fire risk, particularly compared to "leapfrog development."

Researchers have concluded that "human-caused climate change caused over half of the documented increases in fuel aridity since the 1970s and doubled the cumulative forest fire area since 1984." We can expect climate change to increase wildfires. We cannot log out way out of this situation. Climate warming, particularly vapor deficit, rapidly dries vegetation, enhancing fire spread.

In essence, the Forest Service logging juggernaut is misguided at best and corrupt at worst.

The best way to safeguard communities isn't spending billions on logging. Instead, our best strategy is to emphasize land use planning, limit development in the WUI, and invest in home hardening of communities.

Bio George Wuerthner is an ecologist who has published numerous articles and several books on wildfire ecology.

The New York Times https://www.nytimes.com/2022/07/30/opinion/california-wildfires-oak-fire-yosemite-sequoias.html

GUEST ESSAY

The Case Against Commercial Logging in Wildfire-Prone Forests

July 30, 2022

By Chad Hanson and Michael Dorsey
Dr. Hanson is a research ecologist with the John Muir Project, a subsidiary of Earth Island Institute. Dr. Dorsey is the director and chair of the Rob and Melani Walton Sustainability Solutions Service at Arizona State University.

When the Oak fire swept through more than 10,000 acres southwest of Yosemite National Park last weekend, it burned through forests where widespread logging, including commercial thinning, accelerated in recent decades. Much of the forest canopy had been removed, exposing the remaining vegetation to more direct sunlight and creating hotter, drier and windier conditions that favor the spread of flames.

But when the blaze reached the area hit by the Ferguson fire of 2018, it slowed to burning about 1,000 acres a day. The previous fire had left less available kindling such as dry leaves, pine needles, twigs and saplings on the forest floor.

The public has fretted about the threat that the Oak fire, which has burned over 19,000 acres and is less than 50 percent contained, poses to the famed Mariposa giant sequoia grove in Yosemite. One of the logging industry's allies in Congress, Representative Scott Peters, Democrat of California, is trying to exploit the concern about giant sequoias, a species that depends on wildfires to effectively reproduce, to promote a series of sweeping commercial logging measures and environmental rollbacks under the guise of wildfire management.

The truth is that logging activities tend to increase, not decrease, extreme fires, by reducing the windbreak effect that denser forests have, for example, and by bringing in highly combustible invasive grasses that are spread by logging machinery.

Yet federal land agencies, like the U.S. Forest Service and National Park Service, are under significant political pressure to conduct commercial logging operations that benefit timber companies but tend to exacerbate overall fire severity. In December 2018, President Donald Trump issued an executive order directing the Forest Service and the Interior Department to prioritize and expand commercial logging operations on public lands, targeting mature and old trees and forests with chain saws and bulldozers.

Yosemite National Park subsequently began an unprecedented commercial logging program, with the park's superintendent, Cicely Muldoon, agreeing in August 2021 to initiate projects on over 2,000 acres of forest in the Yosemite Valley area under the auspices of thinning, with no prior public notice, comment opportunity or environmental analysis of impacts.

That meant that as visitors arrived in Yosemite National Park this spring, they were met with a jarring sight in a crown jewel of the nation's beloved national park system. Fully loaded logging trucks roared along the roads as commercial logging crews felled countless mature trees — some of them over five feet in diameter — and hauled them to lumber mills and power plants where they'd be burned in the Sierra Nevada foothills. That logging was then temporarily halted in early July by a lawsuit led by one of us and filed by the Earth Island Institute.

The effects were not limited to increasing the risk of more intense wildfires. Groups of giant dinosaurlike logging machines called feller-bunchers were also clear-cutting ecologically vital patches of forest, upon which many kinds of native wildlife, such as woodpeckers and bluebirds, depend for their survival.

Then, in June, a group of House Democrats and Republicans aligned with the logging industry and led by Representative Kevin McCarthy and several others introduced the deceptively named Save Our Sequoias Act. The act would curtail environmental laws, facilitate commercial logging of mature and old-growth trees and hasten postfire clear-cut logging in giant sequoia groves in Yosemite National Park, Sequoia and Kings Canyon National Park and national forests. In a letter dated June 17, over 80 environmental groups strongly opposed this destructive logging bill, for which its sponsors are trying to gather additional support in Congress.

Federal land agencies like the Forest Service and scientists funded by this agency have promoted logging for decades, dubbing it wildfire management or biomass thinning. The Forest Service is even in the commercial logging business, selling trees to private logging companies and keeping the revenue for its budget. In a case that involved Earth Island Institute, the U.S. Court of Appeals for the Ninth Circuit warned that the Forest Service has a "substantial financial interest" in logging, one that creates bias regarding wildfire science.

Trees cut down by the National Park Service in Yosemite Valley in 2021. David McNew/Getty Images

In fact, a large and growing body of scientific research and evidence shows that these logging practices are making things worse. Last fall over 200 scientists and ecologists, including us, warned the Biden administration and Congress that logging activities such as commercial thinning reduce the cooling shade of the forest canopy and change a forest's microclimate in ways that tend to increase wildfire intensity.

Logging emits three times as much carbon dioxide into the atmosphere per acre as wildfire alone. Most of the tree parts unusable for lumber — the branches, tops, bark and sawdust from milling — are burned for energy, sending large amounts of carbon into the atmosphere. In contrast, wildfire releases a surprisingly small amount of the carbon in trees, less than 2 percent. Logging in U.S. forests is now responsible for as much annual greenhouse gas emissions as burning coal.

Worryingly, the Biden administration announced in January a proposal to spend $50 billion of taxpayer money to log as much as 50 million acres of U.S. forests over the next decade, again using the wildfire management narrative as a justification. Under this plan, which congressional backers are attempting to enact in piecemeal fashion in different legislative packages — including a wildfire and drought package passed by the House on Friday and the new climate and tax deal in the Senate — most of the logging would occur on public forests, including national forests and national parks.

The president and Congress must instead increase forest protections from logging to reduce carbon emissions and allow intact forests to absorb more of the excess carbon dioxide in our atmosphere. A failure to do so will put countless species at risk, worsen global warming and increase threats of wildfire to vulnerable towns. Current logging subsidies should be redirected into programs to directly help communities become fire safe.

Such policies could have prevented the loss of over 100 homes in the Oak fire. After all, fires occur in forests, as they have done for millenniums. Assuming otherwise is like living at the coast and expecting no hurricanes. We need to help communities prepare.

Chad Hanson is the author of "Smokescreen: Debunking Wildfire Myths to Save Our Forests and Our Climate" and a research ecologist with the John Muir Project. Michael Dorsey is the director and chair of the Rob and Melani Walton Sustainability Solutions Service at Arizona State University.

The Times is committed to publishing a diversity of letters to the editor. We'd like to hear what you think about this or any of our articles. Here are some tips. And here's our email: letters@nytimes.com.

Follow The New York Times Opinion section on Facebook, Twitter (@NYTopinion) and Instagram.

GEOS INSTITUTE

September 24, 2019

Re: Oregon Governor's Wildfire Council: Feedback on September 12, 2019 Mitigation Committee Report

I am a conservation scientist with over 200 peer-reviewed publications including books on forest-fire ecology, climate change, and forest management globally and in Oregon. I also served on the Oregon Global Warming Commission Task Force on Carbon, and the Governor's Forest Carbon Stakeholder Group. I have reviewed the report from the mitigation subcommittee and I write to provide input and a summary of the scientific literature on wildfires in a changing climate to help with your deliberations.

* While people may feel that large fires are increasing in their lifetimes, across the West, there is still a fire deficit in terms of acres burning compared to the period from the early 1900s-1940s[1]. As large wildfires are mostly driven by climate (high temperatures, drought, wind), I urge caution in framing up 2017 and 2018 very active wildfire seasons as attributed mainly to a fuels build up. While the number of acres that have burned has been increasing since the 1980s, the size of large (>1,000 acres) high severity burn patches (a key indicator of "megafire" potential) has not gone up since 1991. The most extensive, peer-reviewed dataset ever analyzed on this subject confirms this finding[2]. Large burn patches are not homogenous tree-kill zones nor are they "unprecedented" instead they are complex and internally heterogenous, providing ample opportunity for seeds to recolonize severely burned areas.[2]

* Your draft reports do not confront the substantial damage that post-fire logging has done to sensitive burned ecosystems in Oregon. Logging and tree planting after fire damages fire-dependent ecosystems, degrades water quality, and increases fire risks. The scientific evidence is overwhelming that this activity – along with a dense road network - is very harmful to postfire ecosystems.[3] Hundreds of scientists have published papers, written books and gone on record of how postfire logging increases fire risks and can emit more carbon than forest fires.

* Active management (thinning/logging/road building) in the backcountry will not protect communities, stop fires in extreme conditions, or prevent smoke from affecting our communities. The summers of 2017 and 2018 were both very active fire seasons with Oregon in a region-wide drought. The summer of 2019 was much wetter with little fire activity or smoke. Recent fire seasons show that fire activity in our region and across the West is mainly regulated by top-down climate drivers and less so by "fuels[4]." As the climate changes and we experience more drought and extreme temperatures, we can expect more extreme fire weather that has and will continue to overtake our ability to suppress fire.[4]

---

[1] Littell, J.S. et al. 2009. Climate and wildfire area burned in western U.S. ecoprovinces 1916-2003. Ecol. Applic. 19:1003-1021. Also: Egan. T. 2009. The Big Burn. Mariner Books: Boston

[2]DellaSala, D.A. and C.T. Hanson. 2019. Are wildland fires increasing large patches of complex early seral forest habitat? Diversity 2019, 11, 157; doi:10.3390/d11090157

[3] D.B. Lindenmayer, P.J. Burton, and J.F. Franklin. 2008. Salvage logging and its ecological consequences. Island Press: Washington, DC

[4]Abatzoglou, J.T., and A.P. Williams. 2016. Impact of anthropogenic climate change on wildfire across western US forests. PNAS https://www.pnas.org/content/113/42/11770

* The landscape is so vast and efforts to obtain and spend hundreds of millions, if not billions, on thinning are not likely to be effective nor will they make us safer. This is because we don't know exactly where fire will occur, and thinned forests will just grow back. Simply put, we cannot log/manage or suppress our way out of wildfires. We can pursue durable solutions and learn to live with fire via home hardening (95-98% effective), smoke shelters (adaptation), and aid for low-income families[5]. In fact, in 2016, we published the most extensive dataset ever on whether forests with the most active management had the lowest fire severities vs. wilderness and roadless areas[6]. Our peer-reviewed research demonstrates that forests with the most logging burned in the highest severities likely due to extensive flammable tree plantations and logging slash. Oregon's weak logging laws are contributing to uncharacteristically severe fires while impacting water quantity, yet Oregonians would not know it from reading your draft reports.

* Insects and disease are not associated with higher fire risks. The use of risk assessment mapping in the report provides a false sense of comfort that will not make our communities safer or our forests more resilient. The overwhelming scientific evidence from multiple studies in the Pacific Northwest, Pacific Southwest, and Rockies shows that forests recently experiencing large insect outbreaks are actually less susceptible to subsequent fires because there is little fuel remaining in the canopy for fires to crown out.[7] The risk assessment models are, perhaps, better than those in the past, yet they are still coarse and do not reflect empirically based literature.

* The draft report from the Wildfire Council repeatedly refers to wildfires as "catastrophic" while also stating that Oregonians need to "live with wildfire" and understand its beneficial role. While there are certainly risks to people from wildfires, the vast majority of scientific studies shows that forests most often benefit ecologically from what are called mixed-severity fires.[8] These fires produce a patch-work mosaic of different burn intensities (low, moderate, high) and are excellent habitat for wildlife, rivaling the biodiversity of old-growth forests. Using "catastrophic" rhetoric to describe fire directly conflicts with your stated goal of helping Oregonians live with fire. Fires are not ecologically destructive, rather it is logging and suppression before, during, and after wildfires that has the biggest impact on water quantity, quality, wildlife and natural processes.

In closing, I am concerned that the committee is lacking a detailed life-cycle analysis of carbon leaving the forests from wildfires vs. logging. The Oregon Global Warming Commission's 2018 report to the legislature and published literature shows that even in very active wildfire seasons, wildfires average ~10% (some years as low as 3%) of the states' total greenhouse gas emissions compared to at least three times those levels from logging.[9] I urge the committee to work with the Oregon Global Warming Commission and call for an honest carbon accounting of all management activities. In the face of a warming climate, we need to update and modernize our practices to be climate and fire safe.

Sincerely,

Dominick A. DellaSala, Ph.D, Chief Scientist

[5] Moritz, M. et al. 2014. Learning to coexist with wildfire. Nature 515:58-66. Schoennagel, T. et al. 2017. Adapt to more wildfire in western North American forests as climate changes. PNAS www.pnas.org/cgi/doi/10.1073/pnas.1617464114
[6] Bradley, C.M., et al. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western United States? Ecosphere 7: Ecosphere 7:1-13. Also see Zald, H.S.J., and C. Dunn. 2018. Severe fire weather and intense forest management increase fire severity in a multi-ownership landscape. Ecol. Applic. 28:1068-1080.
[7] E.g., Hart, S.J. et al. 2015. Negative feedbacks on bark beetle outbreaks: widespread and severe spruce beetle infestation restricts subsequent infestation. PlosOne 10(5): e0127975. doi:10.1371/journal.pone.0127975. Meigs, G.W. et al. 2016. Do insect outbreaks reduce the severity of subsequent forest fires? Environ. Res. Letters 11 045008
[8] DellaSala, D.A., and C.T. Hanson. 2015. The ecological importance of mixed-severity fires: nature's phoenix. Elsevier: Boston.
[9] https://energyinfo.oregon.gov/blog/2018/12/13/oregon-global-warming-commission-publishes-biennial-report-to-the-legislature; Law, B.E. et al. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. PNAS www.pnas.org/cgi/doi/10.1073/pnas.1720064115

Working from the Home Outward:

Lessons from California for Federal Wildfire Policy

Compiled by Douglas Bevington, PhD
Forest Program Director, Environment Now

May 5, 2021

Environment Now®

Working from the Home Outward:
Lessons from California for Federal Wildfire Policy

Table of Contents

Photo credits

Cover photo of Paradise, CA after the Camp Fire by Trip Jennings

p. 7 figure 1a photo (Paradise, CA) by Trip Jennings

All other photos on pp. 7-8 by Jack Cohen

Executive Summary

- The dominant current approaches to wildfire policy promoted by the Forest Service— wildlands fire suppression and forest alteration through extensive tree-cutting—are failing to keep the public safe, with record losses of lives and homes during wildfires.
- In contrast, an approach of "working from the home outward," focusing on fire-safety home retrofits and the zone immediately around houses and communities, offers the most effective and cost-efficient tools for increasing public safety during wildfires.
- Most wildfire-related government funding subsidizes forest alteration and fire suppression rather than home-outward actions, even in "all of the above" approaches to fire policy. Less than 4% of California's 2021 fire-related budget is for "community hardening."
- A new task force is needed to answer this central question—Which actions will produce the greatest public safety benefits during wildfires in the most cost-efficient manner?
- This task force should include, but not be limited to: public safety experts, scientists not reliant on Forest Service funding, the insurance industry, fire managers outside of the Forest Service, indigenous representatives, and environmental groups currently challenging Forest Service fire-related projects.
- Mechanized wildfire suppression was developed during the cooler, wetter conditions in the 20th century. This approach is increasingly expensive and ineffective amid the hotter, drier conditions of the 21st century and wind-driven fires.
- Forest-altering approaches to fire policy are often based on erroneous claims that misconstrue the role of mixed-intensity wildfires in western forests.
- Tree-cutting results in significant carbon emissions, whereas wildfire is a comparatively small and short-term source of carbon emissions. Protecting forests from logging via "proforestation" can sequester five times as much carbon as tree-planting does.
- Fire policies that subsidize using trees and other forest material to fuel biomass power facilities are polluting (both for the climate and vulnerable communities), ineffective, and expensive.
- Fire policies for forest ecosystems often are not appropriate in chaparral ecosystems, which can lead to more flammable landscapes, destruction of critical habitat, and ineffective protection of nearby communities.
- While prescribed fire has a role in fire policy, the results of large-scale prescribed fire are likely to be disappointing. It can lead to ecological damage, as well as a ten-fold increase in the total amount of smoke. And prescribed fire is a relatively inefficient tool when compared to managed wildfire, cultural burning, and fire-safety home retrofits.

Video Summary

Some of the contributors to this report were interviewed for the upcoming fire documentary *Elemental*. For a short video featuring excerpts of these interviews, see: https://vimeo.com/543710055.

Introduction

A New Direction for Federal Wildfire Policy: Running Faster in the Wrong Direction is Not a Solution

by Douglas Bevington, PhD, Forest Program Director, Environment Now

In the wake of lives lost and communities burned, there is eagerness for more action on wildfire policy. However, *when you are running in the wrong direction, running faster is a problem, not a solution.* Yet, that is exactly what is occurring with wildfire policy in California and the West.

In the 20th century, the dominant approach to wildfire was suppression, attacking fire in remote wildlands. As discussed on pp. 9-10 of this report, *the mechanized approach to wildfire suppression that was developed in the wetter, cooler conditions of the 20th century is increasingly ineffective amid the hotter, drier conditions of the 21st century*, especially during wind-driven events such as the Camp Fire that devastated the community of Paradise in California. Yet, there is now record-level spending on outdated fire suppression approaches and 20th century technologies such as airtankers. The reality is that firefighting airplanes are not able to operate effectively in the windy conditions in which home loss is most likely to occur, and these aircraft were grounded while Paradise burned (see p. 10).

Likewise, in the past quarter century, every time there are wildfires, the Forest Service, the timber industry, and biomass power lobbyists have consistently pushed for more money to subsidize logging under benign-sounding euphemisms such "fuel reduction", "thinning", "restoration," and "forest management," and some well-intended people have joined this drumbeat. Yet, this forest-altering approach to fire policy is often based on outdated and erroneous claims about wildfire (see pp. 11-12). And, as more money has subsidized cutting trees under fire-safety justifications, we are seeing unprecedented loss of lives and homes.

The forest-altering approach has failed to keep the public safe. Instead, it mainly produces stumps, depleted budgets, and excuses. After each failure, logging proponents conveniently claim that things will be different if they get more money for more cutting. Yet, we now see the fires burning readily in places where they have already done lots of cutting. In fact, some of the fastest and most intense fire spread is occurring in these cut areas (see p. 12).

Beyond being ineffective and even counterproductive, the forest-altering approach puts more carbon into the atmosphere (see pp. 13-15) and more pollution in vulnerable communities (see p. 15). And perhaps biggest harm from *the forest-altering approach is that it diverts attention and resources away from real solutions, such as fire-safety home retrofits that genuinely protect communities during inevitable wildfires* (see pp. 7-8, p. 18) The La Tuna Fire in Los Angeles illustrated the effectiveness of home-safety approach when community-level fire-safety standards *enabled more than 99% of the houses in the path of a large wildfire to survive* amid triple-digit temperatures and high winds (Hanson 2018). In addition to being more effective, *home-safety actions can produce more jobs and better-paying jobs* than an equivalent amount of money spent subsidizing logging and other forest-altering activities (Niemi 2018).

"Working from the Home Outward" or the "All of the Above" Run-Around?

How can federal policymakers ensure that fire policies turn in a more productive direction and avoid repeating the mistakes of the past? This report builds on lessons identified in a 2019 report done in conjunction with the Leonardo DiCaprio Foundation, titled "A New Direction for California Wildfire Policy—Working from the Home Outward." That report brought together fire and forest carbon experts from partner organizations of the Environment Now foundation—which supports environmental protection in California-- to prepare concise synopses of key points that are often misunderstood or overlooked in fire policy discussions.

It also featured a piece by Dr. Jack Cohen, a retired US Forest Service scientist. Dr. Cohen has been a pioneer in the study of the importance of home features and the zone right around them for preventing home ignitions during wildfires. Despite the significant implications of Dr. Cohen's research, not nearly enough has been done to incorporate these findings into current fire policies. As one investigative report summarized, "*Cohen thought he had come up with a way to save houses and to let fires burn naturally* — he thought it was a win-win. And so in 1999, he presented a paper about his findings at a fire conference in front of people from the Forest Service and state fire agencies. These were people who were in a position to change policies. But Cohen says they were totally uninterested. Cohen's research implied that *basically everything about how the Forest Service dealt with wildfires was wrong*" (99PI 2018). Dr. Cohen's discoveries provide the cornerstone for a more effective new direction for wildfire policy—summarized as "*working from the home outward*"— in which the greatest public safety benefits come from prioritizing actions in or near homes and communities.

While the 2019 report was written for California's state-level policymakers, Environment Now's new report updates those findings with the goal of sharing lessons from California with federal policymakers. New content has also been added to address *two activities that have received increasing attention in the past two years, but that unfortunately are overstated in terms of their actual benefits— tree-planting (see p. 14) and prescribed fire* (see pp. 19-22).

Unfortunately, in California, we have not yet seen the needed change in direction from state leaders. While there have been a few steps to increase attention on home-safety retrofits, this has been buried within an approach described as "all of the above." *"All of the above" sounds commonsensical, but in practice it is an abrogation of leadership.* The reality is that some fire policy actions are significantly more effective at increasing public safety than others. We need to actively identify and prioritize funding the most effective solutions. Yet, in "all of the above," the well-established but failing approaches still tend to prevail in getting the biggest slices of the budgetary pie. When California's Governor announced his billion-dollar wildfire budget for 2021, *less than 4% of those funds were designated for "community hardening"* (LAO 2021). *Even though home retrofits offer some of the most effective tools for increasing public safety during wildfires, that approach is still getting the crumbs from the actual expenditures.* Meanwhile, state leaders continue putting more money into subsidizing tree-cutting, even when these projects cause ecological damage, put more carbon into the atmosphere, increase fire intensity, and divert resources away from home-safety actions (Hanson and Hansen 2019).

A Key Lesson for Federal Policymakers

One key reason that California state leaders have not pivoted to a more effective direction for wildfire policy is that they have continued to rely heavily on the state-level fire suppression agency (CalFire) and its allies to steer policy recommendations. Unfortunately, we are unlikely to see real change advanced by the same people who promoted the failing fire policies of recent decades. Likewise, *federal policymakers should not expect to find a substantively new approach to wildfire coming from the leaders of the US Forest Service and their allies* who are invested in the current approach focused on suppression and forest-alteration.

Real progress will come from recognizing that *fire policy is fundamentally a public safety issue*, and then seeking out public safety experts rather than relying mainly on "forest management" discussions in which home-safety actions keep getting relegated to the margins. This will likely require setting up a new task force to focus specifically on *this central question—Which actions will produce the greatest public safety benefits during wildfires in the most cost-efficient manner?* While many actions may claim to have some potential benefits under particular circumstances, it is important not to fall into the "all of the above" run-around. Instead, there must be a rigorous and transparent comparative assessment of the costs and benefits of different alternatives, so that resources can then be focused primarily on the most effective actions. To produce an accurate assessment, the following guidance is recommended:

- Public safety experts should be at the forefront. This includes fire marshals, experts in home design, and community planning experts.
- As the Forest Service exerts significant influence over its scientists (Hanson 2021a), it is prudent to ask scientists to be transparent about any Forest Service funding they receive and to actively seek scientists who are not reliant on Forest Service funding.
- The insurance industry has a direct financial stake in identifying which actions are really the most effective in preventing homes from burning.
- Seek alternatives to the Forest Service for information from fire managers, including Tribes with long traditions of working with fire, municipal fire departments on the frontlines of keeping communities safe, and wildland firefighter whistleblowers (see Firefighters United for Safety, Ethics, and Ecology). Likewise, the National Park Service has explored innovative fire management policies. Now, wildfires generally burn less intensely in national parks than national forests (Bradley et al. 2016). Meanwhile, the Forest Service spends more than five times as much on fire per acre burned than the Park Service and other agencies in the Dept. of Interior (Bevington 2018, Stahl 2018).
- There has been a tendency to elevate those environmental organizations that promote the Forest Service's approach to fire policy, which readily turns into an echo chamber. In contrast, environmental groups that are actively challenging Forest Service fire-related projects can provide due diligence in assessing Forest Service claims (Bevington 2018).

A More Effective Approach for Preventing Wildland-Urban Fire Disasters

By Jack Cohen, PhD, Research Physical Scientist, US Forest Service, retired

Summary

Communities exposed to inevitable extreme wildfire conditions do not have to incur inevitable disastrous fire destruction. Research shows that the characteristics of a home and its immediate surroundings within 100 feet (30 meters) principally determine home ignitions. This area, called the *home ignition zone* (HIZ), defines wildland-urban (WU) fires as a home ignition problem and not a problem of controlling wildfires. Communities can readily reduce home ignitability within the HIZ to prevent WU fire disasters instead of increasing wildfire suppression that fails during extreme wildfire conditions. Reducing the ignition conditions within the HIZ to produce ignition resistant homes provides an effective alternative for preventing WU fire disasters without necessarily controlling extreme wildfires.

Inevitable Wildfires and Extreme Burning Conditions

Wildfire occurrence is inevitable and thus, a small percentage of wildfires will inevitably attain uncontrollable extreme wildfire conditions. For over one-hundred years U.S. fire suppression has successfully controlled 95 to 98 percent of wildfires with initial attack (Stephens and Ruth 2005). However, there is no historical evidence or current fire management trend to suggest that all wildfires can be excluded and if not excluded, controlled with an initial suppression response. Thus, we can assume the inevitability of wildfires and the occurrence of extreme wildfire conditions (Williams 2013). Most wildfires controlled at initial attack occur during moderate to high wildfire conditions. During severe conditions of drought, high winds, low relative humidity and multiple ignitions, 2 – 5 percent of the wildfires producing rapid growth with high burning intensities escape initial attack suppression.

Figure 1.

Paradise, CA; 2018 Camp Fire

Southwest CO; 2002 Missionary Ridge Fire

S Cal; 2007 Grass Valley Fire

The primary federal, state and local approach for protecting structures from wildfires and preventing community fire disasters is wildfire control using suppression added by pre-suppression fuel breaks and shrub and forest fuel treatments (Finney and Cohen 2003, Cohen 2010). However, disastrous community wildfire destruction (greater than 100 homes destroyed) has only occurred during extreme wildfire conditions when high wind speeds, low relative humidity and continuous flammable vegetation result in rapid fire growth rates and numerous spot ignitions from showers of burning embers (firebrands); that is, the conditions when wildfire control fails (Cohen 2010, Calkin et al. 2014).

Community fire destruction during wildfires will continue as long as wildfire suppression continues to be the primary residential protection approach. The inevitability of uncontrolled extreme wildfires suggests inevitable disastrous home destruction; however, research on how homes ignite during extreme wildfires indicates practical opportunities for effectively creating ignition resistant homes and thereby preventing community fire disasters without necessarily controlling wildfires (Cohen 2000a, Cohen 2001, Cohen 2004, Cohen and Stratton 2008, Cohen 2010, Calkin et al. 2014, Cohen 2017). We can immediately see how homes were not ignited during a wildfire from the readily observable patterns of destruction.

Patterns of Home Destruction during Wildfires

Total home destruction surrounded by green tree canopies following the Camp Fire in Paradise, CA (Figure 1, top photo) has been reported as unusual; however, unconsumed vegetation adjacent to and surrounding total home destruction is the typical WU fire pattern associated with extreme wildfire conditions (Cohen 2000b, Cohen and Stratton 2003a, Cohen 2003b, Cohen and Stratton 2008, Graham et al. 2012, Cohen 2017). The center photo (Figure 1) shows an example of a burning home that could have only ignited from lofted burning embers (firebrands) on the home and low intensity surface fire spreading to contact the home. The three photos (Figure 1) of home destruction with adjacent unconsumed shrub and tree vegetation indicate the following:

- **High intensity wildfire did not continuously spread through the residential area as a wave or flood of flame.**
- **Unconsumed shrub and tree canopies adjacent to homes did not produce high intensity flames that ignited the homes; ignitions could only be from firebrands and low intensity surface fires.**
- **The 'big flames' of high intensity wildfires did not cause total home destruction.**

High intensity wildfires do not spread through residential areas such as Paradise. The continuous tree and shrub canopies required to maintain high intensity wildfire spread (crown fires) are broken by fuel gaps such as streets, driveways and home sites (Cohen 2010). Figure 2 shows how a crown fire spread to but could not continue beyond the first residential street. Although the crown fire terminated at the street, firebrands showered downwind into the residential area initiating fires resulting in several blocks of total home destruction (Cohen 2010). Extreme wildfire conditions initiate ignitions within residential areas but the residential fuels, structures and vegetation continue the residential burning resulting in total home destruction. Commonly, homes ignite and burn hours after the wildfire has ceased active burning near the community (Cohen and Stratton 2008; Cohen 2010).

Figure 2.

Figure 3.

Furthermore, the typical WU fire patterns indicate that conditions local to a home principally determine home ignitions with firebrands the principal source of ignitions within the residential area. The totally destroyed home in Figure 3 indicates firebrands as the only possible ignition source, potentially igniting the home directly and the flammable materials adjacent to the home. Firebrands are a given during extreme WU fire conditions; however, regardless of the distance firebrands were lofted, firebrand ignitions depend on the local conditions of the ignitable surfaces on or adjacent to a home.

An Effective Approach for Preventing WU Fire Disasters

Research (Cohen 2004) has quantified "local ignition conditions" to be an area of a home and its immediate surroundings within 100 feet (30 meters). This area is called the *home ignition zone* (HIZ) (Cohen 2010, NFPA 2018). The relatively small area of the HIZ principally determines home ignitions during extreme wildfires and defines WU fire destruction as a home ignition problem that can be prevented by readily addressing home ignition vulnerabilities within the HIZ without necessarily controlling wildfires. For example, an ignition resistant home does not have a flammable wood roof, flammable tree debris on the roof, in the rain gutters, on decks or on the ground within 5 feet (1.5 m) of flammable siding, no open firewood within 30 feet (9 m), or unscreened vents. Clearing the HIZ of vegetation is not necessary. As indicated by the typical patterns of WU fire destruction, shrub and tree canopies are not spreading high intensity fires through communities. The inevitability of uncontrolled extreme wildfires spreading to communities does not mean WU fire disasters are inevitable if we address the problem with the readily available approach of reducing home ignitability. Ignition resistant communities increase community fire protection effectiveness, life-safety options for residents and firefighters, and decrease wildfire suppression costs while preventing WU fire disasters without attempting to protect communities by controlling wildfires.

20th Century Fire Suppression Policy is Not Appropriate for a 21st Century Climate

by Timothy Ingalsbee, PhD, Executive Director, Firefighters United for Safety, Ethics, and Ecology

Up until the mid-20th century, we had a lot more fire on the land.
Hundreds of fire history studies document that wildland fires burned significantly more area than burns now. Even in the 20th century up until the 1950s, several tens of millions of millions of acres burned in the U.S. each year (NIFC n.d.).

Then we began mechanized firefighting in the 20th century.
Federal agencies such as the U.S. Forest Service (USFS) began fighting fires in 1905, but with minimal effectiveness due to the large expanse of undeveloped wildlands, the limited size of its workforce, and primitive technology. This changed in the post-World War II period with an influx of military surplus vehicles and equipment in fire suppression (Pyne 1982). Cutting firelines with bulldozers and airtankers dropping chemical retardants brought annual burned acreage crashing. In California alone there was a 36% decline in area burned from the 1940s to the 1950s, the start of a trend of rapidly declining acres burned that continued until the 1980s (CalFire n.d.). This created a historically unprecedented shortage of fire on the landscape that is still adversely affecting fire-adapted ecosystems across the West.

But the post-war surge of suppression success accompanied a change in climate.
At the same time that mechanized firefighting was pushing deeper into backcountry wildlands and containing nearly all wildfires at a small size, the climate had changed. A prolonged cool, wet period from a natural cycle of climate variability called the Pacific Decadal Oscillation (PDO) greatly aided firefighters' efforts in stopping wildfire spread (Littell et al. 2009, Peterson et al. 2011). This created an unprecedented shortage of fire on the landscape during the 1950s and 60s. During this post-war period with its anomalously and artificially low level of wildfire activity, people developed a distorted perception of wildfires as absolutely bad along with a false sense of security that firefighters could put them all out (Murphy et al. 2018).

21st century climate change is making wildfires start easier and spread faster.
At the end of the 20th century that cool, wet PDO cycle ended and was replaced with much warmer and drier conditions that are now being amplified by global warming from fossil-fuel emissions. Prolonged droughts punctuated by frequent severe fire weather conditions (high temperatures, high winds, and low relative humidity) are making vegetation ignite much easier and fires spread more rapidly. Beginning in the 1980s but accelerating after 2000, the signal of anthropogenic climate change is now registering in greatly increased wildfire activity that is leading to longer fire seasons and increased amount of acres burned. But even this recent increase in large fires masks the fact that there still much less fire on the land than is necessary for maintenance of fire-adapted forest ecosystems across many Western landscapes.

21st century climate is ending the efficacy of conventional firefighting.
Conventional firefighting tactics of dumping retardant, cutting firelines, and lighting backfires cannot stop wind-blown flames from jumping over firelines or firebrands lofting in the sky and landing on flammable rooftops miles away from a wildfire's flaming front. Now that 21st century anthropogenic global warming is causing severe fire weather conditions to become more frequent, the efficacy of conventional suppression is further declining. Conventional firefighting strategies and tactics are unable to either prevent or suppress large wildfires that are now being driven by climatic conditions that will be with us for the far foreseeable future.

Suppression spending is soaring.

In response to increasing wildfire activity, both federal and state agencies have been dramatically escalating their suppression spending in recent decades. There had never been a billion-dollar wildfire season before 2000, but now it is nearly an annual occurrence. The most recent 5-year average indicates that firefighting costs have risen to almost $2 billion per year (NIFC 2020). Forest Service tactics remain rooted in a suppression-based approach that is proving more and more expensive and less and less effective in a 21th century climate. In fact, the last four years have seen the highest suppression spending in the Forest Service's existence—accompanied by huge urban fire disasters and record numbers of homes destroyed.

Expanding the fleet of airtankers would be a poor investment of taxpayer dollars.

A signature example of a costly and increasingly ineffective 20th century approach to fire suppression is the emphasis on airtankers. Airtankers are one of the most expensive resources used in wildfire suppression, but several recent studies have found that airtankers are routinely deployed at times, places, and conditions where they are least useful or effective (Stonesifer et al. 2016, Stonesifer et al. 2015, Calkin et al. 2014, Thompson et al. 2012). They are particularly likely to be impaired by high winds associated with severe fire weather. In California, airtankers are required to be grounded when there is even moderate turbulence or windspeeds exceed 35 mph. Heavy smoke is another impediment to effective airtanker use. For example, while the Camp Fire raged through Paradise, a fleet of airtankers located next door in Chico was grounded by high winds and dense smoke.

Fighting fires in backcountry wildlands depletes resources needed to protect communities.

Systematic attempts to exclude or suppress all fires regardless of whether or not they are near communities is costly to taxpayers and puts communities at risk from lack of suppression crews and resources actually protecting homes. For example, in 2016 a joint USFS/CalFire effort spent over $262 million on the Soberanes Fire that burned mostly in the Ventana Wilderness Area and became the most expensive wildfire suppression operation in U.S. history (Ingalsbee et al. 2018). A USFS internal investigation (USDA-FS 2017) concluded that the excessive spending reflected "systemic fire management issues" revolving around lack of fiscal accountability that have yet to be solved. These large expenditures on fire suppression in remote areas pull limited resources away from the actions that are most effective at preventing home loss during fires.

Recommendations:

- *Wildland fires are ecologically necessary and inevitable, but losses of life and property in urban fire disasters need not be inevitable if we adopt new fire management policies and practices suitable for 21st century climate conditions. We need to move away from 20th century mechanized fire suppression strategies, tactics, and tools (e.g., large airtankers) that are inappropriate and increasingly ineffective in the current climate.*

- *Suppression resources should be redirected away from fighting fires in remote wildlands where fire is ecologically necessary and instead focused on directly protecting communities.*

- *Invest in preparing communities to live safely and sustainably in a fire-prone environment: retrofit homes to reduce home ignitability, improve emergency communications, maintain safe evacuation routes, construct community fire shelters, bury powerlines, and implement other infrastructure projects needed to create fire-compatible communities.*

Common Myths about Forests and Fire

by Chad Hanson, PhD, Ecologist and Director, John Muir Project

Do We Currently Have an Unnatural Excess of Fire in our Forests? No. There is a broad consensus among fire ecologists that we currently have far less fire in western US forests than we did historically, prior to fire suppression (dozens of studies discussed in Hanson et al. 2015). Even a very big fire year in modern times, such as the 4-million-acre 2020 fire season in California, would have been merely average historically (Stephens et al. 2007, Baker 2017). California's forests have always burned with a mixture of intensities, including patches of high-intensity fire. We have less fire of all intensities now, including less high-intensity fire (Stephens et al. 2007, Mallek et al. 2013, Baker et al. 2018).

Do Current Fires Burn Mostly at High-Intensity Due to Past Fire Suppression? No. Current fire is mostly low/moderate-intensity in western US forests, including the largest fires (Mallek et al. 2013, Baker et al. 2018). The most long-unburned forests experience mostly low/moderate-intensity fire (Odion and Hanson 2008, Miller et al. 2012, van Wagtendonk et al. 2012).

Do Large High-Intensity Fire Patches Destroy Wildlife Habitat or Prevent Forest Regeneration? No. Hundreds of peer-reviewed scientific studies find that patches of high-intensity fire create "snag forest habitat", which is comparable to old-growth forest in terms of native biodiversity and wildlife abundance (DellaSala and Hanson 2015). In fact, more plant, animal, and insect species in the forest are associated with this habitat type than any other (Swanson et al. 2014). Forests naturally regenerate in ecologically beneficial ways in large high-intensity fire patches (DellaSala and Hanson 2015, Hanson and Chi 2021).

Is Climate Change a Factor in Recent Large Fires? Yes. Human-caused climate change increases temperatures and can exacerbate drought, which influences wildland fire. Some mistakenly assume this means we must have too much fire but, due to fire suppression, we still have a substantial fire deficit in our forests. For example, historically, snag forest habitat, from high-intensity fire and patches of snag recruitment due to drought and native bark beetles, comprised 27% to 34% of the forests in the Sierra Nevada (Baker 2014, Baker et al. 2018). Currently, based on federal Forest Inventory and Analysis data, it comprises less than 8% of Sierra Nevada forests (Hanson and Chi 2020).

Are Forests Unnaturally Dense and "Overgrown", and Do Denser Forests Necessarily Burn More Intensely? No. Our forests actually have a carbon deficit, due to decades of logging. Historical forests were variable in density, with both open and very dense forests (Baker et al. 2018). Recent studies by U.S. Forest Service scientists omitted historical data on small tree density and density of non-conifer trees. When the missing historical data were included, it was revealed that historical tree density was 7 times higher than previously reported in ponderosa pine forests, and 17 times higher than previously reported in mixed-conifer forests (Baker et al. 2018). Wildfire is driven mostly by weather/climate (Bradley et al. 2016). Forest density is a "poor predictor" (Zald and Dunn 2018).

Are Recent Large Fires Unprecedented? No. Fires similar in size to the Rim fire and Creek fire, or larger, occurred prior to modern fire suppression (Bekker and Taylor 2010, Caprio 2016).

Do Occasional Cycles of Drought and Native Bark Beetles Make Forests "Unhealthy"? Actually, it's the opposite. During droughts, native bark beetles selectively kill the weakest and least climate-adapted trees, leaving the stronger and more climate-resilient trees to survive and reproduce (Six et al. 2018). In areas with many new snags from drought and native bark beetles, most bird and small mammal species *increase* in numbers in such areas because snags provide such excellent wildlife habitat (Stone 1995).

Do Forests with More Dead Trees Burn More Intensely? Small-scale studies are mixed within 1-2 years after trees die, i.e., the "red phase" (Bond et al. 2009, Stephens et al. 2018), but the largest analysis, spanning the entire western U.S., found no effect (Hart et al. 2015). Later, after needles and twigs fall and quickly decay into soil, and after many snags have fallen, such areas have similar or *lower* fire intensity (Hart et al. 2015, Meigs et al. 2016). In the 380,000-acre Creek fire of 2020 in the Sierra Nevada, unlogged forests with the highest densities of snags from the 2014-2017 drought had the lowest fire severity, while logged areas, where live and dead trees were removed under the guise of "fuel reduction", had high-severity levels that were 8 to 10 times higher (Hanson 2021b).

Does Reducing Environmental Protections, and Increasing Logging, Curb Forest Fires? No, based on the largest analysis ever conducted, this approach increases fire intensity (Bradley et al. 2016). Logging reduces the cooling shade of the forest canopy, creating hotter and drier conditions, leaves behind kindling-like "slash" debris, and spreads combustible invasive weeds like cheatgrass.

Do "Thinning" Logging Operations Stop Wildland Fires? No. "Thinning" is used as a euphemism for intensive commercial logging projects that kill and remove many of the trees in a stand, often including mature and old-growth trees. With fewer trees, winds, and fire, can spread faster through the forest. In fact, extensive research shows that commercial logging, conducted under the guise of "thinning", often makes wildland fires spread *faster*, and in most cases also *increases* fire intensity, in terms of the percentage of trees killed (Cruz et al. 2008, 2014).

Did the Rim Fire Emit Carbon Equal to Over 2 Million Cars? No. Unpublished reports from the Forest Service and the California Air Resources Board regarding wildfire carbon emissions are based on a flawed model (FOFEM) that has repeatedly been shown to exaggerate carbon emissions by nearly threefold (French et al. 2011). Further, the FOFEM model falsely assumes that no post-fire regrowth occurs to pull CO_2 out of the atmosphere. Field studies of large fires find usually only about 11% of forest carbon is consumed, and only 3% of the carbon in trees (Campbell et al. 2007), and vigorous post-fire forest regrowth absorbs huge amounts of CO_2 from the atmosphere, resulting in an overall *net decrease* in atmospheric carbon within a decade after fire (Meigs et al. 2009).[1]

Would Landscape-Scale Prescribed Burning Reduce Smoke? No, it's the opposite. Prescribed fires do not stop wildland fires when they occur. Though they can briefly alter fire intensity, prescribed-burn areas can burn again in a wildfire in less than a year (Stephens et al. 2009). High-intensity fire patches produce relatively lower particulate smoke emissions (due to high efficiency of flaming combustion in higher-intensity fire patches) while low-intensity prescribed fires produce high particulate smoke emissions, due to the inefficiency of smoldering combustion. Therefore, even though high-intensity fire patches consume about three times more biomass per acre than low-intensity fire (Campbell et al. 2007), low-intensity fires produce 3-4 times more particulate smoke than high-intensity fire, for an equal tonnage of biomass consumed (Ward and Hardy 1991, Reid et al. 2005). As a result, a landscape-level program of prescribed burning would cause at least a ten-fold increase in smoke emissions relative to current fire levels if, for example, prescribed fire was conducted every 10 years in any given area, as many land managers propose (Rhodes and Baker 2008).

[1] For example, Campbell et al. (2007) found that the Biscuit fire of 2002 emitted an average of 19 tons of carbon per hectare, and Campbell et al. (2016) found that decay of fire-killed trees in the Biscuit fire emitted an average of about 0.75 tons of carbon per hectare per year over the first 10 years post-fire (there were lower emissions from decay in subsequent decades). Therefore, for the first 10 years post-fire, the total carbon emissions from the Biscuit fire (carbon emissions from the fire itself, plus subsequent emissions from decay) were approximately 26 tons of carbon per hectare. Meigs et al. (2009) (Table 5) report that, by only five years after fire, regrowth was pulling 3.1 tons of carbon per hectare per year out of the atmosphere. Therefore, by 10 years post-fire, this equates to approximately 31 tons of carbon pulled out of the atmosphere by regrowth—i.e., an overall net increase in carbon of 5 tons per hectare relative to pre-fire levels.

California Forests, Wildfires, and Carbon

By Dominick DellaSala, PhD, Chief Scientist, Wild Heritage

California's older forests (e.g., Sillett et al. 2020) and large trees (e.g., Stephenson et al. 2014) are nature's unique climate solutions readily absorbing and storing massive amounts of carbon for centuries. Protecting the carbon stored in these and other native forests from logging is key to a climate-safe future for California. However, recent misinformed policies proposed by the State seek to elevate logging in response to wildfires, which runs counter to biodiversity conservation, climate mitigation, and may actually intensify wildfires (Bradley et al. 2016). These policies are sometimes portrayed as ways to sequester and store more carbon in forests and wood products. However, there is a better way to address pressing climate issues in California. In sum, this means protecting carbon stocks present in older forests and large trees and allowing young forests time to reach their full carbon potential (referred to as "proforestation," Moomaw et al. 2019).

Do forest fires emit massive amounts of carbon dioxide?
Most of the carbon in a forest remains on site after a wildfire (Campbell et al. 2007, Meigs et al. 2009, Mitchell 2015). Total annual emissions from wildfires over large regions are generally much less (~10% in active fire seasons) than total annual emissions from logging in the same region (Meigs et al. 2009, Campbell et al. 2012, Law et al. 2018, Oregon Global Warming Commission 2018). Some prior estimates of wildfire emissions have grossly exaggerated combustion of carbon during a wildfire. In reality, however; only a small portion of a trees' biomass (mainly twigs and leaves) is actually combusted. Moreover, about half the carbon in burned forests remains bound to the soils for nearly a century, the rest of the soil carbon builds over millennia (Singh et al. 2012). After fires, growth of surviving trees and new vegetation sequester carbon, offsetting emissions within about 5-50 years (depending on site factors; Meigs et al. 2009, Mitchell 2015).

Does logging store or release carbon?
Depending on logging intensity, forest type, and forest age class, over 80% of carbon stored in a forest is released to the atmosphere within 100 years of logging due to decomposition (or burning) with additional emissions released during transport and manufacturing of wood products especially over large hauling distances (Oregon Global Warming Commission 2018, Law et al. 2018, Hudiburg et al. 2019). A small portion of the carbon is temporarily embodied in wood product pools ranging from 1 year (paper) to decades (buildings) before decomposing and emitting CO_2 in landfills (Oregon Global Warming Commission 2018, Hudiburg et al. 2019). Instead, carbon stocks in forests can be doubled if forests are protected from logging on federal lands, timber harvest rotations extended from ~35 to 70 years on industrial lands, and other forestry improvements (Law et al. 2018). Avoiding emissions from forestry is recommended by the Intergovernmental Panel on Climate Change as an effective means for preventing warming in excess of 1.5° C globally. According to NASA's Earth Observatory (2017), California already is pushing temperature increases dangerously close to unsafe levels.

Does "thinning" reduce emissions from wildfires?

Studies of landscape-scale logging ("thinning") to reduce the probability of crown fires show that this practice will not reduce carbon emissions under current or future climate scenarios and may in fact make matters much worse especially if thinning residues are burned as biofuels (Meigs et al. 2009, Hudiburg et al. 2009, 2011, Campbell et al. 2012, Mitchell et al. 2012, Schulz et al. 2012, Law et al. 2013). This is because the amount of carbon removed by landscape-scale thinning and related activities (e.g., road building and maintenance) is larger than that potentially avoided from a fire. Importantly, fire only occurs on a fraction of the areas thinned (Rhodes and Baker 2009, Campbell et al. 2012, Schoennagel et al 2017).

What is the carbon potential from tree-planting compared to proforestation?

While some scientists (Bastin et al. 2019) estimate planting a trillion trees globally could sequester ~200 Gt C within 100 years, others (Veldman et al. 2019) have shown that the correct number is ~42Gt C. Thus, there are better ways to increase the carbon stored in forests. It is estimated that forests currently store only half their potential carbon capacity due to repeat short-interval logging (Erb et al. 2018). Thus, land managers could double the forest carbon stock over a century by simply allowing existing forests time to reach their full carbon potential. Protecting already forested areas so they can mature via proforestation would sequester 120 Gt C by century end, nearly five times that of planting trees (Moomaw et al. 2019). Thus, compared to the "trillion trees initiative," maintaining existing forests is a much more prudent strategy.

Conclusions

California's forests have always benefitted ecologically from periodic mixed-severity fires that create diverse wildlife habitat (DellaSala and Hanson 2015), stimulate plant growth and nutrient cycling, and carbon sequestration. Overall, they are not a major source of emissions currently as most of the carbon remains on site after natural disturbance and new vegetation restarts uptake. Much bigger emissions are produced by logging and other industrial sectors. Thus, policies that advocate for increased logging are inconsistent with California's otherwise ground-breaking climate change efforts, and the recommendations of the Intergovernmental Panel on Climate Change. Protecting forests from logging is a natural climate solution on par with global efforts to mitigate climate change impacts (Griscom et al. 2017). California has some of the most carbon dense forests on the planet and these forests should form the backbone of a comprehensive climate change strategy that includes avoiding emissions from all sectors especially forestry while preparing for unavoidable consequences of climate impacts.

Understanding Why Forest Biomass Energy is a Bad Idea is as Easy as P-I-E

by Shaye Wolf, PhD, and Brian Nowicki, Center for Biological Diversity

Understanding why incinerating forests to generate electricity is a bad idea is as easy as P-I-E.

Forest biomass power is:

- **Polluting**, emitting greenhouse gases, worsening the climate crisis, and harming vulnerable communities
- **Ineffective** for protecting communities during wildfires
- **Expensive** and dependent on subsidies that take resources away from truly clean energy alternatives

Fire policies in California rely heavily on efforts to increase logging to alter forest fire behavior paired with burning cut forest biomass for energy production. Biomass power is often portrayed as being carbon neutral, but it is not. Instead, biomass facilities increase greenhouse gas emissions; undermine the transition to clean, renewable power; pose public health threats in already disadvantaged communities; and distort policies for forest and fire management.

Biomass energy is more climate-polluting than coal.
Forest-sourced woody biomass energy generation emits about 50% more CO_2 per megawatt-hour of electricity produced than coal-fired power and three times the CO_2 of natural gas (Booth 2014). While the baseline emission rate for California's current electricity portfolio is about 485 lbs of CO_2e per MWh (CARB 2020), biomass can emit more than 3,000 lbs of CO_2 per MWh (Booth 2014, Center for Biological Diversity 2021), and smaller-scale facilities using gasification technology are similarly carbon-intensive (Ascent Environmental 2012).

Using forest biomass as a feedstock causes a significant negative impact to the climate.
In addition to smokestack emissions, an accurate accounting of the climate harms of biomass energy must include the carbon consequences of the tree removals that generate the feedstock. Thinning operations tend to remove about three times as much carbon from the forest as would be avoided in wildfire emissions (Campbell et al. 2011), and the removal of live trees from the forest results in a loss of future growth and carbon sequestration by those trees.

The climate damage of biomass energy can persist for decades to centuries.
Incinerating biomass for energy instantaneously releases stored carbon to the atmosphere, increasing greenhouse gas emissions and creating a "carbon debt." Numerous studies show that, even if forests cut for bioenergy are allowed to regrow, it can take several decades to more than a century, if ever, to capture the carbon that was released, and to discharge the "carbon debt." This is the case even where "waste" materials like timber residues and thinning debris are used for fuel (Searchinger et al. 2009, Manomet Center for Conservation Sciences 2010; Campbell et al. 2011, Hudiburg et al. 2011, Law and Harmon 2011, Holtsmark 2012, Mitchell et al. 2012, Schulze et al. 2012, Booth 2018, Sterman et al. 2018). Meanwhile, that carbon pollution worsens the climate crisis and contributes to the probability of passing climate tipping points, causing irreversible harms.

Biomass results in significant emissions of air pollutants, often in California's most polluted communities.

In addition to producing large amounts of CO_2, biomass generation can result in significant emissions of air pollutants that harm human health (Booth 2014). Biomass emissions can exceed those of coal-fired power plants even after application of best available control technology. Many of California's biomass power plants are concentrated in vulnerable communities in the Central Valley already suffering from high pollution burdens (Center for Biological Diversity 2021). For example, the Rio Bravo biomass plant in Fresno is located less than a half-mile from the Malaga Elementary School and surrounding homes in a majority Latinx neighborhood with the state's highest pollution burden score.

Logging for biomass energy Is ineffective for protecting communities during wildfires.

Biomass energy is often promoted as a tool to incentivize large-scale tree-cutting ("thinning") under the claim that this will protect communities and forests during wildfires. However, this approach is ineffective at protecting houses and communities, which is best achieved through a home-focused fire-safety strategy that helps communities safely coexist with inevitable wildfires. Although biomass energy is promoted as a means for disposing of debris piles from forest thinning projects, it is mostly lumber mill residues from commercial logging that end up being subsidized (CalRecycle 2018). Meanwhile, biomass extraction does significant ecological damage to forests.

Policies that subsidize forest biomass divert funds from zero-carbon sources like solar and wind and impede the transition to renewable energy.

Biomass power is the most expensive of California's common electricity sources. In 2018, the levelized cost of biomass power averaged $166 per megawatt hour compared to $49 for solar and $57 for wind (California Energy Commission 2019). Yet, California requires that electricity suppliers collectively purchase 175 MW of forest-sourced woody biomass power annually.

Conclusion: Forest biomass energy is an expensive and highly polluting

Instead of promoting biomass energy that harms our climate, communities, and forests, policymakers should:

- Stop mandating, subsidizing, or otherwise incentivizing biomass power production, and instead direct investments toward truly clean energy production such as solar and wind.

- Fully account for the smokestack emissions from biomass power plants and stop incorrectly treating biomass power as "carbon neutral."

- Create climate-smart wildfire and forest policy that invests in proven home and community-focused approaches to wildfire safety rather than forest-cutting, while increasing forest protections that keep carbon stored in forest ecosystems as an essential climate solution.

To learn more, see "Forest Biomass is a False Solution" (Center for Biological Diversity 2021): https://www.biologicaldiversity.org/campaigns/debunking_the_biomass_myth/pdfs/Forest-Bioenergy-Briefing-Book-March-2021.pdf

Forest Fire Policies are Being Misapplied to Chaparral Ecosystems

by Richard Halsey, Executive Director, California Chaparral Institute

Chaparral is California's most extensive plant community. It is found in every county in the state. Characterized by drought-hardy shrubs, a Mediterranean-type climate, and infrequent, high-intensity fire, chaparral provides the habitat richness responsible for making California one of the most biodiverse regions on earth (Halsey and Keeley 2016). The chaparral's relationship to fire is dramatically different from that of California's forests. *Actions that are often proposed for addressing fire in forest ecosystems are not appropriate in chaparral ecosystems and can lead to more flammable landscapes, destruction of critical habitat, and are an ineffective approach to protecting human communities built in these areas.*

High-intensity fire is required.
The natural fire regime for chaparral is characterized by large, high-intensity crown fires with a return interval of 30 – 150 years (Keeley and Fotheringham 2001, Lombardo et al. 2009, Safford et al. 2014). Research has demonstrated that the higher the intensity of the fire, the better the chaparral is able to recover (Keeley et al. 2005a). Therefore, concerns over reducing fire intensity and severity are irrelevant to chaparral ecosystems; there's no such thing as a low-intensity chaparral fire except at the edges of fire perimeters or when localized conditions (e.g. boulders, wind shifts, moisture) reduce fire intensity. By the very nature of the physical structure of shrubs, high intensity fire is an inherent part of chaparral fires.

Long fire return intervals are required, and too much fire causes loss of chaparral.
When compared to most forests, chaparral has comparatively long intervals between fires (30 – 150 years or more). Long fire return intervals are vital for the chaparral's ecological health. It can take up to thirty years for the native shrubs to build up enough seed in the soil to provide adequate germination rates post fire.

However, increases in fire frequency due to human-caused ignitions and the effects of climate change cause chaparral stands to become more open and are often invaded by nonnative grasses. Fire-return intervals fewer than 10 years have been shown to be highly detrimental to the persistence of chaparral species (Haidinger and Keeley 1993, Jacobsen et al. 2004). As grasses increase, the flammability of the chaparral ecosystem also increases. As a consequence, a positive feedback loop is created whereby more grass encourages frequent ignitions. Such frequent fires not only eliminate the native shrubs, but they facilitate the further spread of invasive weeds and grasses due to the fact that grass fires are less intense than shrubland fires. The type conversion process can ultimately lead to the complete replacement of native chaparral with nonnative grasses (Halsey and Syphard 2015).

Prescribed burns and vegetation clearing are destructive to chaparral and increase fire.
When fire management policies commonly used in forests—such as prescribed fire and vegetation clearing—are misapplied to chaparral, the results are destructive to the ecosystem and can actually increase fire. Since there is too much fire in chaparral plant communities due to human-caused ignitions, adding more through prescribed burns only increases the threat to the chaparral ecosystem's continued existence and conversion to invasive grasses that bring more frequent fires. Furthermore, prescribed burns are typically conducted in the late spring when the ecosystem is the most vulnerable to damage: the plants are growing, the soil is still moist, and many animal species are breeding. Therefore, prescribed burns can cause significant damage to plant growth tissues and destroy seeds in the soil due to soil moisture turning into steam, leading to chaparral type conversion.

Similarly, large-scale vegetation clearing projects ("fuelbreaks") also cause the loss of native chaparral and the spread of invasive grasses that leads to more frequent fires. Amid the increasing dangers to chaparral from the effects of climate change, it is imperative that land management agencies do not exacerbate the loss of chaparral through activities like prescribed burns and large-scale habitat clearance projects away from homes. Instead, fire management in chaparral should focus on reducing the unnaturally high level of fire ignitions that has accompanied human development in this ecosystem (Keeley et al. 2005b, Keeley 2006, Syphard et al. 2007).

Focus on homes and their immediate surroundings to make fire-safe communities.
While fire's role in chaparral is different from in forests, the most effective way to keep homes from igniting during wildfires is the same in chaparral areas as in forest areas— focus on fire-safety features for homes and the zone right around them, rather than large-scale vegetation alteration in wildlands.

In a comprehensive study of the 2007 Witch Creek Fire in San Diego County, researchers found, "Wind-blown embers, which can travel one mile or more, were the biggest threat to homes in the Witch Creek Wildfire. There were few, if any, reports of homes burned as a result of direct contact with flames" from wildland fuels (IBHS 2008).

In a study examining 700,000 addresses in the Santa Monica Mountains and part of San Diego County researchers mapped the structures that had burned in those areas between 2001 and 2010, a time of devastating wildfires in the region (Syphard et al. 2012). Buildings on steep slopes, in Santa Ana wind corridors and in low-density developments intermingled with wild lands were the most likely to have burned. Nearby vegetation was not a big factor in home destruction. Looking at vegetation growing within roughly half a mile of structures, the authors concluded that the exotic grasses that often sprout in areas cleared of native habitat like chaparral could be more of a fire hazard than the shrubs. "We ironically found that homes that were surrounded mostly by grass actually ended up burning more than homes with higher fuel volumes like shrubs," Syphard said.

Working only on defensible space is not sufficient. Many homes with adequate defensible space have still burned to the ground because embers have entered through attic vents, ignited flammable materials around the home (litter in the gutter, wood stacks, wood fencing), or found their way under roofing materials (Maranghides and Mell 2009). The solution is to reduce the flammability of the home as much as possible: install ember resistant vents, Class A roofing, exterior sprinklers operated by an independent system, and remove flammable materials 100 feet from around the structure.

Myths of Prescribed Fire: The Watering Can that Pretends to be a River

by Bryant Baker, M.S., Conservation Director, Los Padres ForestWatch
and Douglas Bevington, PhD, Forest Program Director, Environment Now

The use of prescribed fire—intentionally setting fires in forests and other ecosystems under planned circumstances—has received increased attention in California and elsewhere in recent years. On the one hand, it is good that there is growing recognition that fire is a natural and necessary part of forests and other ecosystems. On the other hand, current advocacy for large-scale prescribed fire across vast areas is often built on outdated assumptions and overstated claims, while downplaying problems stemming from how prescribed fire is actually being implemented. This factsheet identifies five key sets of myths regarding prescribed fire and shows how they can lead to misguided policies and missed opportunities to better accomplish public safety and ecological restoration goals in a more cost-effective manner. To create effective fire policies, we need to face these facts—*Prescribed fire increases fire and smoke. Prescribed fire is inefficient for public safety compared to home retrofits. Prescribed fire is inefficient for ecological restoration compared to managed wildfire. Prescribed fire can be harmful. And prescribed fire and cultural burning are not the same.*

Prescribed fire increases fire and smoke.
A central myth is that increasing prescribed fire will lead to less fire and smoke overall. Proponents of prescribed fire highlight examples where a portion of a wildfire halted when it encountered a previously burned area, but these anecdotes are the exception rather than the rule. The reality is that wildfires can burn through previously burned areas as soon as eight months after the prior fire (Stephens and Moghaddas 2005). Over 106,000 acres within the 2020 LNU Lightning Complex in California had burned within the previous five years, with 67,000 acres having burned just two years prior. As fire researchers have stated, *"fuel treatments are not intended to stop wildfires"* (Omi and Martinson 2004). Instead, the main goal of prescribed fire is to somewhat alter subsequent fire intensity in the affected area, though that may not occur under unfavorable weather conditions. In other words, *prescribed fire is additive to, rather than being a substitute for, wildfire.* Even in instances where prescribed fire has been found to limit wildfire extent, the acreage of a prescribed burn significantly exceeds the acreage of subsequent wildfire reduction, with 3-4 units of prescribed fire needed to reduce wildfire by one unit (Fernandes 2015). Furthermore, the effects of prescribed fire on wildfire behavior fades within a few years. Within as little as 2 or 3 years after prescribed fire, combustible understory vegetation can return to levels equal to or greater than levels prior to prescribed burning (Knapp et al. 2007). Thus, prescribed fires would need to be reapplied on a regular basis, repeatedly adding fire to many places that otherwise might not encounter a wildfire until many years in the future. For all these reasons, *increased use of prescribed fire will likely lead to a net increase in the total amount of fire* (Hunter and Robles 2020).

With that additional fire comes additional smoke. Proposals to implement *landscape-wide prescribed fire could result in ten times as much smoke* (Hanson 2021a; see also p. 12 in this report). In addition to increasing the total amount of smoke, *increasing prescribed fire also increases the duration of smoke* *exposure*. While wildfire smoke is concentrated in the height of fire season—and landscape-scale use of prescribed fire would not preclude this—prescribed fires are typically lit in the "shoulder seasons" when wildfires are less likely, and thus prescribed fires prolong smoke exposure into times when it would not otherwise occur. There can be circumstances where it is appropriate to use prescribed fire, but it should be done knowing that the effect will be an overall increase in the amount and duration of fire and smoke.

Prescribed fire is inefficient for public safety compared to home retrofits.
Prescribed fire is an inefficient and relatively ineffective way to protect homes and communities during wildfires. As Dr. David Lindemayer recently summarized, *"The peer-reviewed evidence is that burning forest miles from houses doesn't protect those houses"* (Foley 2021). As discussed above, prescribed fires generally do not stop subsequent wildfires, and altering fire intensity is largely irrelevant to community safety because home ignitions during wildfires are rarely caused by direct contact with high-intensity fire (Cohen and Stratton 2008, Syphard et al. 2017). Instead, home fire-safety retrofits ("home hardening") offer the most effective ways to keep communities safe during wildfire. Yet the resources to help communities with fire-safety retrofits are currently quite limited compared to the government funding for prescribed fire and associated "fuel treatments" in wildlands. For example, in California's 2021 proposed budget for wildfire preparedness, *less than 4% of the funding is directed to "community hardening"* (LAO 2021). While prescribed burning adjacent to communities can potentially have some benefits, proposals to use large-scale prescribed fire across vast landscapes away from communities represent a remarkably indirect and inefficient way to protect houses when compared with the direct benefits of home retrofits.

Prescribed fire is inefficient for ecological restoration compared to managed wildfire.
One positive outcome of the greater attention on prescribed fire is that it has contributed to growing recognition that fire is a necessary part of forests and other ecosystems, and that currently many forests have a shortage of fire compared to levels prior to modern fire suppression. Unfortunately, many advocates for prescribed fire rely on an *outdated "good fire/bad fire" dichotomy that is out of step with the science*. In this false dichotomy, prescribed fires are characterized as "good" because they are associated with low-intensity fire, whereas wildfires are characterized as "bad" because they are associated with mixed-intensity fire that includes some areas of high-intensity fire. However, there is a growing body of research showing that high-intensity fire has always been a part of forests and other ecosystems, and it produces ecological benefits by creating excellent wildlife habitat and stimulating nutrient cycling (DellaSala and Hanson 2015). In contrast, low-intensity fire associated with prescribed burning does not generate the habitat creation and the nutrient cycling associated with higher-intensity fire. *Each type of fire intensity has its role in a mixed-intensity fire regime, and low-intensity fire is not a substitute for the benefits from some higher-intensity effects in forests.*

Another myth repeated by some prescribed advocates is the erroneous notion that forests that previously experienced fire suppression will now "burn up" in all or mainly high-intensity fire when a wildfire occurs, unless those forests first get prescribed fire or other "fuel treatments." But multiple studies have shown that areas that experience wildfire following long periods of fire suppression still burn mainly at low and moderate intensity, along with some high-intensity patches that provide the benefits described above (Odion and Hanson 2008, Miller et al. 2012). In fact, research has found that forests with the longest fire exclusion actually burn at somewhat lower intensity (Odion et al. 2010). *This is exciting news for efforts at ecological restoration because it means that large-scale prescribed fire or other "treatments" are not needed as a precondition to allowing mixed-intensity wildfire back into forests.*

Instead, *managed wildfire offers a much more efficient way to restore fire to forests that currently have a shortage of fire*, and this has economic and practical benefits. Managed wildfire (also known as wildland fire use) differs from fire suppression in that, rather than trying only to extinguish a wildfire, fire managers seek to shepherd the fire away from communities and into wildland areas where the fire will provide ecological benefits. This is less intensive and costly than full suppression. Likewise, managed wildfire differs from prescribed fire because the latter has an extensive planning process and often quite restrictive parameters before a prescribed fire ignition can occur, whereas managed wildfire works with natural fire ignitions to provide more fire where it is needed in a more expeditious manner.

This is not to say that prescribed fire does not have a role in fire policy, but instead that role has been overstated. Prescribed fire is a useful tool when there are special circumstances where fine-scale control over fire is needed. In this regard, prescribed fire has a role equivalent to the role of watering can. A watering can is a good tool for tending the plants around your house, but *if you are faced with a dry field in need of irrigation, it would be absurd to propose buying thousands of watering cans. Yet this is basically equivalent to current proposals relying mainly on prescribed fire to restore fire to vast areas.* Instead, the right way to water a large field is through large-scale irrigation—a river, not a watering can—and the most efficient way to restore fire to large landscapes is through managed wildfire. Yet, despite its benefits, managed wildfire currently gets surprisingly little attention in current fire policy discussions, compared to prescribed fire.

Prescribed fire can be harmful.

Prescribed fire is sometimes called "good fire" by its proponents, but the reality is that, while it can be useful in some circumstances, *prescribed fire can also cause ecological damage*. One example is when prescribed fire policies get applied to non-forest ecosystems such as chaparral, Great Basin sagebrush, or pinyon-juniper woodlands. Research over the past few decades has established that these ecosystems naturally and historically burned infrequently, with several decades or even centuries between fires (Floyd et al. 2004, Baker 2006, Mensing 2006, Keeley and Zedler 2009, Baker and Halsey 2020). In these ecosystems, the use of prescribed fire can shorten fire-free intervals needed for slow-growing shrubs to re-establish, and such fire conducted outside of the natural fire season can inhibit seed germination for many species while favoring growth of non-native plants that can be more flammable (Parker 1987, Le Fer and Parker 2005, Baker 2006, Syphard et al. 2006).

Prescribed fire can also be harmful in forests, especially when done outside of the main fire season. Wildlife have evolved strategies to coexist with summer forest fires, but prescribed fires are often lit in the spring when bird eggs and nesting chicks cannot get away from fires (Hanson 2021a). There can also be significant ecological damage when logging ("thinning") is treated as a prerequisite for prescribed fire. On national forests, this means that Forest Service projects involving prescribed fire can also include substantial amounts of logging that damages wildlife habitat. Furthermore, logging results in cut vegetation debris that then gets piled up and burned. *The Forest Service is now calling this pile burning* *"prescribed fire,"* but it causes sustained burning in a concentrated location that can scorch and sterilize the soil, and it does not produce the beneficial post-fire wildlife habitat created during genuine forest fire restoration (Korb et al. 2004). *In light of these potential harms, projects involving prescribed fire should not be exempted from proper environmental review.*

Prescribed fire and cultural burning are not the same.

As attention on prescribed fire has grown in recent years, there has also been broader awareness that Native Americans have long traditions of applying fire to the land in practices known as cultural burning. Cultural burning was outlawed or severely restricted when federal and state policymakers imposed their wildfire suppression policies on Indigenous peoples. Now some Indigenous groups seek to restore their ability to do more cultural burning. Traditionally, burning has been done for a variety of purposes, including stimulating the growth of plants that are particularly useful to their communities, such as for basket-weaving or food production. In this regard, traditional cultural burning is notably different from current approaches to prescribed fire from the Forest Service and other agencies that primarily focus on trying to suppress forest fire intensity across vast areas. Yet, the Forest Service's approach to prescribed fire often gets conflated with traditional cultural burning in discussions of fire policy. This can result in cultural appropriation that superimposes Forest Service goals on Tribal practices. The evidence is clear that, prior to modern fire suppression policies, *Native American cultural burning and mixed-intensity forest fires were both much more common than they are now* (Odion et al. 2014, 2016, Vachula et al. 2019, Wahl et al. 2019). *They coexisted, and one did not preclude the other.* Both have been suppressed and marginalized by federal and state agencies.

Conclusion—The disappointing results of prescribed fire

When all is said and done, *the actual results from broad-scale application of prescribed fire would likely be disappointing for most people.* Those who thought it would reduce fire would instead experience more fire and smoke from large-scale prescribed burning. Those who are concerned about public safety would realize that communities would have been much safer if the money used to subsidize backcountry prescribed fires and associated "fuel treatments" had instead been focused on directly assisting with fire-safety home retrofits as part of a home-outward strategy. Those who want to help ecosystems would realize that managed wildfire offers a more efficient and practical way to restore fire to forests, whereas prescribed fire is often tied to increased logging. And those who want to support Tribes' cultural burning would find traditional practices getting appropriated by federal and state agencies. *While prescribed fire can have some benefits in special circumstances, it is important to not overstate the role of prescribed fire—a watering can should not pretend to be a river—or we risk missing more effective and cost-efficient solutions using managed wildfire, traditional cultural burning,* and *home fire-safety retrofits.*

References

99PI. 2018. Built to burn. July 13, 2018: https://99percentinvisible.org/episode/built-to-burn/

Baker BC, Halsey RW. 2020. Chaparral conservation. Reference Module in Earth Systems and Environmental Sciences, 1-12. https://doi.org/10.1016/B978-0-12-821139-7.00013-1

Baker, WL. 2010. Fire and restoration of sagebrush ecosystems. Wildl. Soc. Bull., 34(1): 177-185. https://doi.org/10.2193/0091-7648(2006)34[177:FAROSE]2.0.CO;2

Baker WL. 2014. Historical forest structure and fire in Sierran mixed-conifer forests reconstructed from General Land Office survey data. Ecosphere 5: Article 79.

Baker WL. 2017. Restoring and managing low-severity fire in dry-forest landscapes of the western USA. PLoS ONE 12: Article e0172288.

Baker WL, Hanson CT, Williams MA. 2018. Improving the use of early timber inventories in reconstructing historical dry forests and fire in the western United States: reply. Ecosphere 9: Article e02325.

Bastin JF, et al. 2019. The global tree restoration potential. Science 365:76-79. DOI: 10.1126/science.aax0848.

Bekker MF, Taylor AH. 2010. Fire disturbance, forest structure, and stand dynamics in montane forest of the southern Cascades, Thousand Lakes Wilderness, California, USA. Ecoscience 17: 59–72.

Bevington D. 2018. Lessons from groups that litigate logging. In S Wilent (ed.). 193 million acres: toward a healthier and more resilient US Forest Service. SAF, Bethesda, Maryland.

Bond ML, Lee DE, Bradley CM, Hanson CT. 2009. Influence of pre-fire mortality from insects and drought on burn severity in conifer forests of the San Bernardino Mountains, California. The Open Forest Science Journal 2: 41-47.

Booth MS, 2018. Not carbon neutral: assessing the net emissions impact of residues burned for bioenergy. 13 Environmental Research Letters 035001.

Bradley CM, Hanson CT, DellaSala DA. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? Ecosphere 7: article e01492.

California Department of Forestry and Fire Protection (CalFire). n.d. Historical wildfire activity statistics. http://www.fire.ca.gov/fire_protection/fire_protection_fire_info_redbooks

California Energy Commission. 2019. Staff Report, Estimated Cost of New Utility-Scale Generation in California: 2018 Update. https://ww2.energy.ca.gov/2019publications/CEC-200-2019-005/CEC-200-2019-005.pdf at B-12

Calkin DE, Cohen JD, Finney MA, Thompson MP. 2014. How risk management can prevent future wildfire disasters in the wildland-urban interface. Proceedings of the National Academy of Sciences 111(2):746-751.

Calkin DE, Stonesifer CS, Thompson MA, McHugh CW. 2014. Large airtanker use and outcomes in suppressing wildland fires in the United States. International Journal of Wildland Fire 23: 259–271.

CalRecycle. 2018. SB 498 Reporting, 2018 Biomass Conversion. https://www2.calrecycle.ca.gov/Docs/Web/116706

Campbell J, et al. 2007. Pyrogenic carbon emission from a large wildfire in Oregon, United States. Journal of Geophysical Research Biogeosciences 112: Article G040.

Campbell J, Donato DC, Azuma D, Law B. 2007. Pyrogenic carbon emission from a large wildfire in Oregon, United States. Journal of Geophysical Research Biogeosciences 112: Article G04014.

Campbell JL, Harmon ME, Mitchell SR. 2012. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? Frontiers in Ecology and Environment 10: 83-90.

Campbell J, Fontaine JB, Donato DC. 2016. Carbon emissions from decomposition of fire-killed trees following a large wildfire in Oregon, United States. Journal of Geophysical Research: Biogeosciences 121: 718-730.

Campbell J, Harmon ME, Mitchell SR. 2012. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? Frontiers in Ecology and Environment 10: 83- 90.

Caprio AC. 2016. A historical perspective on large fires in the southern Sierra Nevada: rare or everyday events? Proceedings of the Association for Fire Ecology, Annual Conference, November 2016, Tucson, Arizona.

CARB. 2020. California Greenhouse Gas Emissions for 2000 to 2018: Trends of Emissions and Other Indicators: https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2018/ghg_inventory_trends_00-18.pdf

Center for Biological Diversity. 2021. Forest biomass is a false solution. https://www.biologicaldiversity.org/campaigns/debunking_the_biomass_myth/pdfs/Forest-Bioenergy-Briefing-Book-March-2021.pdf

Cohen JD. 2000a. Preventing disaster, home ignitability in the wildland-urban interface. J Forestry 98(3):15– 21.Cohen JD. 2000b. A brief summary of my Los Alamos fire destruction examination. Wildfire 9(4):16-18.

Cohen JD. 2001. Wildland-urban fire—a different approach. Proceedings of the Firefighter Safety Summit, Nov. 6-8, 2001, Missoula, MT. Fairfax, VA: International Association of Wildland Fire.

Cohen JD. 2003. An examination of the Summerhaven, Arizona home destruction related to the local wildland fire behavior during the June 2003 Aspen Fire. Report to the Assistant Secretary of the US Department of Agriculture.

Cohen JD. 2004. Relating flame radiation to home ignition using modeling and experimental crown fires. Canadian J For Res 34:1616-1626. doi:10.1139/X04-049.

Cohen JD. 2010. The wildland-urban interface fire problem. Fremontia 38(2)/38(3):16-22.

Cohen JD. 2017. An examination of home destruction: Roaring Lion Fire. Report to the Montana Department of Natural Resources.

Cohen JD, Stratton RD. 2003. Home destruction. In RT Graham (ed). Hayman Fire Case Study. Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station, 396 p.

Cohen JD, Stratton RD. 2008. Home destruction examination Grass Valley Fire. USDA R5-TP-026b. https://www.fs.fed.us/rm/pubs_other/rmrs_2008_cohen_j001.pdf

Cruz MG, Alexander ME, Dam JE. 2014. Using modeled surface and crown fire behavior characteristics to evaluate fuel treatment effectiveness: a caution. Forest Science 60: 1000-1004.

Cruz MG, Alexander ME, Fernandes PAM. 2008. Development of a model system to predict wildfire behavior in pine plantations. Australian Forestry 71: 113-121.

DellaSala DA. 2020. Fire-mediated biological legacies in dry forested ecosystems of the Pacific Northwest, USA. Pp. 38-85. In EA Beaver, S Prange, DA DellaSala (eds). Disturbance Ecology and Biological Diversity. CRC Press Taylor and Francis Group, LLC: Boca Raton, FL.

DellaSala DA, Hanson CT (eds.). 2015. The ecological importance of mixed-severity fires: nature's phoenix. Elsevier Publications, Amsterdam, Netherlands.

Erb KH, et al. 2018. Unexpectedly large impact of forest management and grazing on global vegetation biomass. Nature 553:73–76. doi: 10.1038/nature25138.

Finney M, Cohen JD. 2003. Expectation and evaluation of fuel management objectives in Fire, fuel treatments, and ecological restoration. USDA Forest Service Proceedings, RMRS P-29. USDA Forest Service Rocky Mountain Research Station, Ft. Collins, CO, pp 353–366.

Floyd, ML, et al. 2004. Historical and recent fire regimes in Pinon-Juniper woodlands on Mesa Verde, Colorado, USA. Forest Ecol. Manag. 198: 269–289. https://doi:10.1016/j.foreco.2004.04.006

Foley M. 2021. Bushfire risks heat up, demanding new take on fuel load management. WAtoday. March 15, 2021. https://www.watoday.com.au/politics/federal/bushfire-risks-heat-up-demanding-new-take-on-fuel-load-management-20210312-p57abr.html

French NHF, et al. 2011. Model comparisons for estimating carbon emissions from North American wildland fire. Journal of Geophysical Research 116: Article G00K05.

Graham R, et al. 2012. Fourmile Canyon Fire findings. USDA Forest RMRS GTR-289. Griscom BW, et al. 2017. Natural climate solutions. PNAS 114:11645-11650.

Griscom BW, et al. 2017. Natural climate solutions. PNAS 114:11645-11650.

Gunn J, et al. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Manomet Center for Conservation Sciences.

Haidinger TL, Keeley JE. 1993. Role of high fire frequency in destruction of mixed chaparral. Madroño 40, 141–147.

Halsey RW, Keeley JE. 2016. Conservation issues: California chaparral. Reference Module in Earth Systems and Environmental Sciences. Elsevier Publications, Amsterdam, Netherlands.

Halsey RW, Syphard AD. 2015. High-severity fire in chaparral: cognitive dissonance in the shrublands. In DA DellaSala, CT Hanson (eds.) The Ecological Importance of Mixed-Severity Fires: Nature's Phoenix. Elsevier Publications, Amsterdam, Netherlands.

Hanson CT. 2018. Lessons from the La Tuna fire. Los Angeles Times. Aug. 10, 2018: http://www.latimes.com/opinion/op-ed/la-oe-hanson-latuna-fire-homes-20180810-story.html

Hanson CT. 2021a. Smokescreen: debunking wildfire myths to save our forests and our climate. University Press of Kentucky, Lexington, KY.

Hanson CT. 2021b. Is "fuel-reduction" logging justified as fire management in spotted owl and Pacific fisher habitat? In review.

Hanson CT, et al. 2015. Chapter 1: Setting the stage for mixed- and high-severity fire. In DA DellaSala, CT Hanson (eds.) The Ecological Importance of Mixed-Severity Fires: Nature's Phoenix. Elsevier Publications, Amsterdam, Netherlands.

Hanson CT and Hansen J. 2019. California's clear-cutting project in the Rim fire area is setting up the region for another tragedy. Los Angeles Times. Oct. 14, 2019: https://www.latimes.com/opinion/story/2019-10-14/newsom-clear-cutting-rim-fire-california

Hanson CT, Chi TY. 2020. Black-backed woodpecker nest density in the Sierra Nevada, California. Diversity 12: Article 364.

Hanson CT, Chi TY. 2021. Impacts of postfire management are unjustified in spotted owl habitat. Frontiers in Ecology and Evolution 9: Article 596282.

Harmon ME. 2019. Have product substitution carbon benefits been overestimated? A sensitivity analysis of key assumptions. Environmental Research Letters 14: https://iopscience.iop.org/article/10.1088/1748-9326/ab1e95

Hart SJ, Schoennagel T, Veblen TT, Chapman TB. 2015. Area burned in the western United States is unaffected by recent mountain pine beetle outbreaks. Proceedings of the National Academy of Sciences of the USA 112: 4375–4380.

Holtsmark B. 2012. The outcome is in the assumptions: Analyzing the effects on atmospheric CO_2 levels of increased use of bioenergy from forest biomass. 5 GCB Bioenergy 467.

Hudiburg T, et al. 2009. Carbon dynamics of Oregon and Northern California forests and potential land- based carbon storage. Ecol. Applic. 19:163-180.

Hudiburg T, et al. 2011. Regional CO2 implications of forest bioenergy production. Nature Climate Change 1:419-423.

Hudiburg TW, et al. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. Environ. Res. Lett. 14 (2019) 095005https://doi.org/10.1088/1748-9326/ab28bb.

IBHS. 2008. Mega Fires: The Case for Mitigation. The Witch Creek Wildfire, October 21-31, 2007. Institute for Business and Home Safety.

Ingalsbee T, Beasley M, Cowen M, Plummer D. 2018. The sky's the limit: the Soberanes fire suppression siege of 2016. http://www.fusee.org/wp-content/uploads/2018/12/Soberanes-Fire-Final-Report.pdf

Jacobsen AL, Davis SD. 2004. Fire frequency impacts non-sprouting chaparral shrubs in the Santa Monica Mountains of southern California. In M. Arianoutsou and V.P. Papanastasis (eds), Proceedings of the 10th MEDECOS Conference, Rhodes, Greece.

Keeley JE, Fotheringham CJ. 2001. Historic fire regime in Southern California shrublands. Conservation Biology 15:1536-1548.

Keeley JE. 2006. Fire management impacts on invasive plants in the western United States. Conservation Biology 20: 375-384.

Keeley JE, Pfaff AH, Safford HD. 2005. Fire suppression impacts on postfire recovery of Sierra Nevada chaparral shrublands. International Journal of Wildland Fire 14: 255-265.

Keeley JE, Keeley M, Fotheringham CJ. 2005. Alien plant dynamics following fire in Mediterranean- Climate California Shrublands. Ecological Applications 15: 2109-2125.

Keeley JE, Brennan T, Pfaff AH. 2008. Fire severity and ecosystem responses following crown fires in California shrublands. Ecological Applications 18: 1530-1546.

Keeley JE, Zedler PH. 2009. Large, high-intensity fire events in southern California shrublands: Debunking the fine-grain age patch model. Ecol. Appl. 19(1): 69–94. https://doi.org/10.1890/08-0281.1

Kerns BK, Day MA. 2017. The importance of disturbance by fire and other abiotic and biotic factors in driving cheatgrass invasion varies based on invasion stage. Biol. Invasions 19(6): 1853–1862. https://doi.org/10.1007/s10530-017-1395-3

Knapp EE, Schwilk DW, Kane JM, et al. 2007. Role of burning season on initial understory vegetation response to prescribed fire in a mixed conifer forest. Can J For Res 37: 11– 22.

Korb JE, Johnson NC, Covington WW. 2004. Slash pile burning effects on soil biotic and chemical properties and plant establishment: recommendations for amelioration. Restor. Ecol. 34(1): 177-185. https://doi.org/10.2193/0091-7648(2006)34[177:FAROSE]2.0.CO;2

LAO. 2021. The 2021-22 Budget: Wildfire Resilience Package. Feb. 5, 2021: https://lao.ca.gov/handouts/resources/2021/The-2021-22-Budget-Wildfire-Resilience-Package-020521.pdf

Law BE, Harmon ME. 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to climate change, 2 Carbon Management 73.

Law BE, et al. 2013. Thinning effects on forest productivity: consequences of preserving old forests and mitigating impacts of fire and drought. Plant Ecol. & Diversity 6:73-85.

Law BE, et al. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proceedings of the National Academy of Sciences of the United States of America 115: 3663-3668.

Le Fer D, Parker VT. 2005. The effect of seasonality of burn on seed germination in chaparral: the role of soil moisture. Madroño 52(3): 166–174. https://doi.org/10.3120/0024-9637(2005)52[166:TEOSOB]2.0.CO;2

Littell JS, McKenzie D, Peterson DL, Westerling AL. 2009. Climate and wildfire area burned in western

U.S. ecoprovinces, 1916-2003. Ecological Applications 19(4), 1003-1021.

Lombardo KJ, Swetnam TW, Baisan CH, Borchert MI. 2009. Using big cone Douglas-fir fire scars and tree rings to reconstruct interior chaparral fire history. Fire Ecology 5: 32-53.

Mallek C, Safford H, Viers J, Miller J. 2013. Modern departures in fire severity and area vary by forest type, Sierra Nevada and Southern Cascades, USA. Ecosphere 4: Article 153.

Maranghides A, Mell W. 2009. A case study of a community affected by the Witch and Guejito Fires. National Institute of Standards and Technology Technical Note 1635. US Department of Commerce.

McIntyre PJ, et al. 2015. Twentieth-century shifts in forest structure in California: Denser forests, smaller trees, and increased dominance of oaks. Proceedings of the National Academy of Sciences of the United States of America 112: 1458-1463.

Meigs GW, Donato DC, Campbell J, Martin J, Law BE. 2009. Forest fire impacts on carbon uptake, storage, and emission: The role of burn severity in the Eastern Cascades, Oregon. Ecosystems 12:1246–1267.

Meigs GW, Zald HSJ, Campbell JL, Keeton WS, Kennedy RE. 2016. Do insect outbreaks reduce the severity of subsequent forest fires? Environmental Research Letters 11: 045008.

Mensing S, Livingston S, and Barker P. 2006. Long-term fire history in Great Basin sagebrush reconstructed from macroscopic charcoal in spring sediments, Newark Valley, Nevada. West. N. Am. Nat. 66(1), 64–77. https://doi.org/10.3398/1527-0904(2006)66[64:LFHIGB]2.0.CO;2

Miller JD, Skinner CN, Safford HD, Knapp EE, Ramirez CM. 2012. Trends and causes of severity, size, and number of fires in northwestern California, USA. Ecological Applications 22: 184–203.

Mitchell SR. 2015. Carbon dynamics of mixed- and high-severity wildfires: pyrogenic CO2 emissions, postfire carbon balance, and succession. In D.A. DellaSala and C.T. Hanson (eds.) The Ecological Importance of Mixed-Severity Fires: Nature's Phoenix. Elsevier Publications, Amsterdam, Netherlands.

Mitchell SR, et al. 2012. Carbon debt and carbon sequestration parity in forest bioenergy production, 4 Global Change Biology Bioenergy 818.

Murphy BP, Yocom LL, Belmont P. 2018. Beyond the 1984 perspective: Narrow focus on modern wildfire trends underestimates future risks to water security. Earth's Future 6:1492-1497.

NASA Earth Observatory. 2017. California temperatures on the rise. https://earthobservatory.nasa.gov/ images/7596/ california-temperatures-on-the-rise

National Interagency Fire Center (NIFC). n.d. https://www.nifc.gov/fireInfo/fireInfo_stats_ totalFires.html

NIFC. 2020. Federal firefighting costs (suppression only). https://www.nifc.gov/sites/default/files/document-media/SuppCosts.pdf

NFPA. 2018. How to prepare your home for wildfires. National Fire Protection Association. Quincy, MA.

Niemi E. 2018. Potential Jobs and Wages from Investments in Defensible-Space Approaches to Wildfire Safety. Natural Resource Economics. https://nreconomics.com/reports/2018-04-28_EnvNow_Report.pdf

Odion DC, Hanson CT. 2008. Fire severity in the Sierra Nevada revisited: conclusions robust to further analysis. Ecosystems 11: 12-15.

Odion DC, Hanson CT, Arsenault A, Baker WL, DellaSala DA, et al. 2014. Examining historical and current mixed-severity fire regimes in ponderosa pine and mixed-conifer forests of western North America. PLoS ONE 9(2): e87852. doi:10.1371/journal.pone.0087852

Odion DC, Hanson CT, Baker WL, DellaSala DA, Williams MA. 2016. Areas of agreement and disagreement regarding ponderosa pine and mixed conifer forest fire regimes: a dialogue with Stevens et al.. PLoS ONE 11(5): e0154579. doi:10.1371/journal.pone.0154579

Oregon Global Warming Commission. 2018. Forest Carbon Accounting Project Report.

Parker VT. 1987. Effects of wet-season management burns on chaparral vegetation: implications for rare species. In TS Elias (ed.). Conservation and management of rare and endangered plants: proceedings of a California conference on the conservation and management of rare and endangered plants, 233–237. California Native Plant Society, Sacramento, CA.

Parks SA, et al. 2015. Wildland fire deficit and surplus in the western United States, 1984–2012. Ecosphere 6: Article 275.

Peterson DL, et al. 2011. Responding to climate change in national forests: a guidebook for developing adaptation options. USDA-Forest Service Pacific Northwest Research Station. PNW-GTR-855.

Pyne S. 1982. Fire in America: A cultural history of wildland and rural fire. Univ. of Washington Press.

Reid JS, Koppmann R, Eck TF, Eleuterio DP. 2005. A review of biomass burning emissions part II: intensive physical properties of biomass burning particles. Atmospheric Chemistry and Physics 5: 799-825.

Rhodes JJ, Baker WL. 2008. Fire probability, fuel treatment effectiveness and ecological tradeoffs in western U.S. public forests. The Open Forest Science Journal 1: 1-7.

Safford HD. 2013. Natural Range of Variation (NRV) for yellow pine and mixed conifer forests in the bioregional assessment area, including the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests. Unpublished report. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.

Safford HD, Van de Water KM. 2014. Using Fire Return Interval Departure (FRID) Analysis to Map Spatial and Temporal Changes in Fire Frequency on National Forest Lands in California. USDA. PSW-RP-266.

Schulze ED, et al. 2012. Large-scale bioenergy from additional harvest of forest biomass is neither sustainable nor greenhouse gas neutral. Global Change Biology Bioenergy 4: 611-616.

Schoennagel T, et al. 2017. Adapt to more wildfire in western North American forests as climate changes. PNAS 114 (18) 4582-4590.

Searchinger TD, et al. 2009. Fixing a critical climate accounting error, 326 Science 527.

Show SB, Kotok EI. 1925. Fire and the forest (California pine region). Circular 358, United States Department of Agriculture Department Washington, DC.

Sillett SC, et al. 2020. Aboveground biomass dynamics and growth efficiency of Sequoia sempervirens forests. Forest Ecology and Management 458 https://www.sciencedirect.com/science/article/pii/S0378112719319449

Singh NS, et al. 2012. Fire-derived organic carbon in soil turns over on a century scale. Biogeosciences 9:2847-2857.

Six DL, Vergobbi C, Cutter M. 2018. Are survivors different? Genetic-based selection of trees by mountain pine beetle during a climate-change driven outbreak in a high-elevation pine forest. Frontiers in Plant Science 9: Article 993.

Stahl A. 2018. From timber service to fire service: the evolution of a land management agency. In S Wilent (ed). 193 million acres: toward a healthier and more resilient US Forest Service. SAF, Bethesda, Maryland.

Sterman JD, et al. 2018. Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy. 13 Environmental Research Letters 015007.

Stephens SL, Ruth LW. 2005. Federal forest-fire policy in the United States. Ecological Applications 15(2):532–542.

Stephens SL, et al. 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications 19: 305-320.

Stephens SL, et al. 2018. Drought, tree mortality, and wildfire in forests adapted to frequent fire. BioScience 68: 77-88.

Stephens SL, Martin RE, Clinton NE. 2007. Prehistoric fire area and emissions from California's forests, shrublands, and grasslands. Forest Ecology and Management 251: 205–216.

Stephenson NL, et al. 2014. Rate of tree carbon accumulation increases continuously with tree size. Nature 507, 90–93. doi: 10.1038/nature12914.

Stewart OC. 2002. Forgotten Fires: Native Americans and the Transient Wilderness. Univ Oklahoma Press, Norman, OK.

Stone WE. 1995. The impact of a mountain pine beetle epidemic on wildlife habitat and communities in post-epidemic stands of a lodgepole pine forest in northern Utah. Doctoral Dissertation, Utah State University.

Stonesifer CS, Calkin DE, Thompson MP, Stockmann KD. 2016. Fighting fire in the heat of the day: an analysis of operational and environmental conditions of use for large airtankers in United States fire suppression. International Journal of Wildland Fire 25: 520–533.

Stonesifer CS, Thompson MP, Calkin DE, McHugh CW. 2015. Characterizing large airtanker use in United States fire management. USDA-Forest Service Proceedings RMRS-P-73.

Sugihara NG, van Wagtendonk JW, Shaffer KE, Fites-Kaufman J, Thode AE. 2006. Fire in California's ecosystems. Univ. of Berkeley Press.

Swanson ME, Studevant NM, Campbell JL, Donato DC. 2014. Biological associates of early-seral pre- forest in the Pacific Northwest. Forest Ecology and Management 324: 160-171.

Syphard AD, Franklin J, Keeley JE. 2006. Simulating the effects of frequent fire on Southern California coastal shrublands. Ecol. Appl. 16(5): 1744–1756. http://www.jstor.org/stable/40061747

Syphard AD, et al. 2007. Human influence on California fire regimes. Ecological Applications 17: 1388– 1402. doi:10.1890/06-1128.1

Syphard AD, Keeley JE, Bar Massada A, Brennan TJ, Radeloff VC. 2012. Housing arrangement and location determine the likelihood of housing loss due to wildfire. PLoS ONE 7(3): e33954. doi: 10.1371/ journal.pone.0033954

Syphard AD, Brennan TJ, Keeley JE. 2017. The importance of building construction materials relative to other factors affecting structure survival during wildfire. International Journal of Disaster Risk Reduction 21: 140–147.

Thompson MP, Calkin DE, Herynk J, McHugh CW, Short KC. 2012. Airtankers and wildfire management in the US Forest Service: examining data availability and exploring usage and cost trends. International Journal of Wildland Fire.

USDA-Forest Service, Washington Office. 2017. Soberanes Fire Review. May 5.

Vachula RS, Russell JM, Huang Y. 2019. Climate exceeded human management as the dominant control of fire at the regional scale in California's Sierra Nevada. Environ. Res. Lett. 14: https://doi.org/10.1088/1748-9326/ab4669

Veldman JW, et al. 2019. Comment on "the global tree restoration potential." Science 366 (6463) DOI:10.1126/science.aay7976.

Wahl ER, Zorita E, Trouet V, Taylor AH. 2019. Jet stream dynamics, hydroclimate, and fire in

California from 1600 CE to present. Proc. Natl. Acad. Sci. 116: 5393-5398.

van Wagtendonk JW, van Wagtendonk KA, Thode AE. 2012. Factors associated with the severity of intersecting fires in Yosemite National Park, California, USA. Fire Ecology 8: 11–32.

Williams J. 2013. Exploring the onset of high-impact mega-fires through a forest land management prism. Forest Ecology and Management 294:4-10.

Zald HSJ, Dunn CJ. 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications 28: 1068-1080.

Environment **Now**®

Action. Results. Change.

www.environmentnow.org

Open Letter to President Biden and Members of Congress from Scientists: It is essential to Remove Climate-Harming Logging and Fossil Fuel Provisions from Reconciliation and Infrastructure Bills

November 4, 2021

Dear President Biden and Members of Congress,

As scientists with expertise in ecology, forest management, biodiversity, and climate change, we are writing to urge you to remove from the Budget Reconciliation and Infrastructure provisions that promote logging and fossil fuels because such measures will only make worse the global climate and biodiversity crises. As an initial matter, we note that, even under optimistic expert estimates, the clean energy provisions in these bills are insufficiently bold and would, by themselves, only achieve a fraction of what we would need to reach the Administration's minimum climate crisis mitigation target of a 50% reduction in annual U.S. greenhouse gas emissions from 2005 levels by 2030.[1] Making matters worse, the bills contain numerous logging provisions that would dramatically increase annual carbon emissions from logging for lumber, forest biomass energy, and wood pellets on public and private forestlands nationwide, which would undermine natural climate solutions and our forests' carbon storage and sink capacities. The Reconciliation Bill is in jeopardy unless the cost can be reduced. Removing these compromising logging provisions and the subsidies for logging, bioenergy and fossil fuels would help accomplish that goal.

As hundreds of climate and forest scientists warned Congress last year, logging in U.S. forests emits 723 million tons of uncounted CO_2 into our atmosphere each year—more than 10 times the amount emitted by wildfires and tree mortality from insects combined.[2] Greenhouse gas emissions from logging in U.S. forests are now comparable to the annual CO_2 emissions from U.S. coal burning, and annual emissions from the building sector.[3] Most of the carbon in trees removed from forests through logging is emitted almost immediately, as branches and tree tops are burned at biomass energy facilities, and mill residues are burned at the sawmills, typically for energy production[4]—emitting more CO_2 than burning coal, for equal energy produced.[5] Logging conducted as commercial "thinning," under the rubric of fire management, emits about three times more CO_2 than wildfire alone.[6]

The Reconciliation Bill currently contains $14 billion in new subsidies for logging on federal public lands—more than double existing levels—as well as billions in new logging subsidies on private forestlands. The Reconciliation Bill further proposes nearly $1 billion in new subsidies for forest biomass energy, wood pellet facilities, and mass timber (cross-laminated timber) under the heading of "wood innovation." This ignores the advice of hundreds of climate and forest scientists who have previously informed Congress that these industries substantially increase emissions and worsen the climate crisis.[7]

The Infrastructure Bill includes a legislative mandate for 30 million acres of additional logging on federal public lands over the next 15 years, in addition to misdirecting billions of dollars in new subsidies for the fossil fuel industry and an exemption from environmental analysis for new oil and gas pipelines across federal lands. It also includes provisions that would roll back the National Environmental Policy Act by creating new "categorical exclusion" exemptions from environmental analysis and disclosure of adverse impacts of this logging on our climate and forest biodiversity, while eliminating the public's right to file administrative objections on logging proposals. Further, the Infrastructure bill includes $400 million for destructive post-fire clearcutting on public lands, and $400 million in new subsidies for forest biomass and wood pellet facilities, which not only harm our climate and forest ecosystems but also disproportionately adversely affect communities of color with increased particulate and toxic pollution.[8] In addition, there are $18 billion in new subsidies in the bill for the forest biomass/pellet and fossil fuel industries to promote carbon capture and storage (CCS) and biomass energy with carbon capture and storage (BECCS), and construction of a massive network of CO_2 pipelines. Hundreds of climate scientists, and conservation and environmental justice organizations, have decried this as a false climate solution that can actually increase net carbon emissions and energy consumption while increasing pollution in communities of color.[9]

In both bills, logging provisions are promoted as wildfire management and climate solutions measures, but commercial logging conducted under the guise of "thinning" and "fuel reduction" typically removes mature, fire-resistant trees that are needed for forest resilience. We have watched as one large wildfire after another has swept through tens of thousands of acres where commercial thinning had previously occurred due to extreme fire weather driven by climate change. Removing trees can alter a forest's microclimate, and can often increase fire intensity.[10] In contrast, forests protected from logging, and those with high carbon biomass and carbon storage, more often burn at equal or lower intensities when fires do occur.[11]

We urge Congress to move in the opposite direction by shifting from more logging toward natural climate solutions that store carbon in mature and older forests and allow naturally regenerating forests to continue growing for greater carbon accumulation. For example, protecting U.S. federal public forestlands from logging would not only reduce direct carbon emissions but would also increase annual drawdown of atmospheric CO_2 by 84 million tons per year.[12] We do not wish to follow our Canadian neighbors where some of their managed forests have become a source of emissions because they followed many of the proposed policies in these Bills. There is a path toward meeting the vital 2030 climate crisis mitigation goals, but not with the Reconciliation and Infrastructure Bills as currently written.

We need the Administration and Congress to enact policies that will substantially *reduce* annual greenhouse gas emissions from logging, and from fossil fuels, and increase accumulation of carbon in our forests. The recent IPCC AR6 report released in August makes clear the urgent need to reduce emissions by at least half by 2030 to avoid large increases of devastating heat domes, prolonged droughts, wildfires that can impact communities, intense precipitation events, and catastrophic storms. The logging and fossil fuel subsidies and policies in the Reconciliation and Infrastructure Bills will only intensify the rate and intensity of our changing climate.

Lead Signatories

** Affiliations listed for identification purposes only*

William R. Moomaw, Ph.D.
Emeritus Professor

The Fletcher School Co-director Global Development and Environment Institute Tufts University
Medford, MA, USA

Chad T. Hanson, Ph.D., Forest Ecologist
Earth Island Institute
Berkeley, CA, USA

Dominick A. DellaSala, Ph.D., Chief Scientist
Wild Heritage, a project of the Earth Island Institute
Talent, OR, USA

James E. Hansen, Ph.D.
Director, Program in Climate Science, Awareness and Solutions
Earth Institute, Columbia University
New York, NY

Pushker A. Kharecha, Ph.D.
Climate Scientist and Deputy Director
Climate Science, Awareness, and Solutions Program
Columbia University Earth Institute, New York, NY

Beverly Law, Ph.D., Professor Emeritus, Global Change Bio. and Terrestrial Systems Science
Department of Forest Ecosystems & Society Oregon State University
Corvallis, OR

William Ripple, Ph.D.
Distinguished Professor of Ecology
Oregon State University, Corvallis, OR

Peter H. Raven, Ph.D.
President Emeritus, Missouri Botanical Garden George Engelmann Professor of Botany Emeritus, Washington University in St. Louis
St. Louis, MO

Thomas Lovejoy, Ph.D.
Professor, Environmental Science and Policy George Mason University
Fairfax City, VA
Senior Fellow, United Nations Foundation

William H. Schlesinger, Ph.D.
James B. Duke Professor of Biogeochemistry Dean (Em.) the School of the Env., Duke Univ. President (Em.), the Cary Inst. of Eco. Studies
Millbrook, NY

William L. Baker, Ph.D.

Emeritus Professor
Program in Ecology
University of Wyoming
Laramie, WY 82071

John Talberth, Ph.D.
Center for Sustainable Economy
Portland, OR

Michael Dorsey, Ph.D., M.F.S., M.A.
M.F.S., Yale University, School of Forestry
M.A., The Johns Hopkins Univ., Anthropology
Ph.D., University of Michigan, School for Environment and Sustainability

Mary S. Booth, Ph.D., Director
Partnership for Policy Integrity
Pelham, MA

Christopher Neil, Ph.D., Senior Scientist
Woodwell Climate Research Center
Falmouth, MA

Wayne S. Walker, Ph.D., Carbon Program Director
Woodwell Climate Research Center
Falmouth, MA

Jennifer Francis, Ph.D., Acting Deputy Director, Senior Scientist
Woodwell Climate Research Center
Falmouth, MA

Susan M. Natali, Ph.D., Arctic Program Director, Senior Scientist
Woodwell Climate Research Center
Falmouth, MA

Marcia N. Macedo, Ph.D., Water Program Director, Associate Scientist
Woodwell Climate Research Center
Falmouth, MA

Derek Lee, Ph.D.
Associate Professor
Penn State University, PA

Monica Bond, Ph.D.
Wild Nature Institute
Concord, NH

Robert L. Beschta, Ph.D.
Professor Emeritus
Forest Ecosystems and Society, Oregon State University
Corvallis, OR 97333

Thomas T. Veblen, Ph.D.
Distinguished Professor, Emeritus
University of Colorado Boulder, CO

Stuart Pimm, Ph.D.
Doris Duke Chair of Conservation Duke University
Durham, NC

Mark E. Harmon, Ph.D., Professor Emeritus
Department of Forest Ecosystems & Society
Oregon State University
Corvallis, OR

Anne H. Ehrlich, Ph.D.
Center for Conservation Biology Stanford University
Palo Alto, CA

Paul R. Ehrlich, Ph.D., Professor Emeritus, Biology Stanford University
President, Center for Conservation Biology
Palo Alto, CA

Steven Green, Ph.D.
Senior Professor Emeritus
University of Miami, Coral Gables, FL

Tonja Chi, M.S., Wildlife Ecologist
Campbell, California

Maya Khosla, M.S.
Wildlife Biologist and Toxicologist
Rohnert Park, CA

Richard W. Halsey, M.A.
California Chaparral Institute

Bryant Baker, M.S., Conservation Director
Los Padres ForestWatch
Santa Barbara, CA

Shaye Wolf, Ph.D.
Climate Science Director

Center for Biological Diversity

Eric Chivian, M.D.
Founder and Former Director, Center for Health and the Global Environment
Harvard Medical School
Boston, Massachusetts

Gregory F. Grether, Ph.D.
Professor of Ecology and Evolutionary Biology
University of California, Los Angeles

Bruce G. Baldwin, Ph.D.
W. L. Jepson Professor & Curator
Department of Integrative Biology and Jepson Herbarium
University of California, Berkeley

John P. O'Brien, Ph.D., Climate Scientist
National Center for Atmospheric Research
Boulder, CO

A. Scott Denning, Ph.D.
Monfort Professor of Atmospheric Science
Colorado State University and
Coleman P. Burke Distinguished Visiting Professor
Yale School of the Environment

Scott Goetz, Ph.D.
Regents Professor of Earth Observation & Ecological Informatics
School of Informatics, Computing and Cyber Systems
Northern Arizona University, Flagstaff AZ
Science Lead, NASA Arctic Boreal Vulnerability Experiment
Deputy PI for Science, NASA Global Ecosystem Dynamics Investigation

John Sterman, Ph.D.
Professor and Director
MIT Systems Dynamics Group
Sloan School of Management
Massachusetts Institute of Technology
Cambridge, MA

Juliette N. Rooney-Varga, Ph.D.
Director, Climate Change Initiative
Professor, Environmental Science
Co-Director, Rist Institute for Sustainability and Energy
Lowell, MA

Lori S. Siegel, Ph.D., P.E.
Senior Modeler
Climate Interactive

Cathy Whitlock, Ph.D.
Regents Professor Emerita of Earth Sciences
Fellow of the Montana Institute on Ecosystems
Montana State University
Bozeman, MT

James N. Galloway, Ph.D.
Sidman P. Poole Professor, Environmental Sciences
University of Virginia
Charlottesville, Virginia

Meg Lowman, Ph.D.
National Geographic Explorer
Director, TREE Foundation

Colden V. Baxter, Ph.D.
Professor, Stream Ecology Center, Department of Biological Sciences
Director, Center for Ecological Research & Education
Idaho State University
Pocatello, Idaho

Janet Franklin, Ph.D., Distinguished Professor
Department of Botany and Plant Sciences
University of California - Riverside
Riverside, CA

Diana L. Six, Ph.D., FRES
Professor of Forest Entomology/Pathology
WA Franke College of Forestry and Conservation
Dept. Ecosystem and Conservation Sciences
The University of Montana
Missoula, MT

John M. DeCicco, Ph.D.
Research Professor Emeritus
University of Michigan Energy Institute
Ann Arbor, Michigan

Additional Signatories

Carlos Carroll, Ph.D.
Klamath Center for Conservation Research

PO Box 104
Orleans, CA 95556

Neville Winchester, Ph.D.
Adjunct Assistant Professor
SLI, Biology Department
University of Victoria
Board member International Canopy Network

Craig C. Downer, A.B. (UCB), M.S. (UNR), Ph.D.c. (UDurhamUK)
Andean Tapir Fund
P.O. Box 456
Minden, NV 89423 USA

Mitchell M. Johns, Ph.D.
Professor Emeritus of Soil and Plant Science
College of Agriculture
California State University
Chico, CA 95929-0310

Will Russell, Ph.D.
Professor, Department of Environmental Studies
San Jose State University
One Washington Square, San Jose, CA

John Harte, Ph.D.
Professor of the Graduate School
Ecosystem Sciences
ERG/ESPM
University of California
Berkeley, CA 94720

Garry Rogers, Ph.D., President
Agua Fria Open Space Alliance, Inc.
Humboldt, AZ

Ronald W. Abrams, Ph.D.
Dru Associates, Inc.
Chintsa, South Africa and
Glen Cove, New York

Rob Mrowka, M.S.
Landscape Ecologist, retired
Machias, NY

Alan Stemler, Ph.D.

Professor Emeritus
Plant Biology Department
University of California-Davis
Davis, California USA

Sam Davis, Ph.D., Conservation Scientist
Dogwood Alliance
Asheville, NC

Bitty A. Roy, Ph.D.
Professor Emerita
Inst. of Ecology and Evolution
University of Oregon

John W. Schoen, Ph.D.
Wildlife Ecologist, retired
Anchorage, Alaska

David F. DeSante, Ph.D.
President, The Institute for Bird populations
Petaluma, CA 95953

Paul Schaeffer, Ph.D., Associate Professor of Biology
Miami University
Oxford, OH

Mary V. Price, Ph.D.
Professor of Biology, Emerita
University of California, Riverside

Tina Rhea, M.S.
Greenbelt, MD

Don Charles, Ph.D.
Academy of Natural Sciences
Drexel University

Melanie Szulczewski, Ph.D.
Associate Professor of Environmental Science
University of Mary Washington, Fredericksburg VA

Thomas Michael Power, Ph.D.
Professor of Economics, Emeritus
The University of Montana

Michael C. Swift, Ph.D.

Assistant Professor Emeritus of Biology
St. Olaf College

David W. Roberts, Ph.D.
Professor Emeritus
Department of Ecology
Montana State University
Bozeman, MT 59717-3460

K. Greg Murray, Ph.D.
Professor Emeritus of Biology
Hope College
Holland, Michigan

Gretchen North, Ph.D.
John W. McMenamin Endowed Professor of Biology
Occidental College
Los Angeles, CA 90041

Glenn E. Walsberg, Ph.D.
Professor Emeritus
School of Life Sciences
Arizona State University

Timothy P. Spira, Ph.D.
Emeritus Professor, Ecology
Clemson University

Barbara C. (Kitti) Reynolds, Ph.D.
Professor Emerita, Department of Environmental Studies
University of North Carolina at Asheville
Asheville, NC 28804

Richard A. Bradley, Ph.D,
Associate Professor, Emeritus
The Ohio State University, Columbus, OH

George Robinson, Ph. D.
Emeritus Professor of Biological Sciences
State University of New York at Albany

Susanne C. Moser, Ph.D.
Susanne Moser Research & Consulting
University of Massachusetts-Amherst

Mary S. Tyler, Ph.D.

Professor Emerita of Zoology
University of Maine, ME

Matthew J. Rubino, M.S.
Research Scholar
NC State University Department of Applied Ecology

Richard S. Ostfeld, Ph.D.
Distinguished Senior Scientist
Cary Institute of Ecosystem Studies
Millbrook, NY 12545, USA

John F Weishampel, Ph.D.
Professor of Biology
University of Central Florida

Dr. Faisal Moola, Ph.D.
Associate Professor
Department of Geography (347 Hutt).
College of Social and Applied Human Sciences
University of Guelph
Guelph, Ontario

Judith S. Weis, Ph.D., Professor Emerita
Rutgers University
Newark, NJ

Alan Dickman, Ph.D.
Professor Emeritus, Environmental Studies and Biology
University of Oregon

Nicanor Saliendra, Ph. D.
USDA Agricultural Research Service
Mandan, ND

Paula M Schiffman, Ph.D.
California State University, Northridge

Stacey Harmer, Ph.D.
Professor, Department of Plant Biology
University of California Davis

Robert M. Pyle, Ph.D.
Founder, The Xerces Society for Invertebrate Conservation

Peter Stacey, Ph.D.

Research Professor (retired)
Department of Biology
University of New Mexico
Albuquerque, NM 87507

Thomas L. Fleischner, Ph.D.
Senior Advisor & Director Emeritus, Natural History Institute
Faculty Emeritus, Prescott College

Melissa Savage, Ph.D.
Professor Emerita
University of California Los Angeles
Los Angeles, CA

Allen G. Gibbs, Ph.D.
Professor, University of Nevada, Las Vegas

James R. Strittholt, Ph.D., President
Conservation Biology Institute
Corvallis, OR

Philip J. Nyhus, Ph.D.
Professor of Environmental Studies
Colby College, Waterville, ME

Thomas W. Sherry, Ph.D., Professor
Department of Ecology and Evolutionary Biology
Tulane University

John Ratti, Ph.D.
Professor and Research Scientist, Retired University of Idaho
New Meadows, Idaho

Malcolm K. Cleaveland, Ph.D., LTC USAR (Ret.)
Professor Emeritus of Geosciences
University of Arkansas - Fayetteville
Department of Geosciences

Brett R Riddle, Ph.D.
Professor
Life Sciences
University of Nevada, Las Vegas
Editor-in-Chief, Journal of Mammalogy

Karen Holl, Ph.D.
Professor of Environmental Studies

University of California, Santa Cruz

Anthony Snider, Ph.D.
Associate Professor of Environmental Sciences
University of North Carolina Wilmington
601 S. College Rd., Dobo 2038-D
Wilmington, NC 28403-5949

Rick Van de Poll, Ph.D.
Ecosystem Management Consultants of New England, LLC
30 N. Sandwich Rd
Center Sandwich, NH 03227

Joshua Schimel, Ph.D., Professor, Environmental Studies
University of California Santa Barbara

Craig Benkman, Ph.D.
Distinguished Chair in Ecology
University of Wyoming

James R. Blauth, Ph.D., Professor of Biology
University of Redlands
1200 E. Colton Ave.
Redlands, CA 92373

John G. Robinson, Ph.D.
Joan L. Tweedy Chair in Conservation Strategy
Wildlife Conservation Society

Esther C. Peters, Ph.D. || Associate Professor
Environmental Science & Policy, George Mason University
4400 University Drive, MS 5F2, Fairfax, VA 22030-4444

Jack A. Sobel, M.S.
Bethesda, MD 20816

Chris Myers, Ph.D.
Professor of Biology
Miami University

Terry L. Root, Ph.D., Senior Fellow Emerita
Stanford Woods Institute for the Environment
Stanford University

Tony Povilitis, Ph.D.
Wildlife Biologist

Life Net Nature
Bozeman, MT USA

Edward Huang, Ph.D., AICP, LEED AP, CGBP, CGREP, QWEL
Principal Researcher, California Institute of Environmental Design & Management
Arcadia, CA

Brian T. Miller, Ph.D., Professor
Department of Biology
Middle Tennessee State University
Murfreesboro, Tennessee 37132

Jessica Dawn Pratt, Ph.D.
Associate Professor of Teaching
Ecology & Evolutionary Biology
Conservation & Restoration Science Program
University of California at Irvine

Stephen T. Tettelbach, Ph.D.
Professor Emeritus of Biology
LIU Post
720 Northern Blvd.
Brookville, NY 11548-1300

Barry R. Noon, Ph.D.
Professor Emeritus
Department of Fish, Wildlife and Conservation Biology
Colorado State University

Roger A Powell, Ph.D.
Department of Applied Ecology
North Carolina State University

Paul C. Paquet, Ph.D.
Raincoast Conservation Foundation
Senior Scientist & Professor Adjunct
Applied Conservation Science Lab
University of Victoria
Victoria, BC Canada

Gary D. Grossman, Ph.D.
Fellow, American Fisheries Soc.
Fellow, The Linnean Soc.
Professor of Animal Ecology
Warnell School of Forestry & Natural Resources

University of Georgia
Athens, GA, USA 30602
Affiliate Professor Haifa University

John Swaddle, Ph.D.
Faculty Director, Institute for Integrative Conservation
William & Mary, Williamsburg, VA

James A. Quinn, Ph.D.
Professor Emeritus
Rutgers University
New Brunswick, NJ

Roger W. Ruess, Ph.D.
Professor Emeritus, Senior Research Associate
Institute of Arctic Biology, University of Alaska
Fairbanks, AK 99775

WS Armbruster, Ph.D.
University of Portsmouth, UK
& University of Alaska Fairbanks, USA

Dan Spencer, Ph.D.
Professor, Environmental Studies
The University of Montana

Kathleen McCarthy, M.S.
Restoration Ecologist

John R. Cannon, Ph.D.
Conservation Biologist,
Consultant to the International Whooping Crane Recovery Team

Michael Rosenzweig, Ph.D.
Professor emeritus,
University of Arizona

Thomas Rooney, Ph.D.
Department of Biological Sciences
Wright State University
Retired

James R. Karr, Ph.D., Professor Emeritus
School of Aquatic and Fishery Sciences
University of Washington, Seattle, WA

Donald M. Waller, Ph.D.
Former J.T. Curtis Professor of Botany
University of Wisconsin-Madison
Madison, WI 53706 USA
Chief Scientist, Superior Bio Conservancy

Curt Bradley, M.S., Senior Scientist
Center for Biological Diversity
Tucson, AZ

Carol Baskauf, Ph.D.
Austin Peay State University

David J. Mildrexler, Ph.D.
Eastern Oregon Legacy Lands
Joseph, OR

Edwin B. Royce, Ph.D.
Mahogany Station
Kennedy Meadows, CA

Cameron Barrows, Ph.D.
Conservation Ecologist
Center for Conservation Biology
University of California Riverside

Ann Sloat, Ph.D.
University of Hawaii, Public Health (retired)
Oahu, Hawaii

Hank Stevens, Ph.D.
Director, PhD Program in Ecology, Evolution, and Environmental Biology
Miami University
Oxford, OH, USA

Kathleen L. Shea, Ph.D.
Professor of Biology and Environmental Studies
St. Olaf College
Northfield, MN

Elke Schoffers, Ph.D.
Professor of Chemistry, Department of Chemistry
Western Michigan University
Kalamazoo, MI

James A. Schmid, Ph.D.

President, Schmid & Co., Inc., Consulting Ecologists
Media, PA

Elizabeth Horvath, M.S.
Associate Professor of Biology, Westmont College
Research Associate, Invertebrate Zoology
Santa Barbara Museum of Natural History

Bruce Kirchoff, Ph.D., Professor
University of North Carolina at Greensboro

Jon Grinnell, Ph.D.
Francis Morey Uhler Chair in Biology
Gustavus Adolphus College
St Peter, MN

Johannes Foufopoulos, Ph.D., Associate Professor
School for Environment and Sustainability
University of Michigan

Richard T. Holmes, Ph.D.
Professor Emeritus of Biological Sciences
Dartmouth College
Hanover, NH

Lee E. Frelich, Ph.D.
Director, Center for Forest Ecology
The University of Minnesota
St. Paul, MN

Jennifer Gervais, Ph.D.
Wildlife Ecologist
Oregon Wildlife Institute

Cheryl Harding, Ph.D.
Professor Emerita
Hunter College, City University of New York
New York, NY

Malcolm Hunter, Jr., Ph.D., Emeritus Professor of Wildlife Ecology
University of Maine

John A. Kloetzel, Ph.D.
Associate Professor, Emeritus
Department of Biological Sciences
University of Maryland Baltimore County (UMBC)

Gene E. Likens, Ph.D.
Distinguished Research Professor, University of Connecticut and
Founding President Emeritus, Cary Institute of Ecosystem Studies
Millbrook, NY

Jay H. Jones, Ph.D.
Professor Emeritus of Biology and Biochemistry
Departments of Biology and Chemistry
University of La Verne
La Verne, CA

Jack Kirkley, Ph.D.
Emeritus Professor of Biology
The University of Montana - Western

William D. Newmark, Ph.D.
Research Curator
Natural History Museum of Utah
University of Utah
Salt Lake City, UT

Holmes Rolston III, Ph.D.
University Distinguished Professor
Colorado State University
Fort Collins, CO

Gary K. Meffe, Ph.D.
Adjunct Professor, Retired
Wildlife Ecology and Conservation
University of Florida
Gainesville, Florida

Pamela Morgan, Ph.D.
Professor of Environmental Studies
School of Marine & Environmental Programs
University of New England
Biddeford, ME

Travis D. Marsico, Ph.D.
Professor of Botany
Arkansas State University
Jonesboro, Arkansas

C. Riley Nelson, Ph.D.
Professor, Biodiversity

Department of Biology
Brigham Young University
Provo, UT

Michael Rentz, Ph.D.
Associate Teaching Professor
Iowa State University

Jon Evans, Ph.D.
Professor of Biology
Department of Biology
University of the South
Sewanee, TN

Hartwell H. Welsh, Jr., Ph.D.
Research Wildlife Biologist
Arcata, CA

Cara R. Nelson, Ph.D.
Professor & Chair
Department of Ecosystem and Conservation Sciences
W.A. Franke College of Forestry and Conservation
University of Montana
Missoula, MT

Steve LaDochy, Ph.D., Professor Emeritus
Dept. of Geosciences & Environment
California State University, Los Angeles

Eric Burr, M.S., Forestry
Methow Conservancy

Philip D. Cantino, Ph.D.
Professor Emeritus of Environmental and Plant Biology
Ohio University, OH

Joseph A. Cook, Ph.D.
Distinguished Professor of Biology
University of New Mexico

John A. Cigliano, Ph.D.
Professor of Biology and Director of Environmental Conservation
Department of Biological Sciences
Cedar Crest College,
Allentown, PA

Brian Bodenbender, Ph.D.
Professor of Geology and Environmental Science
Hope College
Holland, MI

Amy Denton, Ph.D.
Professor of Biology
California State University Channel Islands
Camarillo, CA

F Stuart Chapin III, Ph.D.
Professor Emeritus of Ecology
Institute of Arctic Biology
University of Alaska Fairbanks
Fairbanks, AK

James Woodley, M.S.
Environmental Biologist
President, JAPRI.Org
Greenville, NC

Richard A. Cellarius, Ph.D.
Emeritus Member of the Faculty (Plant Biology; Biophysics; Environmental Policy)
The Evergreen State College
Olympia, WA

William R. Bromer, Ph.D.
Professor Emeritus of Biology and Environmental Sciences
University of St. Francis
Joliet, IL

Char Miller, Ph.D.
W.M. Keck Professor of Environmental Analysis & History
Pomona College
Claremont, CA

William D. Anderson, Jr., Ph.D.
Professor Emeritus
Grice Marine Biological Laboratory
College of Charleston
Charleston, South Carolina

Wayne D. Spencer, Ph.D.
Chief Scientist
Conservation Biology Institute

Janet Marsden, Ph.D.
Research Associate
Syracuse University

Ileene Anderson, M.S.
Senior Scientist
Center for Biological Diversity
Los Angeles, CA

Jesse R. Barber, Ph.D.
Associate Professor
Dept. of Biological Sciences
Boise State University
Boise, ID

Patrick Crist, Ph.D., Principal
PlanIt Forward
Broomfield, Colorado

A.Z. Andis Arietta, M.S.
Ph.D. Candidate
Yale University, School of the Environment
New Haven, Connecticut

Elizabeth Borer, Ph.D.
Professor
Department of Ecology, Evolution, and Behavior
University of Minnesota
St. Paul, MN

Tom Dudley, Ph.D.
Marine Science Institute
& Cheadle Center for Biodiversity and Ecological Restoration
University of California, Santa Barbara, CA

C. Dusti Becker, Ph.D., Co-Director
Life Net Nature
Bozeman, MT

Anthony Metcalf, Ph.D.
Professor of Biology
Conservation Biology and Evolution
California State University
San Bernardino, CA

Rosemary Sherriff, Ph.D.

Professor, Geography, Environment & Spatial Analysis Department
Faculty, Environmental Studies Program & Forest and Wildland Sciences Graduate Program
Humboldt State University, Arcata, CA

Margot Griswold, Ph.D.
Senior Restoration Ecologist
Land IQ
Los Angeles, CA

George Wuerthner, M.S.
Researcher/Biologist/Writer
Public Lands Media
Bend, Oregon

Daniel G. Gavin, Ph.D., Professor
Department of Geography
University of Oregon
Eugene, OR

Daniel C. Fisher, Ph.D.
Claude W. Hibbard Collegiate Professor,
Department of Earth and Environmental Sciences
University of Michigan
Ann Arbor, MI

Jacob Kann, Ph.D.
Aquatic Ecosystem Sciences LLC
Ashland, OR

Mark Hunter, Ph.D.
Earl E. Werner Distinguished University Professor
University of Michigan
Ann Arbor, MI

Marc Imlay, Ph.D., Biologist
Bryans Road, Maryland

Jerry Freilich, Ph.D.
Bend, OR

Ken Carloni, Ph.D.
Restoration Ecologist
Yew Creek Land Alliance
Roseburg, OR

Christopher A. Frissell, Ph.D.

Chair Department of Hydrology
Salish Kootenai College
Pablo, MT

David R. Kanter, Ph.D.
Associate Professor of Environmental Studies
New York University

Doug Meikle, Ph.D.
Professor, Department of Biology
Miami University
Oxford, OH

Dan Rosenberg, Ph.D.
Oregon Wildlife Institute
Corvallis, OR

John Terborgh, PhD
James B. Duke Professor Emeritus
Nicholas School of the Environment
Duke University
Durham, NC

Anna Tyler, Ph.D., Research Scientist
The Jackson Laboratory
Bar Harbor, Maine

Ellen Moyer, Ph.D., PE
Principal
Greenvironment, LLC
Montgomery, MA

Knute Nadelhoffer, Ph.D.
Professor Emeritus, Dept. of Ecology & Evolutionary Biology
University of Michigan
Ann Arbor, MI

Vicky Meretsky, PhD,
Professor of Environmental Science
O'Neill School of Public and Environmental Affairs
Indiana University
Bloomington, IN

Karl Jarvis, Ph.D., Lecturer of Biology
Southern Utah University
Cedar City, UT

Kenneth Driese, Ph.D., Senior Lecturer (Emeritus)
University of Wyoming
Laramie, WY

David F. Whitacre, Ph.D.
Instructor (retired)
Treasure Valley Math and Science Center
Boise, Idaho

Dennis Murphy, Ph.D.
Emeritus Research Professor
University of Nevada
Reno, Nevada

John G. Carter, Ph.D., BME, MBA
Ecologist
Kiesha's Preserve
Bondurant, WY

References

1: Larsen, J., et al. 2021. Pathways to Build Back Better: Nearly a Gigaton on the Table in Congress. Rhodium Group, New York, NY. Accessed at: https://rhg.com/research/build-back-better-congress-budget/

2: (a) Moomaw, W.R., et al. 2020. Scientists concerned about climate and biodiversity impact of logging. Accessed at: https://johnmuirproject.org/2020/05/breaking-news-over-200-top-u-s-climate-and-forest-scientists-urge-congress-protect-forests-to-mitigate-climate-crisis/ ; (b) Harris, N.L., et al. 2016. Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance Manage. 11: Article 24.

3: USEIA. 2021. How much of U.S. carbon dioxide emissions are associated with electricity generation? U.S. Energy Information Administration (2020 data). Accessed at: https://www.eia.gov/tools/faqs/faq.php?id=77&t=11

4: (a) Harmon, M.E. 2019. Have product substitution carbon benefits been overestimated? A sensitivity analysis of key assumptions. Environmental Research Letters 14: Article 065008; (b) Hudiburg, T.W., Beverly E. Law, William R. Moomaw, Mark E. Harmon, and Jeffrey E. Stenzel. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. Environmental Research Letters 14: Article 095005.

5: Sterman, J.D., L. Siegel, and J.N. Rooney-Varga. 2018. Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy. Environmental Research Letters 13: Article 015007.

6: Campbell, J.L., M.E. Harmon, and S.R. Mitchell. 2012. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? Frontiers in Ecol. and Environ. 10: 83-90.

7: Moomaw, W.R., et al. 2020. Scientists concerned about climate and biodiversity impact of logging. Accessed at: https://johnmuirproject.org/2020/05/breaking-news-over-200-top-u-s-climate-and-forest-scientists-urge-congress-protect-forests-to-mitigate-climate-crisis/

8: Koester, S, and S. Davis. 2018. Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States. Environmental Justice 11: 64-70.

9: (a) Art, H.W., et al. 2021. A Statement by Scientists and Economists on BECCS from Forest Biomass. Accessed at: https://www.biofuelwatch.org.uk/wp-content/uploads/BECCS-letter-by-scientists-and-economists-1.pdf ; (b) 350.org, et al. 2021. Carbon capture is not a climate solution. Accessed at: https://www.ciel.org/wp-content/uploads/2021/07/CCS-Letter_FINAL_US-1.pdf .

10: (a) Bradley, C.M. C.T. Hanson, and D.A. DellaSala. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? Ecosphere 7: article e01492; (b) Cruz, M.G., M.E. Alexander, and J.E. Dam. 2014. Using modeled surface and crown fire behavior characteristics to evaluate fuel treatment effectiveness: a caution. Forest Science 60: 1000-1004; (c) Cruz, M.G., M.E. Alexander, and P.A.M. Fernandes. 2008. Development of a model system to predict wildfire behavior in pine plantations. Australian Forestry 71: 113-121.

11: (a) Zald, H.S.J., and C.J. Dunn. 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications 28: 1068-1080; (b) Odion, D.C., and C.T. Hanson. 2008. Fire severity in the Sierra Nevada revisited: conclusions robust to further analysis. Ecosystems 11: 12-15; (c) Odion, D. C., M. A. Moritz, and D. A. DellaSala. 2010. Alternative community states maintained by fire in the Klamath Mountains, USA. Journal of Ecology 98: 96-105; (d) Bradley, C.M. C.T. Hanson, and D.A. DellaSala. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? Ecosphere 7: article e01492; (e) Dunn, C.J., et al. 2020. How does tree regeneration respond to mixed-severity fire in the western Oregon Cascades, USA? Ecosphere 11: Article e03003; (f) Meigs, G.W., et al. 2020. Influence of topography and fuels on fire refugia probability under varying fire weather in forests of the US Pacific Northwest. Canadian Journal of Forest Research early online 1-30. doi; 10.1139/cjfr-2019-0406; (g) Lesmeister, D.B., Sovern, S.G., Davis, R.J., Bell, D.M., Gregory, M.J., and Vogeler, J.C. 2019. Mixed-severity wildfire and habitat of an old-forest obligate. Ecosphere10: Article e02696.

12: Depro, B.M., et al. 2008. Public land, timber harvests, and climate mitigation: Quantifying carbon sequestration potential on U.S. public timberlands. Forest Ecology and Management 255: 1122-1134.