

How many cigarettes in a burning tree?

had a hissy fit one morning last spring – 2018 – just as we were heading into yet another godawful wildfire season in northern Idaho. So, I did something I rarely do. I posted my tirade on our website. It was titled "How many cigarettes in a burning tree." ⁵²

This morning I reread it. I still like what I said – enough so that I've cut and pasted it here. See what you think:

A cigarette is what, three inches long? A burning tree is anywhere from 100 to 250 feet tall.

How many cigarettes in a burning tree? No one knows...

Not the American Cancer Society. Not the American Lung Association. Not the Centers for Disease Control. Not even the U.S. Forest Service, which will soon be sending young men and women into harm's way to fight the country's godawful forest fires.

In fact, none of these organizations has anything to say about the risks of cancer-causing chemicals found in the wildfire smoke that will be invading young lungs during the 2018 fire season. So far as I know, we here at *Evergreen* are the only ones thus far willing to pin the bell on this cat. We hope to change that this year.

The American Cancer Society and the American Lung Association both have lots to say about cigarettes and air pollution. And

they should. It's their job. Shouldn't they also be waving

red flags about wildfire smoke? They don't seem to think so.



I'll give my friends at the Forest Service a pass on this one. They are funding research aimed at identifying the long list of deadly chemicals found in wildfire smoke. Google "smoke from wildland fires" and you'll be led to scads of studies dealing with wildfire smoke and how wildland firefighters are prepared for risking their lives and health on fire lines.

Now that Congress and most of the West's state legislatures are back in session, all sorts of ideas for combating "climate change" are being run up flagpoles. Climate change is pretty much the default position for gasbags who are "concerned" about air polluted by wildfire smoke.

The state legislatures in Oregon and Washington are pretty sure that raising energy taxes will improve air quality. No mention of economic impacts or – inexplicably – the health and economic losses associated with enduring months of wildfire smoke.

Most legislators in these states seem determined to whistle past the wildfire graveyard. Why? Don't they breathe the same air we breathe? Meanwhile, California Assemblyman, Tim Grayson, a Bay Area Democrat, has introduced legislation that would make it harder for litigators to stop the construction of roads and transit projects that have already passed muster with state climate regulators.

We sympathize with Mr. Grayson's frustration with slow moving or derailed transit projects. Serial litigators are destroying our national forests – to say nothing of our rural timber economies – faster than we can grow new ones.

Litigators don't need to prove environmental

harm. Simply showing that confusing regulations have not been followed – a crap shoot at best – is sufficient. Just ask the leadership in any federal resource management agency. I doubt Assemblyman Grayson knows this. Likewise, urban legislators anywhere in our nation.

California has long been a political petri dish, much to the dread of voters in "flyover" country – the vast expanse that lies between west of the Great Smokey Mountains and east of the Cascade Range. I wonder what great public inconvenience will finally force legislators in California, Oregon and Washington to get serious about the environmental and health risks posed by these enormous wildfires and the cancerous smoke they generate.

Tom Bonnicksen's analysis of one 1990s California wildfire included an estimate that every car in California needed to be garaged for an entire year to mitigate the fire's emissions.

No one blinked. The PhD fire ecologist's report landed with a dead-cat bounce on the state legislature's front porch in Sacramento.

When will well-choreographed, fake concern for public health, safety and welfare give way to legislation that reflects genuine concern for people and the environment?

"You're lucky," a dying and disgusted forester friend told me 15 years ago. "I won't live long enough to see blood in the streets, but you will."

I hope he was wrong about the blood part.

Here's an idea ripe for California's petri dish: The federal government can't be sued without its permission. But Congress already cleared the way for such suits when it ratified the Equal Access to Justice Act. Serial litigators routinely use its provisions to help stymic Forest Service plans for reducing the risk of wildfire in National Forests.

It's time for state legislators to test the veracity of the Act by suing the federal government for sponsoring and paying serial litigators who are poisoning our air, water and citizens.

States could lose this lawsuit, but if they do there will be a citizen uprising unlike any in our country's long history. To save themselves, members of Congress who routinely cast their free environmental votes will be forced to join beleaguered rural delegations that have been trying for years to fix this damned mess. To help set the stage, we're going to find someone who can help us figure out how many cigarettes it takes to equal the cancer-causing chemical release from a single 100-foot-tall burning tree.

A year has passed since I posted my temper tantrum and I still can't tell you have many cigarettes there are in a burning tree, but I've read dozens of reports ⁵³ that warn about the chemical composition of wildfire smoke.

Although no one has confirmed my assertion that inhaling wildfire smoke all day the same as smoking a pack of cigarettes, every report I've read affirms my long-held belief that breathing wildfire smoke for months on end can cause lung cancer, heart disease and many lesser respiratory diseases.

And so my question: why hasn't the federal government gone after wildfire smoke culprits with the same vengeance it directed at cigarette makers? The answer is simple: *Our federal government is the culprit!* It alone holds the power to reduce the amount of wildfire smoke we inhale summer after summer. Yet the government refuses to hold itself to the same legally enforceable air quality standards it holds American industry.

A few weeks after I had my hissy fit, a friend sent me a copy of the *Montana/Idaho Wildfire Carbon Emissions Inventory for 2013-2017*. I was so astonished by the report's findings that I posted them on our website with the following editor's note:

I never cease to be amazed by the stuff that comes over the transom here at Evergreen. Just when I thought I'd said all that need be said for now about the cancerous risks of wildfire smoke.

We owe a debt to the Forest Service's Shawn Urbanski for assembling this data, and the data that appears in my earlier temper tantrum, "The Pack-a-Day Club," in which I assert that the choking wildfire smoke that hung over much of the West for more than two months last summer was the easy equivalent of smoking a pack of cigarettes a day.

Thus far, no one has contested my claim. I don't think anyone will, and the

data sets that appear below help explain why.

Apart from the deadly health risks associated with wildfire



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smoke, there is the matter of its contribution to atmospheric pollution and, of course, climate change itself. Note the record 15,129,539 tons of carbon dioxide that Montana's wildfires generated in 2017 – more even than the 13,925,262 million tons of CO₂ that Idaho's wildfires generated in 2015.

The governors of Washington and Oregon are proposing new taxes on industrial polluters in their states, but there is no mention of the biggest air polluter of all: The West's federal lands wildfire crisis and, by extension, the United States Government. In a word: Congress.

I have no idea how many million tons of CO₂ wildfires in Oregon, Washington and California dumped into the atmosphere in 2013-2017, but I intend to find out. I do recall PhD forest ecologist, Tom Bonnicksen, telling me a few years ago about one northern California firestorm that released more pollution into the state's airsheds than all the cars in California had released in the same year.

We're going to be treated to lots of electionyear posturing from the usual gasbags in the coming months, but I don't see much evidence that the West's state and federal delegations are serious about curbing the economic and environmental impacts of climate change, to say nothing of the carcinogenic risks associated with breathing wildfire smoke for months on end. If any of you think I'm wrong, tell me what I'm missing.

Meantime, here are some of the data sets Shawn Urbanski assembled.

Montana/Idaho Wildfire Carbon Emissions Inventory

Wildfire carbon emissions were calculated for Idaho and Montana for 2013 through 2017. The results are shown in the Table 1 and Figure 1. To allow further context a graph is provided of acres burned over the last 13 years compared to the number of wildfire data flags for the same year (Figure 2). The method used to calculate emissions is on page 124.



Figure 1

Darameter	Voor	Montana	Idaha
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Area burned (acres)	2012	00.002	752 455
	2013	89,923	/52,455
	2014	24,/62	232,597
	2015	537,572	/93,410
	2016	52,431	231,686
	2017	922,038	512,023
CO_2 Emissions (tons) =	2012	2 4 4 2 5 0 1	10.020 746
	2013	2,443,791	10,830,746
	2014	260,911	2,648,319
	2015	8,327,930	13,925,262
	2016	1,033,597	4,907,299
	2017	15,129,539	6,590,812
CO Emissions (tons) —			
	2013	230,116	1,021,286
	2014	17,060	251,012
	2015	825,666	1,369,736
	2016	86,156	403,165
	2017	1,252,740	517,325
$PM_{2.5}$ Emissions (tons)			
	2013	37,216	165,237
	2014	2,666	40,261
	2015	134,042	222,276
	2016	14,752	68,726
	2017	214,06	486,914
CH_4 Emissions (tons) =			
	2013	11,128	49,651
	2014	754	12,206
	2015	40,291	66,991
	2016	4,660	21,743
	2017	67,669	27,632
Hg Emissions (tons) 🗕			
-	2013	0.21	0.93
	2014	0.02	0.23
	2015	0.72	1.21
	2016	0.09	0.41
	2010	0.01	



Number of monitored days that were flagged by Montana DEQ staff as having been impacted by wildfires during a year shown along with the number of wildfire acres burned during that year. 2



Number of monitored days that were flagged by Montana DEQ staff as having been impacted by wildfires during a year shown along with the number of times that the 24 -hour average ambient fine particulate matter (PM_{2.5}) concentration exceeded the corresponding National Ambient Air Quality Standard (NAAQS) level of 35 micrograms per cubic meter (ug/m^3).

Year to Date Wildfire Emission Inventory

2013 through 2017 carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$), and mercury (Hg) emission estimates for wildfires in Montana and Idaho have been estimated by Shawn Urbanski, United States Forest Service. This describes the methodology used to derive the emission estimates.

Methodology

Fire emission of pollutant X (EX) may be estimated as the product of area burned (A; m2), fuel load (F; kg-dry vegetation m-2), combustion completeness (C; unitless), and specific emission factor for X (EFX; [g-compound X] [kg-dry vegetation burned-1]) (Urbanski et al., 2011 and references therein):

$$EX = A \times F \times C \times 0.001 \times EFX$$

(1)

Equation (1) was used to estimate annual fire emissions of CO2, CO, CH4, PM2.5, and Hg from wildfires in Montana and Idaho. The methods and data sources used to estimate EX are described in the following sections.

Area Burned, A

Burned area polygons were compiled using four burned area/fire activity datasets: Monitoring Trends in Burn Severity (MTBS) fire boundaries (https://www. mtbs.gov//direct-download; last access August 18, 2017), the Moderate Resolution Imaging Spectroradiometer (MODIS) active-fire based Direct Broadcast Monthly Burned Area Product, the incident fire perimeters from the Geospatial Multi-Agency Coordination Wildland Fire Support archive (GEOMAC http://www.geomac.gov/index.shtml) and a spatial wildfire occurrence database (FOD).

Fuel Load, F

The fuel load for the area burned was estimated from an overlay of the fire perimeters with vegetation and fuel loading maps. Forest vegetation type and fuel loading was assigned using an expanded version of the Fuels Type Group (FTG) fuel classification system [Keane 2013], which used recently available Forest Inventory and Analysis (FIA - https://www.fia.fs.fed.us/library/database-documentation/index.php fuels data. The forest surface fuel loading was augmented with fuel loading estimates of understory fuels [Wilson et al., 2013] and canopy fuels, the latter which was derived from FIA plot Treelist tables. Rangeland fuels were estimated using the Rangeland Vegetation Simulator (RVS) [Reeves, 2016]. Woody and herbaceous fuel loading was quantified using the inputs from LANDFIRE (https://www.landfire.gov), in addition to using the normalized difference vegetation index (NDVI) from MODIS for herbaceous material.

Fuel Consumption, C

Fuel consumption for forest surface, understory, shrub and herbaceous fuels was estimated from simulations using the fire effects models CONSUME [Prichard et al., 2006] and First Order Fire Effects Model (FOFEM; http://www.firelab.org/science-applications/fire-fuel/111-fofem) [Lutes, 2016a].

Emission Factors, EFX

Emission factors for CO₂, CO, PM_{2.5}, and CH₄ used modified combustion efficiency (MCE) values, fire types and emissions factors for western forests [Urbanski 2017]. Emission factor for Hg was based on Wiedinmyer and Friedli (2007) Environ. Sci. Technol., 2007, 41 (23), pp 8092-8098.

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Wilson, B. T., C. W. Woodall, and D. M. Griffith (2013), Imputing forest carbon stock estimates from inventory plots to a nationally continuous coverage, Carbon Balance and Management, 8, doi:10.1186/1750-0680-8-1. I know reports like this one are more than a little daunting, but it is very important that you know that the health risks associated with exposure to wildfire smoke are real and that this isn't some scary story that I made up to sensationalize *First, put out the Fire!* Far from it.

I admit that I was tempted to title this chapter "Smoke Deniers," because there is a lot of hokum swirling around the "climate change" debate that can easily divert your attention from the fact that there is much we can do to significantly reduce the amount of carcinogenic smoke our wildfires belch into the atmosphere every summer. We simply aren't doing it – thanks to the political influence of people who distrust science and see nothing morally or ethically wrong with allowing nature to burn our western national forests to the ground.

Last week, I sat in on a Forest Service-sponsored webinar titled *Wildfire Fighter Smoke Exposure and Risk of Lung Cancer and Cardiovascular Disease Mortality.*

It was as close to an actual autopsy as I hope to ever get.

Host Kathleen Navarro, a PhD at the University of California Berkeley, ran us through some of the latest field research involving wildland firefighters. These are tough-as-nails men and women who spend long months on torturous fire lines every summer. There is an esprit de corps in their DNA that merits our respect and thanks, but I wonder if they know that among career firefighters the risk of lung cancer increases 43 percent and the risk of heart disease 25 percent. Or do they know that the heart attacks kill more wildland firefighters than fire.

And, again, I wonder why our government is sending young men and women into harm's way when there is so much we could and should be doing to reduce the size, frequency and destructiveness of these wildfires. Why aren't we doing it? How many innocents must die in wildfires like the one that leveled Paradise, California last summer? *This will happen again – and again.*

Here are the links to dozens of studies that help define and quantify the health hazards associated with wildfire smoke. You decide, but first do your homework.



How many cigarettes in a burning tree?

Part of your assignment is to sign up for a nifty "citizen science" project developed by the EPA. It's called "Smoke Sense," ⁵⁴ and its purpose is to give you the opportunity to report what you are experiencing when you can't see a half-block down your street for all the damned wildfire smoke.

The app is amazing. Works for Android and iOS. Among its features:

- Current and forecasted air quality information
- Maps showing current fire locations and plumes
- A log for reporting personal health symptoms and smoke observations
- A learning module about air pollution, wildland fire and health impacts
- Reward badges for completing tasks

I'm not much for reward badges at my age, but I'm signing up and reporting what I experience. I don't know if it will do any good but after what we experienced in northern Idaho and western Montana in July, August and September I'll try anything that might help awaken

our conflicted federal government.

More on that in the next chapters.

