

Science AMA series: I'm Brian Buma, Assistant Professor at the University of Alaska. I study forest disturbances around the world, focusing on emerging mortality associated with climate change and carbon/water/forests as an integrated system. AMA!

Brian Buma¹ and r/ScienceAMAs¹

¹Affiliation not available

April 17, 2023

Abstract

Hi reddit! I am a disturbance ecologist (think fires, windstorms, landslides) that primarily studies the response of forested ecosystems to emerging disturbances triggered by climate change. I'm particularly interested in how resilient forests may be to these new stresses - and if that resilience is a good thing. Will our forests recover from future disturbances? What will that recovery look like? Does this recovery - or lack thereof - help or hinder species ability to migrate in response to climate change? What new disturbances are emerging? One striking example of all of these issues is the emerging mortality of species along the remote southeast Alaskan and Canadian west coast, where 400,000 ha (so far) of trees have died due to low snow conditions brought about by warming winters. The cause is surprisingly related to freezing - the soil is no longer insulated by snow, so cold snaps can kill. This is an emerging disturbance that we are just beginning to study, and it's dramatically changing the forest community. But it also appears to be associated with migration in other, less climate sensitive species. So perhaps this disturbance, and others, are facilitating the migration of species into more favorable climates. It's a complex ecological story of adaption/maladaptation and creative destruction (so to speak), and great fun to investigate. Most of my work involves a focus on either forest biodiversity, forest carbon, or water resources, and I've worked in Hawaii, the Rocky Mountains, and Alaska, and collaborated on projects around the world using a combination of fieldwork, remote sensing/satellites, GIS, and modeling. I am also the caretaker of what is believed to be the longest running permanent study plots studying primary succession in the world in Glacier Bay, Alaska (100 years and counting). So the data comes from a lot of sources, and I'm happy to discuss integration of methods as well. For more info, [check out this website.](www.brianbuma.com) I will be answering your questions at 1 PM ET, AMA! Edit: Thanks everyone! Some really interesting and thought provoking questions in here, and it's humbling and exciting to see so many people concerned and interested in the state of the world's forests. There were lots of great ideas for next steps, projects, etc mentioned here and I'd love to hear how those progress. I have to run for a meeting but I'll check back in tonight (it's only 1PM in Alaska right now, after all, lots of time) and keep on doing what I can. Edit 2: And I'm back for a bit. This is really fun. ...off for dinner. Will log in later to reply further. In the meantime, most of my work is posted on my website, and for those great questions about coastal forests I would encourage you to check out the Alaska Coastal Rainforest Center (<http://acrc.alaska.edu/>) for all things coastal forest related. Feel free to email with questions as well, I'm always looking for interested students and research collaborations, in addition to partners in management and policy. Alrighty, it's late in Alaska, so I'm done (and Denzel is online...). Thanks so much for your questions!

[REDDIT](#)

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BRIAN_BUMA [R/SCIENCE](#)

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CORRESPONDENCE:

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Can humans realistically plant enough trees to reverse the effects of mass deforestation since the Industrial Revolution? Is there reasonable room for thinking people to be optimistic about the future of Earth's forests?

[DogStarGodTsar](#)

Perhaps, and yes.

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Many places actually have more forests now than a few centuries ago. The eastern US, for example, is a solid carbon sink because of abandoned fields turning back into forests. Other areas, like Europe, have been permanently converted so they are gone. Plus it just takes time - some forests recover fairly quick, but others, like where I'm at, take several hundred years to really approximate an old growth setting.

Older paper but still a good read on carbon sinks at the global level: Pan, Y., Birdsey, R.A., Fang, J., Houghton, R., Kauppi, P.E., Kurz, W.A., Phillips, O.L., Shvidenko, A., Lewis, S.L., Canadell, J.G. and Ciais, P., 2011. A large and persistent carbon sink in the world's forests. *Science*, 333(6045), pp.988-993.

Afforestation (planting trees where there wasn't a forest before) is an option, and certainly does sequester carbon, but unlikely on a scale that really reverses anything. If it does get to that scale, you're going to start impacting other things, like food security/agriculture. One analysis:

Zomer, R.J., Trabucco, A., Bossio, D.A. and Verchot, L.V., 2008. Climate change mitigation: A spatial analysis of global land suitability for clean development mechanism afforestation and reforestation. *Agriculture, ecosystems & environment*, 126(1), pp.67-80. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.527.6267&rep=rep1&type=pdf>

But optimistic - yes, in some cases. The general population trend of people moving to urban areas is a cause for optimism. I was on the Yukon this summer, and it was odd to think that if I got in trouble now (boat flipped, bear, whatever) I would have a much bigger problem than a century prior, when there were plenty of little towns around. People are leaving the countryside for urban settings, which is presenting new opportunities for forest recovery. Farm abandonment (Europe as well) is allowing for more forests. Rewilding is a bit of a dream, but it's a good rallying cry.

The tropics are in much worse shape though. Expanding populations and resource dependent economies have hit areas hard, and there are concerns that deforestation will alter local climates such that forests couldn't recover even if they wanted to. That is because forests pump a lot of water into the atmosphere which is immediately rained out, recycling the water. A reduction in trees means a general decrease in precipitation, which is a nasty feedback loop in heavily water dependent forests.

Perhaps the more readable of the options, Spracklen, D.V., Arnold, S.R. and Taylor, C.M., 2012. Observations of increased tropical rainfall preceded by air passage over forests. *Nature*, 489(7415), pp.282-285.

Found it here:

<http://classes.uleth.ca/201303/biol3700a/Lab%20Materials/Lab%20Presentation/Project%201/Spraklen%20Nature%202012.pdf>

Hey thanks for doing this AMA! This strikes really close to home for me, I live in north west Labrador above the 53rd parallel, very remote area, literally 700 miles in either direction to the next town.

We have a couple of unique features in my area and I'm hoping you can offer some advice.

We have a huge problem with dust. We're located in between two iron ore mines, two very large ore productions within 2 miles of town. Their tailings line's have piled up over the last 50 years so basically the entire outline of town is a giant sand pit

Included a photo for reference. [You can clearly see tailings lines and their proximity to town.](#)

One of the mines closed a couple years ago leaving absolutely no upkeep for dust reduction.

And here comes problem number two, [the Forrest fire of 2013](#)

It's a bit hard to see but on that map but you can see the outline of the tailings sand pits from the previous photo and, in red, the amount of tree cover we lost to that one fire.

So, after spending the last 3 years choked to death with [dust](#) in the summer time.

And being "Conveniently" located in between the two biggest CO2 producers east of Montreal, and with the upcoming changes in the carbon tax pricing

I've been looking at the viability of a Silviculture project to help with

1) dust suppression 2) reforestation 3) species diversification 4) local area ascetics 5) the creation of offset credits

So my questions are

What cold hardy species can be successfully introduced to a boreal forest area, dominated by coniferous trees to improve diversification?

in regards to dust suppression, I'm assuming a root heavy shrub or bush, perhaps an alder bed might be more effective in retaining top soil material. In the past they would just hydroseed grass on top, but that requires annual upkeep. Any species in mind that might have a good, fast growing (hopefully not super invasive), tight holding root system to use in between trees?

And honestly, I don't know very much about the creation of offset credits, any experience with this?

And in regard to aesthetic, you can see the entire project area from my town, do you know of any diversification projects that had visual appeal for an area in mind during the creation process? I'd love to look into them

Thanks again for doing this AMA, look forward to your reply

[robtheAMBULANCE](#)

That's an interesting problem. Certainly silviculture can help with dust and aesthetics (aesthetics are a different matter, you may need a young priest and an old priest), and carbon credits are an important emerging market.

I'm curious about your improving biodiversity point. Why would you introduce a species? You mean one previously extinct? The boreal are fairly low diversity.

For dust - yes, you probably want a fast growing, busy species to keep the wind down at the soil level, your thought of alder (native to the region) is a good one. Willows are another.

Carbon offset - currently still in flux, but you'll need very tight biomass estimation methods so it's repeatable, and you'll need to demonstrate that your actions are maintaining more C on the landscape than if you did nothing (at least in the programs I know about). That can be difficult, but very good if you can get something going. I would look to the local schools for forest mensuration classes and hook up with an economist for the credit question.

What's the most interesting anomaly you've found whilst doing this job?

[CamPlaysOverWatch](#)

A decapitated wild boar.

It was strung across the trail by a local hunter upset the area was set aside for conservation.

On a more intellectual note, finding species way outside of their normal range is always fun, like a "what the heck are you doing here" sort of thing. There is a population of yellow-cedar, a species specializing in very wet environments, that is for some reason in eastern Oregon, the high desert, a remnant of the last glaciation. How it has hung on is anybody's guess at this point.

Have you ever worked with someone or do you have knowledge of anyone studying the effects of climate change on the microbiology of such systems?

I ask because of the possibility that bacteria might not be as adaptable to climate change as first thought - <https://www.sciencedaily.com/releases/2016/03/160315085942.htm>

How could this affect/be affecting the ecosystems you study?

[thatsconelover](#)

I don't, but it could be fascinating. Bacteria are certainly more sensitive to temperature changes than many organisms.

In my current area, very little is known about the bacterial-arboreal relationship beyond nitrogen fixation. Great question!

Do you and your colleagues anticipate changes in how your research is conducted/funded with an incoming administration that has openly questioned climate change?

[TheWorriedWart](#)

Yes, and we're seeing the effects informally already.

Funding is already tight for Environmental research, with success rates at NSF around 8% last I checked, lower for some programs. That favors established programs that have a lot of history, making it difficult to expand. It also makes it hard to establish new labs.

I've started looking more and more at private funding, NGO's, etc, and had some success with places like National Geographic for our Glacier Bay work. But those are often smaller and difficult to support graduate students on, so the options are limited.

All that said, it is a good time to do research - sharing data is incredibly easy, satellite data is free and plentiful (in most cases), collaboration is easy via email and encouraged, and technical skills are easy to develop. So I don't see research output on a per person basis going down, but I do worry about how the declining public money will narrow research, limit training opportunities, etc.

[One study has shown](#) that the rate of growth in atmospheric carbon dioxide has slowed, despite an increase in CO2 emissions from human activity, due to an increased uptake of the greenhouse gas by the planet's plants.

[Another has shown](#) that over the past 110 years some climate models over-predicted the amount of CO2 that remains in the atmosphere, by about 16%.

[Another study](#) has shown that melting permafrost has released large amounts of methane.

Taking these studies into consideration, is it possible that we may still be able to halt, slow, or reverse, the currently inexorable increase in global temperatures? And if it IS possible, what steps would that entail?

[drewiepoode](#)

It's a complicated system, certainly. Southeast Alaska, one of the densest forest biomes (in terms of carbon) in the world, is also apparently growing rapidly. We estimated that, despite disturbances, we're accumulating about 1 Tg in biomass per year in this relatively small area in live trees - that excludes the larger carbon stock of the soil, etc. Plants will generally get more productive as temperature increases if water is not limiting (to a point), so many places will see increases in their overall productivity. We're seeing that in a variety of what we call energy limited places. Those are the areas to focus sequestration efforts on, because those are places where you're working with climate change and not against it.

Buma, B. and Barrett, T.M., 2015. Spatial and topographic trends in forest expansion and biomass change, from regional to local scales. *Global change biology*, 21(9), pp.3445-3454. (available on my website)

There are concerns that increasing disturbance rates will offset the increases in plant storage in many areas, however, for example Europe: Seidl, R., Schelhaas, M.J., Rammer, W. and Verkerk, P.J., 2014. Increasing forest disturbances in Europe and their impact on carbon storage. *Nature climate change*, 4(9), pp.806-810.

Also that declining C is rapid (e.g., a fire with little recovery) but accumulating C due to growth is slower even in areas that are accumulating carbon with climate change: Koven 2013. Boreal carbon loss. <http://www.nature.com/ngeo/journal/v6/n6/abs/ngeo1801.html>

Overall, of course it's possible to slow the increase in global temperatures. We (i.e., the globe) just have to want to do it, and stop using so much fossil fuels. I say that knowing full well that's highly unlikely, to say the least, but it's important to at least realize it's a choice, it's not inexorable. Sometimes I think people forget that. But I do think it's going to come down to using less fossil energy if that's going to happen. It's a relatively "direct line" to global climate (carbon) so it's the knob we need to be dialing down.

There are a lot of things that could accelerate carbon accumulation/temperature rise, and probably things that could slow it. Unfortunately there seems to be more of the former than the latter.

Currently around my hometown in the Beaverhead-Deerlodge National Forest there is a massive issue with Beetle-Killed trees. To the extent that the forest is more red than green. What initiative should we take to prevent further infestation, and most-likely, a forest-replacing wildfire?

[Vindit](#)

First, I'd ask why you want to prevent a "forest-replacing" wildfire. Those forests naturally burn, and the natural fire regime in those areas (esp. the higher elevation forests) is the rare but "stand replacing" (i.e., everyone dies) type. So a big fire isn't necessarily the end of the world. Just seems to be from our short-time span perspective.

As for the infestation, not much to do to stop it, but while it's atypical in terms of extent it's not an invasive species. I can say that, having worked in many beetle killed forests, you just have to walk in and you'll realize the forest isn't dead. It's really not the major insult the way it appears superficially, though it does impact the scenery.

And there is little evidence of beetle action actually causing more fires, despite what it looks like. When I started out in the sciences that was the big question, and the general thought seemed to be that fires would be much worse, but there has been little evidence of broad-scale changes in fire due to beetles yet, though for individual fires sometimes there are noted interactions. That is probably because while the needles are dead and slightly drier in that red phase, the main control on fire occurrence is weather, not needle moisture. So in a bad weather year you'll get fires regardless. And once the needles fall off (2-5 years) there is less fuel for big fires.

All that applies to higher elevation forests - spruce, fir, pine. For lower elevation, more widely spaced Ponderosa forests, big fires can be devastating. Those are areas that are generally adapted to frequent ground fires that we have suppressed.

Check this out, it is available various places as pdf on Google Scholar:

Hart, S.J., Schoennagel, T., Veblen, T.T. and Chapman, T.B., 2015. Area burned in the western United States is unaffected by recent mountain pine beetle outbreaks. *Proceedings of the National Academy of Sciences*, 112(14), pp.4375-4380.

Wat would be the effect of the States not investing in climate change for 4 years, do you think?

[MissingFucks](#)

We can back up work and be creative, people have been operating on shoestring budgets for a while. A bigger and more scary loss would be the loss in continuity of measurements - yearly datasets on sea ice, for instance, or forest cover. If we miss a year, that year is gone.

Thanks for answering questions! I'd like to know : if you could only get one point across to the general public, what fact do you feel everyone should know regarding water resources?

[SixVISix](#)

In the US:

It takes about 13 gallons of water to produce one orange, plus the energy resources to transport that orange to your house. For those of us getting oranges and citrus (and almonds) from California, that's taking water from a drought affected, dry place and moving it at great expense elsewhere so we can have a sweeter breakfast.

Think about the droughty situation in California, the fact that the Colorado River (which supplies much of Cali's water), and that we get most of our food from Cali... water is a big issue.

Globally - some places will get more, some less. But all places need water and it's very difficult to move water around.

How do you keep from getting despondent about the way we treat our environment?

[Iammaddramma](#)

Go outside into the woods, surrounded by big trees that are centuries old. I think if people were more personally connected to their natural world they would both fight harder and probably breathe a little easier that life will find a way (cue dino music) to survive.

How much does your research rely on data from NASA? Do you have any insight on what the trump administration means for this kind of data collection?

[Loopy565](#)

I rely on NASA quite a bit for a variety of data. It is hard to overstate how important their work is for the ecological community, as it provides a perspective which simply isn't available from multiple plots or ground based data. I don't have any more insight than anyone else on what will happen, as it seems to shift from day to day, but any de-prioritization of earth observations from NASA would be devastating.

Our ability to really handle the types of big data coming from satellites is really just emerging as computing power increases (I've been using Google Earth Engine some - it's awesome!) and techniques are improving. And of course our issues are global in scope and we really need the spatial perspective satellites provide.

To threaten that data source now is scary. I've heard there proposal is to move earth observing responsibilities to NOAA, which is not an independent agency (as I understand, NASA is independent of the executive branch, NOAA is under the Secretary of Commerce), which opens up the science to political pressure even more so than it is now. So I'm concerned.

How many years of schooling did it take to get where you are? What degrees do you have? Can you make a decent living in environmental science?

[ZeroXephon](#)

2 years for Masters (unrelated topic, but likely helped in admissions, jobs, etc). 5 years for PhD. I did not do a postdoc. I had a lot of help from the NSF EPSCoR program in Alaska, which supported part of my salary for my first few years.

Decent living - yes, of course. You can make an amazing living in ENVS. By that I mean your work can take you to amazing places, with amazing stories, and you can live in amazing places. You won't make a ton of money, but you will likely have a better life. Certainly I had all sorts of interesting jobs (mountain goat tracker, Hawaiian conservation, etc) which paid next to nothing but were totally worth it.

Easy for me to say, and exponentially harder with a family. But it is true, especially now as upward mobility is harder and harder to come by, that a focus on experiences is potentially better than a focus on dollar values.

If you want to do both, a Masters is the new Bachelors, and be ready to move around to find a spot.

Trump and his stance on climate change being a hoax. How will this affect your work and what measures are being taken to allow its continuance?

[LG-Transformed](#)

Eh, Trump can deny all he wants, the instruments say otherwise. So it won't affect the work. But it will affect funding, see the other responses there.

This is a good point to rant about the hoax thing. It's a fundamental misunderstanding of both the motivations and goals of scientists. If you could publish a study showing climate change science was wrong - just one that held up to scrutiny and was comprehensive - you would have made your career. science THRIVES on those iconoclasts. Upending the paradigm is a dream! There's no conspiracy and, more importantly, there's no motivation to have a conspiracy.

Second, we get into this field because we like the earth... so if it warming was all of a sudden called off, I'd be stoked. But we see no evidence of that.

Dr. Buma, thank you for doing this AMA.

I and my colleagues have been working with GIS data of Alaska wildfires to study effects of human interaction and fire suppression methods, and how it's been changing. We would like to incorporate indicators about the health of the local trees. For a simple example, if there is a lot of dead trees, I would expect the fire to spread faster.

What would you recommend that we focus on? Do you know of any GIS data of such indicators for Alaska?

[weaselword](#)

As [u/Trailbear](#) said, NDVI is probably a good start. The USFS and State do aerial surveys, but they are limited in extent and spatial accuracy (which may or may not matter depending on the scale of your work).

Are we being lied to about global warming?

Particularly around the possible outcomes. If we took corrective action right now I understand that we're still going to experience a rise of ~3 degrees.

Are we past saving civilization now, and just hoping to save our species?

[dirtsunshine](#)

People are clever. Civilization will survive and adapt, though local civilizations may not (e.g., very warm areas, very dry areas). I think it's alarmist to go to that extreme and is probably counter productive in the end. But extinctions of "non-economically viable" species, e.g., species we don't care about? Certainly. I certainly do NOT think the threat of climate change to the world as a region is overstated. And perhaps the most threatening things aren't those we can predict now, like longer heat spells killing folks in cities, but those that will emerge from a novel combination of things we didn't expect and plan for, the "unknown unknowns."

Fellow Alaskan here, out of Anchorage, and your area of study instantly reminded me of the massive wind storm we had a few years back that caught us in the fall, uprooted tons of trees, did a lot of damage and so on. Many outlets at the time contributed it to an unusually warm fall and the ground not being frozen enough to withstand the seasonal winds. If this is indeed the case, do you suspect these kind of events will become more common as we keep getting hit with warmer winters?

We had so little snow fall here in Anchorage last year that it's been pretty prominent in my mind. Not in a doom and gloom sense, just in a eye opening way once I thought back to how I remember winters being when I was a kid versus now.

[RendiaX](#)

I do think they will be more common, and I think this is an emerging aspect of climate change that hasn't got a lot of press yet. The lack of snow is caused by just a slight warming of course, on average from -1 to +1 C in the winter (of course, year to year variations occur, but on average and over broad areas). That isn't much. We're always focusing on big changes in temperature, but there are "special" temperatures that cross important physical or biological thresholds, where a little bit of warming causes a lot of change - the freezing threshold is one of those.

If you look at a map of where winter temps are currently right about 0 degrees on average (fig 1 here: <http://www.brianbuma.com/s/Buma-et-al-2016.pdf>) it's a pretty big area. Coastal Alaska is sort of a canary in the coal mine right now, one of the first areas to cross that threshold. And we're seeing all sorts of things - 400,000 ha of cedar death, more uprooted trees like you say, etc. So yes, all else being equal, storms that bring rain and wind instead of snow and wind will cause more blowdown I expect.

Is planting a ginkgo or other ancient species in your yard a good hedge against the erratic/extreme weather and migrating bugs that come with climate change? If so, what are some other species that

have a better chance of survival from extreme or abnormal conditions? (I live in the Great Lakes region.)

[LudovicoSpecs](#)

I don't know if you can count on that. Part of the problem with CC is that new issues are emerging, new pathogens, new dynamics (like the loss of snow leading to increasing tree death, <http://www.brianbuma.com/s/Buma-et-al-2016.pdf>).

Certainly some species are more sensitive to extreme conditions than others, and if you're doing this in your yard you have some latitude in what will survive - you don't have to worry about competition with other plants. I'd encourage you to talk to the local USDA Extension Agent or the local NRCS office or the local university to get some advice on specific species.

Redditor from Fairbanks, AK here. Seeing as our seasons bring some of the most dramatic changes not only in temperature, but also hours of daylight, shouldn't ecosystems in our area be adapted for unpredictability and variability in climate?

[jcmoney18](#)

In some sense yes. The areas where climate is expected to go completely outside its historical norms are mainly in the tropics, where conditions are so consistent currently - a few degrees there is fundamentally new. There was a recent study on that comparing areas around the world that got a lot of press - highlighted that equatorial areas will see a fundamentally new climate, not just an altered one.

Interior AK - yes, those species are well adapted to variability. Fires are an issue though. And in southeast Alaska, where I am, it's not the temperature rise per se, but rather that we're going from snowy winters to rainy winters. That's a fundamental shift which is causing mass mortality. You have a bit of a cushion in that sense. However, permafrost melting is an emerging issue that is affecting forests in a variety of ways, mainly by influencing drainage (increasing drainage). That dries the soil, and changes how fires burn, how much soil is lost, etc.

Recent paper on that, it was in ADN: Buma B, Hennon PE, Harrington CA, Popkin JR, Krapek KR, Lamb M, Oakes LE, Saunders SC, Zeglen S. Emerging broad-scale mortality driven by climate warming and loss of snowpack. *Global Change Biology*. In press.

Alaska field scientist here and occasional UA adjunct. What large mega fauna changes are you witnessing? I've heard of big changes in the biogeography of moose mainly moving north. What forest species do you see having issues?

[Fossilhog](#)

Down here we have moose moving into town this year. One noticeable issue is warmer winters causing changes in bear behavior, difficulty hibernating, etc. Snow pack is especially important for brown bears, and there hasn't been a lot. Deer are going nuts in the warmer winters though, much higher populations. That could feed back to impact forest regeneration (it has in many forests where large carnivores have been eliminated, for example). We have those around still, so there's a bit of a buffer.

The soil observation is interesting. How much of that is "normal," in that it happens from time to time, like a forest fire? Also, at NOAA they talk a lot about the beetle problem. Does that affect your area of study, too?

[YoursTroolee](#)

The Beetle problem - yeah, they get a lot of credit for re-inventing music but are a bit overplayed. Ha.

I have done quite a bit of work in mountain pine beetle forests in the Rockies, and there are similar outbreaks in Alaska. The bark beetle phenomena is driven by only a couple genus of beetles, and in particular the *Dendroctonus*. In coastal Alaska and south central Alaska, the spruce beetle (*D. rufipennis*) is endemic and has caused major outbreaks on the Kenai peninsula near Anchorage, where it's fairly dry in the summer. Where I am currently they are easy to find - just peel the bark from a

dead tree - but don't seem to reach outbreak status. That's likely because the cool summers and lack of dry periods mean slower development and relatively resistant trees.

The soil temperature thing - anytime you reduce snowpack you potentially cool the soils in the winter. In wildfires that may occur, depending on the size of the burn. Sometimes you get more snow in burned areas if it catches the snow, but in large patches wind can scour the snow away. Regardless, regeneration of the forest will limit that effect. Climate warming is a much more fundamental, baseline shift with obviously longer lasting effects.

Hi! That's good work that you're doing.

I wonder, with Trump's statements regarding NASA's Earth Sciences division, do you fear that your work too might be somewhat in jeopardy or at least hampered if those plans come to fruition? I can imagine it really screwing with data collection.

[C0wabungaaa](#)

Yes, copying from another post:

I rely on NASA quite a bit for a variety of data. It is hard to overstate how important their work is for the ecological community, as it provides a perspective which simply isn't available from multiple plots or ground based data. I don't have any more insight than anyone else on what will happen, as it seems to shift from day to day, but any de-prioritization of earth observations from NASA would be devastating.

Our ability to really handle the types of big data coming from satellites is really just emerging as computing power increases (I've been using Google Earth Engine some - it's awesome!) and techniques are improving. And of course our issues are global in scope and we really need the spatial perspective satellites provide.

To threaten that data source now is scary. I've heard there proposal is to move earth observing responsibilities to NOAA, which is not an independent agency (as I understand, NASA is independent of the executive branch, NOAA is under the Secretary of Commerce), which opens up the science to political pressure even more so than it is now. So I'm concerned.

I too think the die-offs from lack of insulating snow is an interesting interaction. Do you think that there are any communities or ecological interactions that are known and studied, but are crucially underrepresented in the "mainstream" media in its possible effects on climate change? I'm always wondering if changing climatic conditions affecting something like mycorrhizal communities more quickly and drastically than the trees themselves. Do you think there are cases of devastating ecological changes that have already occurred (or are occurring) and are known, but are almost entirely glossed over?

[flapjackncoke](#)

Of course, but that's somewhat inevitable. There is a huge bias in favor of what is reported in favor of highly visible phenomena in areas where people live, especially the US.

Our work on cedar mortality is in an area that contains as much carbon as 8% of the lower 48 put together, but very few people live here (maybe 100,000 in a place the twice the size of Florida with hardly any roads) and so nobody notices that 400,000 ha has died.

Major issues that need to be reported more in the worlds forest: -Cryptic deforestation in the Amazon.

-Fires in tropical peatlands (one fire season in Indonesia alone released carbon equivalent to about a 1/4-1/2 of global fossil fuel emissions).

-Emerging disturbances like cedar decline that are tied to truly novel things, like a switch from snowy winters to rainy winters.

-Emerging processes exactly like you mention.

For a map of the cedar decline: Buma B, Hennon PE, Harrington CA, Popkin JR, Krapek KR, Lamb M, Oakes LE, Saunders SC, Zeglen S. Emerging broad-scale mortality driven by climate warming and loss of snowpack. *Global Change Biology*. In press.

<http://www.brianbuma.com/s/Buma-et-al-2016.pdf>

BC is currently working on their second major study on assisted migration to deal with climate change (<https://www.for.gov.bc.ca/hre/forgen/interior/AMAT.htm>). It seems like these large scale die-offs of the high-latitude coastal ecosystems, while devastating, will provide researchers with an opportunity to study tree species that are better adapted to the current climate (either survivors or planted species).

Is assisted migration research being conducted in Alaska to help foresters manage and adapt their strategies to mitigate the effects of climate change on our future forests?

Edit: link to assisted migration trial.

[idroveanxi](#)

It is and it isn't. The policy of most forests is to not do assisted migration, as it's seen as too drastic of a step. So the BC research you mention (that exact study, in fact) has been quite useful. That said, the concept of range edge is fuzzy. A Masters student of mine did amazing work documenting the northern edge of yellow-cedar and found it to be quite scattered. That allows for experimenting with migration while still staying within the bounds so to speak.

It is something I'm interested in. I've published modeling work exploring how planting new species might maintain A forest at the expense of THE forest, which is useful for some ecosystem services. The real challenge is you can't plant those new species until the climate is suitable, but other species are already dying at that point, so there's a temporal gap.

You mention large areas of deadfall. What is the best way to deal with this to minimize CO2 release into the environment. Harvest burn in a power plant, make pulp out of it or?

[Wheatking01](#)

It really depends. If it's accessible, then one could offset fossil fuel emissions by burning it instead of diesel (say). Building with it is probably the best, as that will preserve it inside a building for a century potentially. But much of these areas don't have road access (and even if there's a road, operationally you can't get too far from the road), and building roads/bridges/culverts/infrastructure is far more destructive.

What are options for artificially insulating the soil, as a replacement for the natural snow these areas are no longer receiving?

[yeracnitsua](#)

Not sure if there are viable options. And to do it at scale would be very difficult. What did you have in mind?

I'm not sure it's worth it anyway, if the trend line is going to low/no snow. Time would be better spent focusing on preserving landscapes likely to survive and thinking about what the best places for conservation will be 100 years from now and focusing on them (rather than current best sites).

I know nothing about your trees, but I studied a lot about the amazon and their trees and how it's a carbon sink and as there is less flooding (because of dams) those adapted trees are dying. So like I said I know nothing:

The trees that die off in Alaska due to lack of snow how much carbon do they hold, and what do you suspect is being release?

what is the percent of illegal logging(is there?) that's contributing to deforestation compared to environmental effects?

Remind me to share with my professor she will love this! Thank you!

Edit: spelling.

[generalswanson](#)

The die-off in Alaska doesn't seem to be reducing total biomass, which is good, so little carbon impacts. But significant biodiversity impacts - there are only a handful (like 4 or 5) dominant tree species and one is rapidly becoming rare in many areas. We don't know the total implications yet, as this is really emerging research.

Not a lot of illegal logging, it's US Forest Service land and private land...

Who do you work with? I'm always happy to make new connections.

I have a high school kid that might be interested in work like this. What was your field of study in college?

Also, are insects like the pine bark beetle part of your research?

[pantsmeplz](#)

College- I was a biology BS/Chem minor, with most of my emphasis in ecology (though mainly organismal, like fish and lizards). It's a great degree because it's a good base to go a variety of directions, since you'll no doubt refine your goals and may go in a very different direction by the end of college.

Yes, I've done quite a bit of beetle related work. It's hard not too in some parts of the country.

What are you seeing in the way of invasive species in Alaska? Are invasives impacting habitat quality for other species?

[PM_ME_YOUR_GSDs](#)

Not a lot of invasive species up here thankfully. It is difficult to invade relatively harsh environments, because it's difficult to find species that can handle it and many species/genus are distributed across the entire boreal region. There are a few, but nothing compared to invasive species elsewhere.

Most invasives are from similar climates but dissimilar regions, like Mexico to Hawaii. In Hawaii on the other hand, that was my entire job.

Sudden Oak Death. What gives?

[Lucid Bolt](#)

Ha. I can best direct you to others. Email Dr. Ross Meentemeyer, Whalen Dillon, or others in that group, they are great people and very knowledgeable. There are also lots of folks in California that know it better.