**Sugar Pine**

*Mortality and management*

* Big challenge is teasing apart disturbance-buffering effects of climate from ownership or management history (*e.g.,* in some regions all high-elevation sites are wilderness – is it the management or the climate that’s leading to patterns of mortality there?)
* Begin by parsing by land ownership class (private vs fed), looking at patterns of mortality using FIA estimation
  + *Did some of this already, see doc worked up in Feb*
* Within Fed plots, break out by treated vs. not treated (probably using FACTS database), build quick individual-based mortality model to see whether treatment has an important interaction with size or disturbance (e.g., drought/beetles) on mortality\
  + Size, competition, baseline climate, drought anomaly predictors
* *Question becomes*: There’s less drought mortality on private land. Is that due to climate or management differences? Are there management treatments on Fed land that produce the same mortality patterns as we see on private lands? Or is it a climatic effect (*i.e.,* are private lands more resilient to drought through topographic and microclimatic buffering, as we see in sage-steppe habitat elsewhere in the West)?

*Tree rings*

What unique aspects of the sugar pine dataset can we leverage to do more than a simple space vs time test?

* High geographic and climatic sampling density
* Tree-level competition data
* Decent estimates of recent mortality (from dead ba counts)
* Excellent spatial coordinates for every tree
* A multi-year drought event in the past 20 years

One thought here is that an intense multi-year drought will have a pretty different growth signal than slow secular warming (like we leveraged for PIPO analyses). We could use the recent drought, which is also a survival filter that all our sampled trees passed through, to test similar questions about how climatic disturbance shapes spatial vs temporal growth patterns.

One potential hypothesis is that drought temporarily “breaks” the spatial growth responses – this would happen if there is a strong gradient in populations’ drought sensitivities, which we should expect (*see figure drawings in notebook; also speaks to energy-moisture limitation switch*). It would be interesting to see if the same spatial response that we find pre-drought is still present during the drought event, and how long afterward it takes to reform. How do subsequent beetle outbreaks play out in that context?

* Drought info from GRIDMET across range, mostly constrained to CA but crept up into OR
* Might find signature of past large-scale drought events in timeseries, which would be cool

**Forest community trajectories**

*Spruce-fir manuscript*

The paper has been reworked to be framed largely around subalpine forest vulnerability, with the larger framework being a useful tool. I think this works well for this paper; the thought would be to follow-up with a generalized conceptual piece on the framework itself (below).

Plan here is to crank forward and get the paper submitted by early September.

Potential reviewers…

* Rupert Seidl
* Kim Davis (friendly review?)
* Bob Shriver (but maybe COI with Dave)
* Janneke HRL?
* Tyler Hoecker?

*Generalized framework*

Idea here is to generalize our trajectory framework for more systems, n-species, etc. It’s important that we don’t just do a Seidl & Turner redux; what we’re doing here is presenting a method for actually determining what trajectory forests are on. We take **known** and **knowable** information (*i.e., abundance and basal area trends*) and organize it in a way that is interpretable and usable. The hope would be to turn this into a Frontiers or Trends-style piece; notes about framing below:

**Framing for multi-species trajectory paper:**

Ecological change is happening; that’s inevitable. Major changes are baked into the climate-environment system, regardless of what management actions we do or don’t take. However, it’s critically important for us to slow the rate of those changes so that both ecological and human social/cultural/economic systems can adapt. So, we need a way to identify where and when systems might be undergoing or will undergo major changes. In forest systems, much of this change is catalyzed by disturbance; however, we need to consider non-disturbance-related climate-driven change as well – both the fast and the slow.

We’re presenting a framework building on Seidl & Turner that takes **known or knowable** information (e.g., species-level abundance and basal area trends) and turns it into ecosystem-level trajectories. These can then be used to identify resilience hotspots, prioritize areas for intervention, and assess where change is happening too quickly and too broadly to fight.

* How do we deal with loss of function? In systems that have high functional redundancy, a 10% change in composition might not actually matter much.
  + Can we **weight species by functional uniqueness**? Build the framework so that it inherently prioritizes species that contribute unique function/structure?
* True resilience versus acceptable resilience 🡪 example of eastern chestnut… were eastern forests resilient to invasive chestnut blight? Well, there was massive compositional and structural change… but there’s still forest there that supports roughly the same species diversity, right?
* Harold brought up idea of adding a third, “function” dimension to framework… how would that play out?

**Plots, planes, pixels**

The current difficulty is that the MPB outbreak NW of Klamath Falls that Danny identified for us largely falls in the first round of annualized plot visits. As it turns out, FIA crews didn’t assign AGENTCDs to dead trees during that inventory – so we don’t get any tree-level disturbance information. While this is an interesting point of comparison, it does present a hurdle for getting some of the on-the-ground impact information we want.

Plan:

* Dig into 2011-2019 ADS to find other MPB outbreaks in region
  + Will run this by Danny as well
* I’ll send HZ the area of interest for MPB case study; HZ will throw back raster stack or GEE script for LCMS info
  + Considerations for LCMS
    - Don’t rely on insect/disease attribution, that gets circular
    - We want everything that’s not fire/harvest
    - Check correspondence against ADS severity classes
* Goal is to get MPB case study worked up to point of composite mortality product by end of FY24 (FIA meeting in November)

*Figure/comparison idea:* at what ADS damage severity (i.e., mortality pa, or just class) do FIA and ADS and RS area estimates converge?

**Job and funding thoughts**

Important to break down options into short-term and long-term pathways.

*Short term*

We have 1-1.5 years of funding left right now, and 2.5 more available years of ORISE eligibility. That does provide some time to come up with options, but not a ton. So, two possible ideas for short-term additional hits of funding to keep things going:

1. Pitch an extension to PPP and subalpine vulnerability work; idea here is to apply the vulnerability framework to southern Oregon forests in the context of firmaggedon. We’ll have a really nice workflow and data product to id and attribute large mortality events. Question becomes: **Are these landscape-scale mortality events pushing forests into new states? Where should we be expecting forest resilience vs reassembly vs replacement if new mortality events occur?** 
   1. Two possible funding sources – Environmental monitoring grant (usually comes up in late October) or EOY $ from WWETAC
   2. Possible concern is that it’s a little premature given that the generalized framework paper hasn’t been written and PPP is still getting off the ground… but it’s a great extension
2. Harold and Dave’s DBH measurement error idea – basic thought is to use QA data from FIA to quantify diameter measurement error and see if it’s systematic (i.e., on steep slopes or for certain species/forest types). Could work up that additional uncertainty into BA change and carbon estimates; are there places and contexts in which measurement error is larger than sampling error?
   1. A good pitch for EOY $ from station or FIA – should be relatively quick to put analyses together once data are in hand. More difficult proposition would be figuring out how to incorporate measurement uncertainty into FIA estimators

*Long term*

Sounds like there could be some FS positions trickling out in the next year or so, but tough to tell/predict. There’s a good chance that they may be technical staff (*i.e.,* support scientist roles) instead of research – which could be good depending on the team and supervisor, or could kind of be a black hole. Will keep an eye out for that.

Another strategy is to start thinking about soft money funding channeled through UM or similar. This can be a tenuous route, but can also work out okay depending on whatever else we have going on. Can be supplemented with teaching as well if necessary.

I need to continue investing in network of folks here, including at fire lab – Phil, Sol, Kim, Sharon, etc.

If we get to ~6 mo or so before funding runs out (so, maybe June 2025) and nothing has materialized, we can slow burn rate of ORISE funds and maybe look at other ways to supplement – adjunct instructing, field courses, etc.

**Timeline for next several months**

**July –** finish spruce-fir

**August –** finish spruce-fir (PILA data complete?)

**September –** submit spruce-fir, crank on PPP (\*\*EOY money?)

**October –** crank on PPP (\*\*EM grant)

**November –** FIA meeting, present spruce-fir and PPP

**December – June** – bug out about jobs and stuff