**Disturbance detection project**

**Plots, planes, and pixels**

The core question here is how the data source we’re using changes the picture we get of the geographic distribution and impact of biotic forest disturbances. We have three basic ways of learning about biotic forest disturbances – plot-based data (FIA), aerial surveys for impacts (ADS), and remotely-sensed spectral signatures (Landsat, LandtrendR). They operate on different scales, have different footprints, and different levels of specificity, etc (see attached table). We’ll focus on 2-3 case studies to assess how the **detection**, **area impacted**, and **impacts** differ between these three data sources, and potentially give some recommendations for how to choose or combine data sources to make the best inference.

*Case studies*

1. Balsam woolly adelgid in the Pacific Northwest. BWA can be difficult to detect at the plot level, can persist for many years without causing mortality, and is very host-specific. This makes it the “hard” case study, and we expect large differences in detection, area, and impact between all three data sources/approaches. Geographically bounded, because BWA has a limited distribution; should also expect differences in commission/omission between western PNW (where BWA has had long residence time) and northern Rockies (where spread is active and ongoing)
2. Bark beetles in California Sierra Nevada. This is a case where impact is easy to detect, but the system is complex – there are multiple agent species, multiple host species, and mixed forest types interspersed with other disturbances and fire.
3. Bark beetles in a simple, monospecific system. Where should this be? Outbreaks in southwest? Central ID?

*Core metrics*

1. **Detection –** is the agent in question detected as present in the area?
2. **Area –** how large is the impacted area? How does it change through time (maybe?)?
3. **Impact --**  what is the forest impact (e.g., mortality, spectral change) attributed to the disturbance?

*Timeline*

After status/trends manuscript is submitted, put 40% of time toward this, 60% toward mortality modeling? Aim for summer?

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| --- | --- | --- | --- | --- |
|  |  | **FIA** | **ADS** | **Landsat** |
| **Extent** | *temporal* | 2000-2019 (for annual design) | 1970s? - present | 1984 - present |
|  | *spatial* | national | Depends on annual flown area | global |
| **Scale** | *temporal* | difference between inventories | ? | annual? |
|  | *spatial* | estimation strata; 90 m plot | variable -- watershed? | pixel |
| **Resolution** | *temporal* | decadal or annual sample | annual? | annual |
|  | *spatial* | 90m plot; individual tree | variable | 30 m |
| **Effects** | *attribution* | direct observation, trained crews | indirect observation, expert evaluation | remote observation, spectral analysis |
|  | *specificity* | variable; low specificity for dead, higher specificity for live damage | qualitative determination; variable by agent and region | quantitative determination; generic agent |
|  | *severity* | tree-level effects | variable; stand to watershed-level; binned | quantitative; severity requires context |

**Comparison of data attributes**. Red boxes roughly correspond with the attributes compared by the metrics described above (i.e., detection, area, impact).