**Slide one:**
We are planning to use the LandTrendr change detection method as part of a remote sensing strategy for regions 10 and 6
Today I will share this strategy and an example of what we are doing to prepare for this unusual survey season
The LandTrendr user interface tool will be covered in the Track 1 training session tomorrow, so I won't go into details about this tool now.
Instead, I use one product of this tool, a map showing change in NBR that has been brought into ArcGIS.

**Slide two**:
Because this is a recorded session and I want you to have important details about Landsat and LandTrendr change detection, I have listed a few things here.
We plan to use LandTrendr because it is the…

**Slide 3-4**: joke slide

**Slide five**:
I want to encourage you to ask questions now via the chat or later via email
This is a work in progress for all of us.

**Slide six**:
First: Identify your team
You will need all of these components – people with knowledge in GIS, RS, and local knowledge – and by local I mean ADS, entomologists, pathologists who know I&D and landscape patterns in your region.
This is what we have started doing in R6 and R10 – this way we can put our heads together and motivate each other. If you are missing a strong RS component, do reach out to others presenting today and tomorrow.
Although it can be overwhelming at first,
There is nobody better able to do this than you
Because you have the knowledge and interest for your area
You just need to learn a few new things.

**Slide seven**:
Here is a workflow to help us think through the season. We will be adapting it to our needs as we learn more.
LandTrendr is featured in each section, but we also plan to use high resolution imagery and possibly ForWarn if it detects our agents.
Using multiple methods can offer a check and balance – although the results may not always be directly comparable.
We are in the pre-survey part of the season so we are preparing by identifying our priority locations and agents and by practicing with LandTrendr.

(I will use one example to run through a possible workflow using LandTrendr – this is an actual example that we have been working with this past week.)
During the survey period we will gather all the observations we can, and simultaneously use satellite imagery, high resolution imagery, and ground checks to detect, inspect, and identify forest damage. The exact order is not yet clear - LandTrendr has about a 14 day lag and we don't know when we will be able to acquire high resolution imagery; teams may be on the ground inspecting some reported damage.
Also, we may be able to improve detection by LandTrendr by training the data using pixels with known agent damage. Some of this could also be done with historic data, but we have not worked on this yet.
Then, the idea is to measure, validate and report the data during fall and winter months.

**Slide 8**:
Back to preparation phase, we are working together to identify areas and agents that are our highest priorities for 2020
Here is a map of Oregon and Washington priority areas.
We are assessing what high resolution imagery we may have access to for these areas, and considering if we need to order it early for some areas
In Alaska we have identified three priority agents that are most likely detectable by satellite imagery, HSF SPB and Birch leaf miner. We still need to test some assumptions.

**Slide 9**:
For each priority agent we are adding information to a table that should help us detect the change. Using Pandora moth as an example…

**Slide 10**:
For our practice example, we brought LandTrendr results into ArcGIS for a small area
(working with a small area first is helpful bc it takes time to move large data sets out of GEE)
This area was known to have Pandora moth in 2018
Here I classified the LandTrendr data using Properties>symbology>classified to display a range of magnitude change from -50 to about -1000
I used the basemap provided by ESRI in ArcGIS as my HR imagery to show underlying substrate
The green is the boundary we used to limit our detection area.
We have a few layers in our table of contents to help us figure out what is going on (fire, forest cover, vegetation type)
Fires tend to be the very high magnitude damage (although there are low severity fires also). These two points are suspect for fire.

**Slide 11**:
I overlay the fire layer and find that they are indeed fire.
The challenge can be to find an up-to-date fire layer for your area. Examining higher resolution imagery can help too.

**Slide 12**:

Lakes and water reservoirs were showing up as change detected – circled here in blue
I had thought water was removed during image processing, but I forgot to select that option
So we fixed this for future runs.
The new tool you will see tomorrow also has an additional hydrologic layer you can select.

**Slide 13**:
We had a report that the damage circled in white was the result of a hail storm

**Slide 14**:
Close-up of hail damage on the left
Linear features (right) are generally suspect for human activity,
but may also indicate where trees are present to be affected by a damage agent
Needs ground truthing

**Slide 15**:
Orange boxes indicates area of suspected management activity…
Ideally you would have a layer indicating where management activities have occurred or are planned
So you can remove these areas from I&D assessments

**Slide 16 & 17**:
Close-up of suspected management areas.
Based on the location (harvest unit shapes) and intensity, I suspect Rx burn, thinning or harvest
Harvest activity is confirmed by looking at the high resolution imagery layer beneath

**Slide 18**:
Here, compared side by side, the harvest activity is clear.
I will want to find out what caused the offset between LT and the imagery and fix that.
If you can get an "activity" layer from your foresters, it would be handy to have this info ahead of the survey season

**Slide 19**:
For the subtle activity inside the green box and above it, it may help to look at a vegetation layer.

**Slide 20**:
Green here is forest dominated by mountain hemlock. You may want to inspect this forest for an agent, but not for Pandora Moth.
Blue signifies all the Pine species that are host to Pandora moth. Plenty of yellow change occurring within the blue area.
Blank area (upper right) has no GNN data; perhaps it's recent forest. We will assume that it may be pine.

**Slide 21**:
So, to hone in on Pandora moth we

1. apply a forest mask that eliminates all non-host areas - just pine forest is showing (plus the forest with no GNN data)
2. mask out all damage that is known to not be Pandora moth
This yellow looks like what you would expect for I&D damage

**Slide 22**:
Group them into 4 areas that appear to be related by spread pattern.
Let's pretend that we are doing this assessment this summer.
A ground truth (or fly over)
Let's pretend that ground visit was made and we discovered abundant PM in areas #2 and #3 and negligible PM in #1 and #4
We may feel comfortable measuring this LT detected damage area as PM activity for #2 and #3 (fully documenting the process and decisions that were made.)
Let's pretend that we chose to fly instead. How does this 2018 result compare to ADS?

**Slide 23**:
Flight lines are green, so you see that the survey area was well covered

**Slide 24**:
ADS basically confirmed what we found with ground survey, but let's take a closer look…

**Slide 25**:
Here is area #2. Does this match up?
Best in the high severity group
But is this good enough?

**Slide 26**:
Here is area #3. Not a great match.
What is going on here?

**Slide 27**:
Now what? This is a very real example. Gather more info…