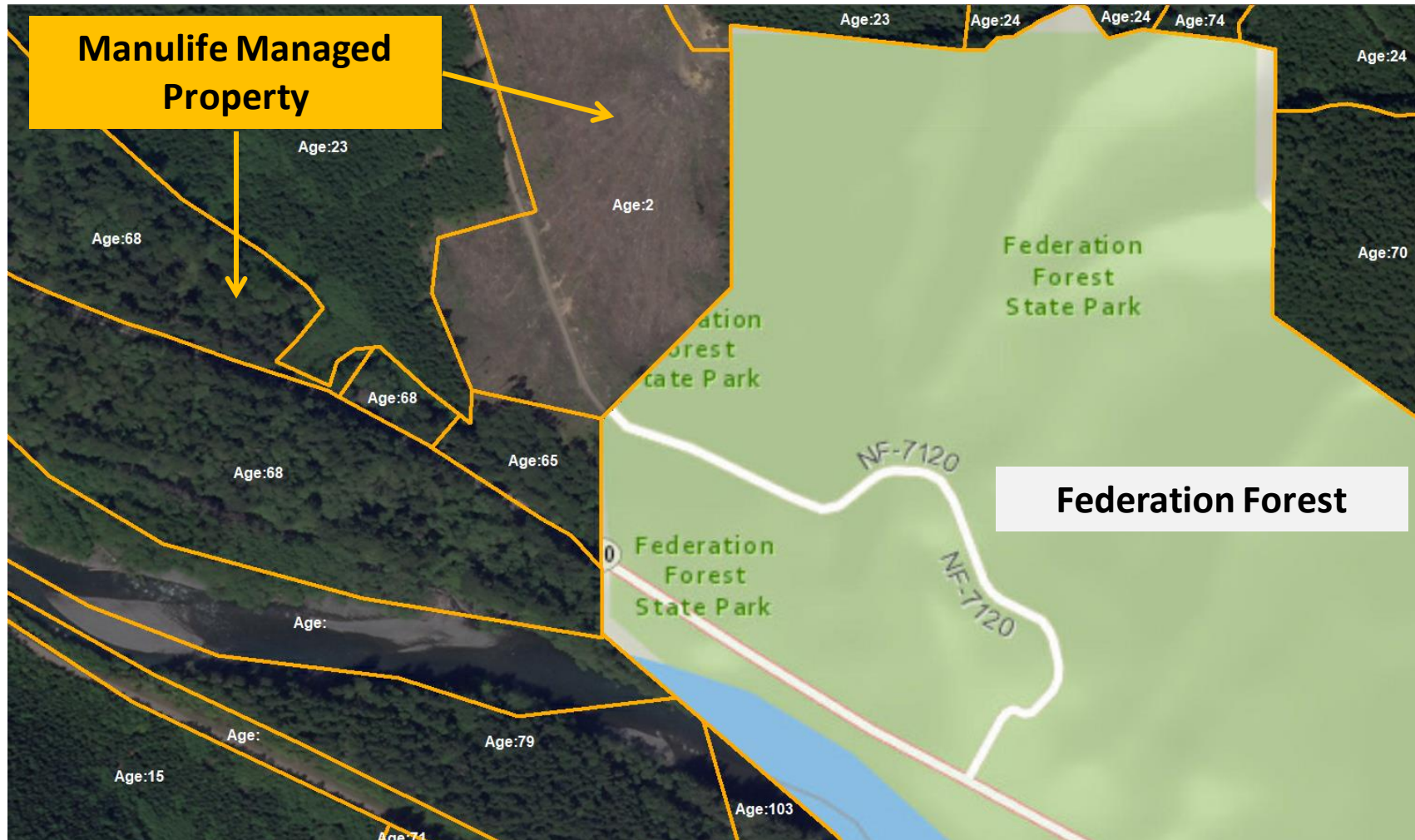


# Federation Forest Area

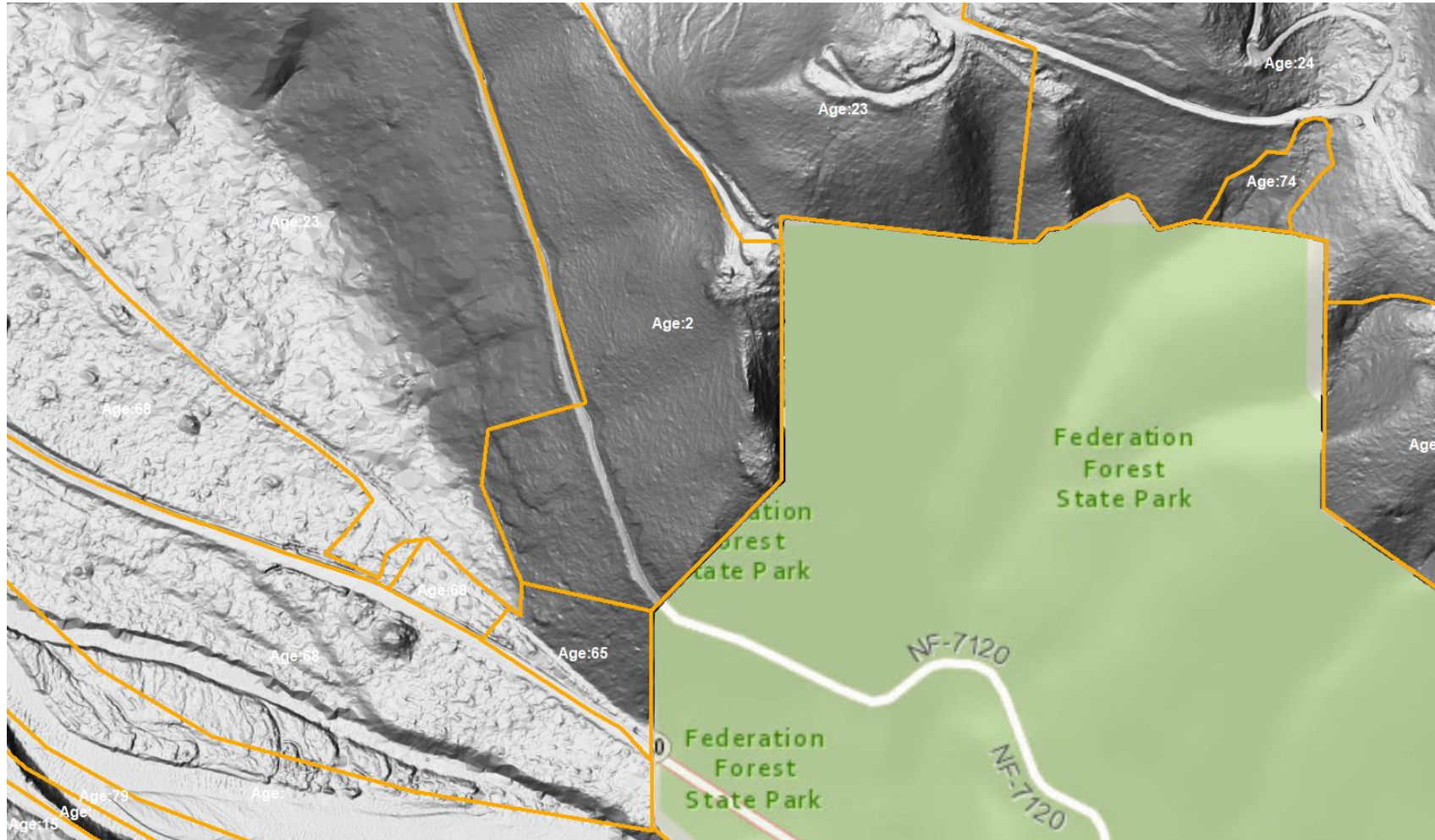


## Manulife LiDAR Goals

1. Project size was nearly 3 million acres across North America.
2. Capture high quality LiDAR data for every acre in the project.
3. Ensure that ground points were precisely captured completely throughout the project.
4. Map all identifiable trees throughout the project.

*\* The results shown in this presentation are early prototype results*

# Hillshade From DEM

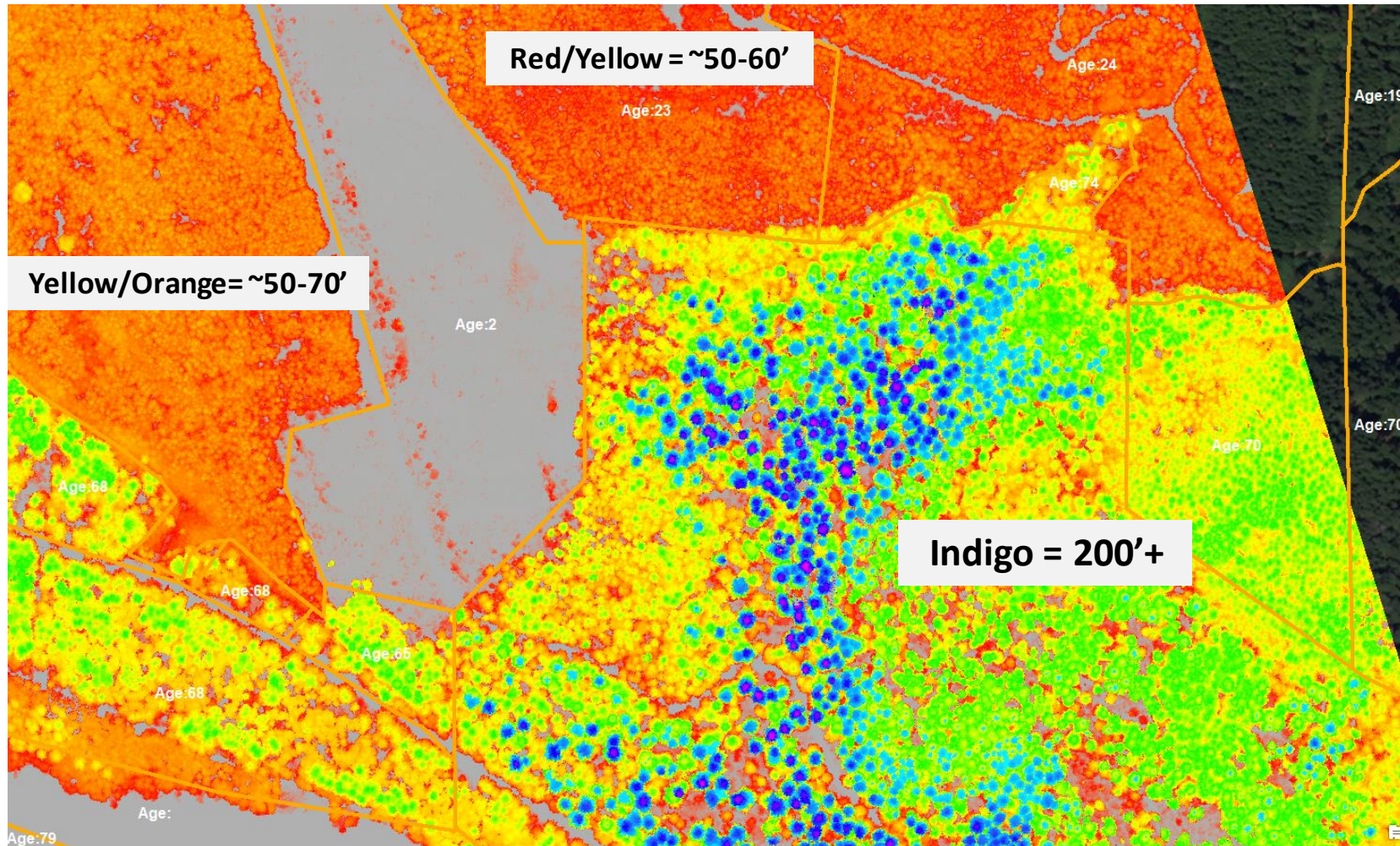


## Hillshade

The Hillshade product clearly shows the roadbeds, landings and skid corridors in some cases.

In this case the DEM/Hillshade was clipped at the ownership boundary.

# Canopy Height Model

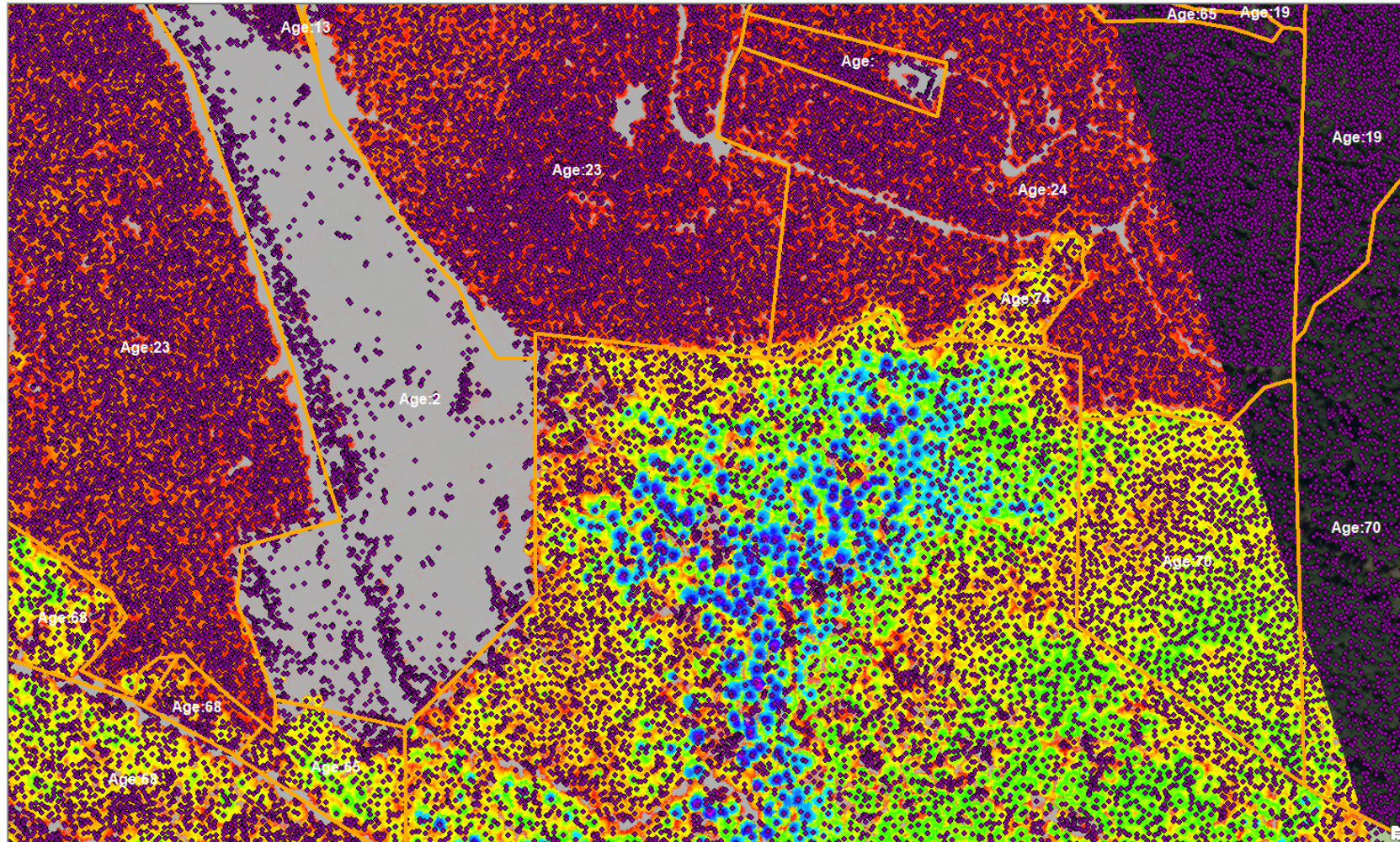


## Canopy Height

The canopy height model shows the height of the canopy across the footprint.

The new harvest on the east side of the panel that was recently planted shows the potential for extreme variation in both total forest cover as well as density. Proper LiDAR specs are crucial to property accuracy at an individual tree level.

# Individual Tree Detection



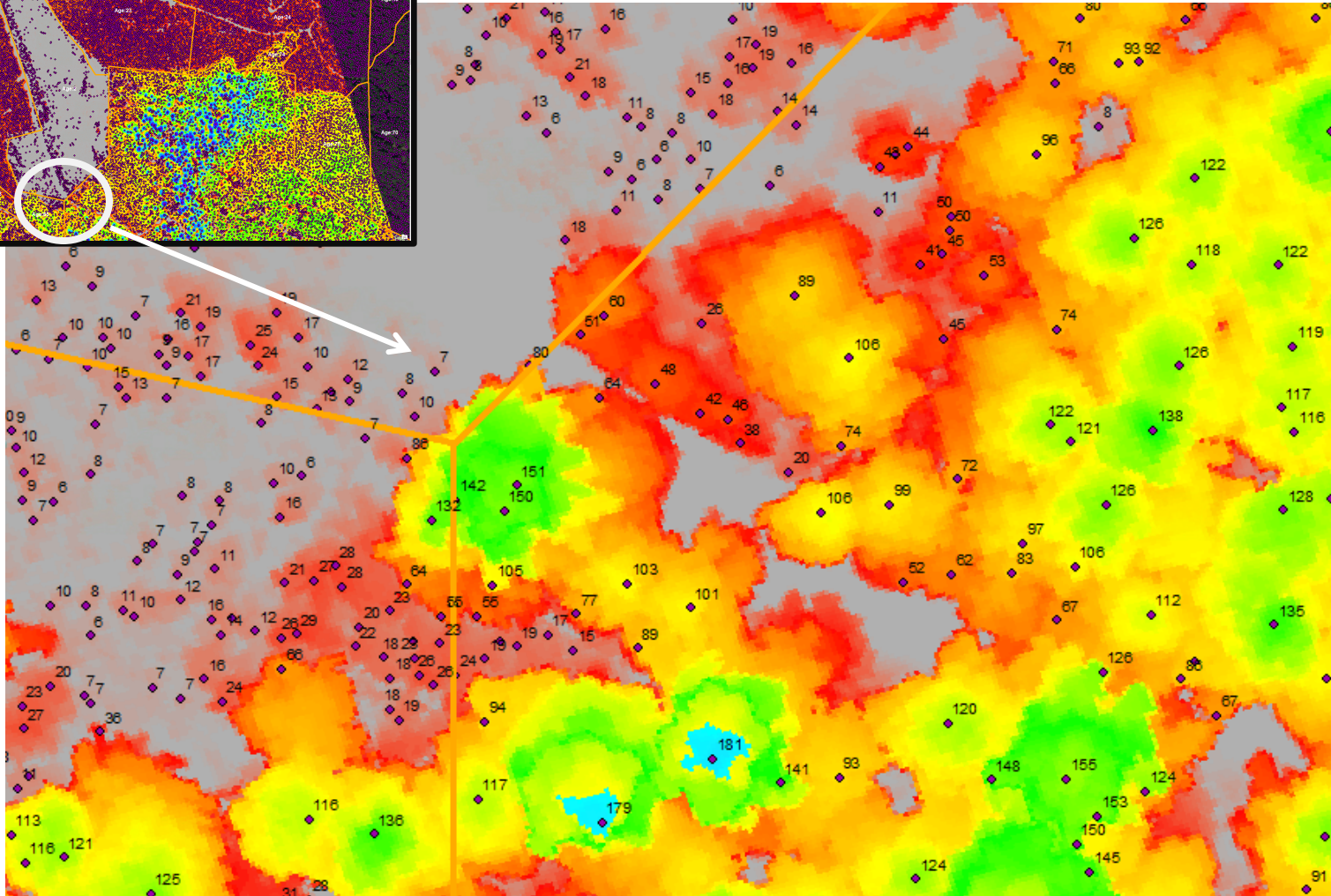
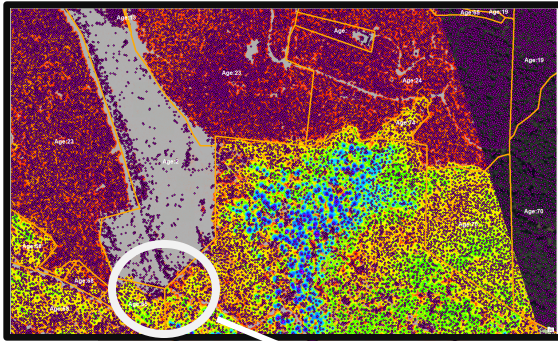
## Individual Trees

The purple dots on the map to the left indicate individual trees or undifferentiated clumps of vegetation from the preliminary analysis.

These “trees” form the basis for installing the training plots that are used to calibrate and train the AI models used for final tree detection.

There is a clear distinction on the number of trees represented on the young stands to the north and west and the old growth in the Federation Forest.

# Boundary Area



## Individual Trees

Boundary area showing heights of individual trees. When complete the biometrics data will include the measured height and canopy area as well as the modeled dbh, species, tree quality/defect, and numerous other attributes. The small “trees” in the harvest area are likely small residuals that remained after the harvest was complete.

# Inventory Implications

The implication of changing from a traditional sample-based inventory to a comprehensive census inventory are very far reaching. Here are some (not all) things to think about and discuss as it relates to this issue.

1. A census-based inventory is fundamentally VERY different once you get beyond the initial novelty to knowing where each tree is precisely located. You will be challenged to think differently.
2. You are committing to switch the principal components that are actually being measured from dbh to total height and canopy size. This is a major change in thinking that you need to be prepared for.
3. If you are going to switch to individual trees it comes at a cost in terms of data size and potentially performance. You must be prepared for this increase in size. The major difference is in tracking the individual trees. Industrial timberlands in the south and west should prepare for around 300-350 tpa on average across the project. So for each million acres total tree counts may exceed 350 million points. That is a lot of data but it is feasible with proper design.
4. What's "revolutionary" about census samples:
  1. No more blind spots. You see the entire forest including areas that were previously under-sampled.
  2. The ability to track individual tree growth(site potential) across repeated measurements.
  3. The ability to better plan harvest operations
  4. Potentially the ability to better market specific trees or species