FBRI/FPS Update

2026 Growth Model Users Group Meeting
Water Resources Education Center
Vancouver, Washington
April 22, 2026

Dan Opalach, PhD
President & Senior Forest Biometrician
Forest Biometrics Research Institute

Forest Biometrics Research Institute

Forest Biometrics Research Institute (FBRI)
Overview of the Institute

- FBRI is a 501(c)(3) nonprofit organization founded by Dr. Jim Arney in 2002
- The Forest Projection & Planning System (FPS) is the Institute's flagship software program
  - It is a combination of forest inventory, growth & yield, and harvest scheduling applications embedded within Microsoft Access
- 70+ member organizations financially support FBRI
  - Member organizations come from every corner of the industry: tribes, federal, state, large private timber, small private timber, conservation, carbon, and forestry consultants
- FBRI's Mission: Provide FPS to member organizations and assist them with forest inventory, growth & yield projections, and forest planning
- FBRI has a five-member Board of Directors
  - Ken Borchert, Chairman, Bureau of Indian Affairs
  - Bruce Ripley, University of Idaho
  - Brian Sharer, Finite Carbon
  - Marc Vomocil, Starker Forests Inc.
  - Dave Walters, Green Diamond Resource Company
- Web site: *https://forestbiometrics.org/*

Forest Biometrics Research Institute

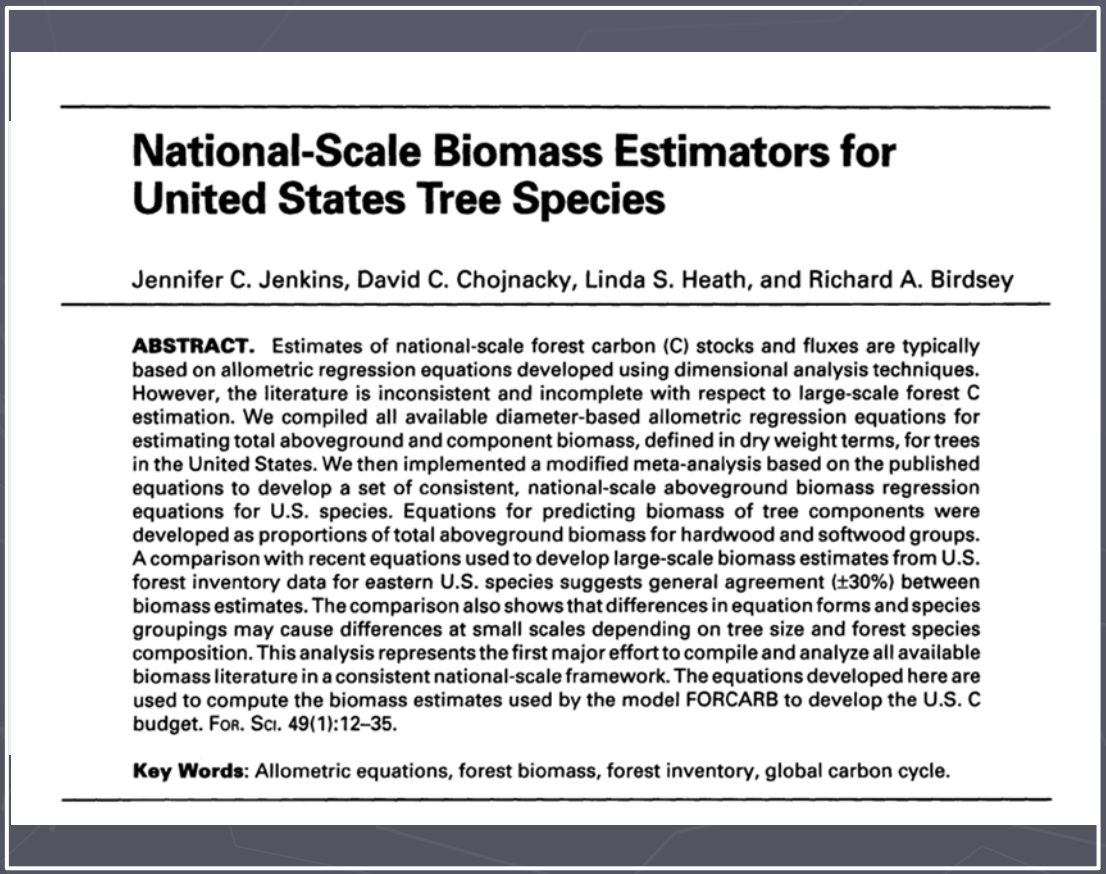
Today's Agenda
FBRI/FPS Update

- Brock Purvis, FBRI's Technical Support Manager, promoted to the position of Vice President
  - Brock is now responsible for accounting, taxes, budgeting, agreements, workshops, etc.
  - He will continue to provide FPS technical support
  - This will allow me to spend more time on Fortran programming as Brock takes responsibility for the day-to-day operations of the Institute
- Ongoing projects
  - Small landowner carbon project with Jim Mehrwein, President of Forest CO_2
  - Site productivity mapping project for the Colville Tribe
  - USDA-NRCS grant project with Dr. Mark Kimsey, University of Idaho
  - Single-tree inventory project with Idaho Department of Lands

Small Landowner Carbon Project with Forest CO_2

- FBRI signed an agreement with Forest CO_2 to help small forest landowners successfully participate in the carbon market
- The President of Forest CO_2 is Jim Mehrwein, a consulting forester operating out of Springfield, Oregon

Small Landowner Carbon Project with Forest CO_2



National-Scale Biomass Estimators for United States Tree Species

Jennifer C. Jenkins, David C. Chojnacky, Linda S. Heath, and Richard A. Birdsey

ABSTRACT. Estimates of national-scale forest carbon (C) stocks and fluxes are typically based on allometric regression equations developed using dimensional analysis techniques. However, the literature is inconsistent and incomplete with respect to large-scale forest C estimation. We compiled all available diameter-based allometric regression equations for estimating total aboveground and component biomass, defined in dry weight terms, for trees in the United States. We then implemented a modified meta-analysis based on the published equations to develop a set of consistent, national-scale aboveground biomass regression equations for U.S. species. Equations for predicting biomass of tree components were developed as proportions of total aboveground biomass for hardwood and softwood groups. A comparison with recent equations used to develop large-scale biomass estimates from U.S. forest inventory data for eastern U.S. species suggests general agreement (±30%) between biomass estimates. The comparison also shows that differences in equation forms and species groupings may cause differences at small scales depending on tree size and forest species composition. This analysis represents the first major effort to compile and analyze all available biomass literature in a consistent national-scale framework. The equations developed here are used to compute the biomass estimates used by the model FORCARB to develop the U.S. C budget. For. Sci. 49(1):12–35.

Key Words: Allometric equations, forest biomass, forest inventory, global carbon cycle.

Task 1. Update the Carbon Metrics in FPS

- The carbon metrics currently reported in FPS are not recognized for use by any of the carbon market registries
- Our first task, therefore, is to program FPS so that it utilizes a recognized standard
- As Mr. Mehrwein intends to work with the American Carbon Registry (ACR), we'll start by integrating the Jenkins equations into FPS
  - The ACR is the primary registry that officially approves and utilizes the Jenkins equations
- Over time our intention is to program FPS so that it can utilize equations from several of the major carbon registries that oversee carbon markets

PLOTS

STD_ID	PLOT	TREE	SPECIES	GRP	X_ARC	Y_DIST	MSMT	DBH	TREES	HEIGHT	H
47	1	76171	PP	..	2	2	2019	6.9	1	38	
47	1	76172	PP	..	15	4	2019	8.6	1	48	
47	1	76173	PP	..	8	6	2019	9.2	1	51	
47	1	76174	PP	..	6	7.5	2019	9.3	1	52	
47	1	76175	PP	..	5	9.5	2019	8.6	1	48	
47	1	76176	PP	..	1	17.5	2019	6.3	1	35	
47	1	76177	PP	..	15	85.5	2019	5.4	1	30	
47	1	76178	PP	..	2	84.5	2019	3.7	1	21	
47	1	76179	PP	..	12	80	2019	5.5	1	30	
47	1	76180	PP	..	8	80	2019	5.1	1	29	
47	1	76181	PP	..	7	44.5	2019	5.7	1	32	
47	1	76182	PP	..	8	39	2019	5.1	1	28	
47	1	76183	PP	..	3	39	2019	4.6	1	26	
47	1	76184	PP	..	1	19	2019	5.7	1	32	
47	1	76185	PP	..	82	140.5	2019	12.3	1	68	
47	1	76186	PP	..	72	149.5	2019	12.4	1	69	
47	1	76187	PP	..	73	151.5	2019	13.1	1	72	
47	1	76188	PP	..	71	152	2019	12.4	1	69	
47	1	76189	PP	..	69	160.5	2019	7	1	39	
47	1	76190	PP	..	73	160	2019	6.5	1	36	
47	1	76191	PP	..	83	134	2019	11.6	1	64	
47	1	76192	PP	..	16	148.5	2019	6	1	33	
47	1	76193	PP	..	17	154	2019	6.1	1	34	
47	1	76194	PP	..	47	156.5	2019	5.3	1	30	
47	1	76195	PP	..	38	156	2019	5.1	1	29	
47	1	76196	PP	..	43	163	2019	4.8	1	27	
47	1	76197	PP	..	43	165	2019	5.4	1	30	

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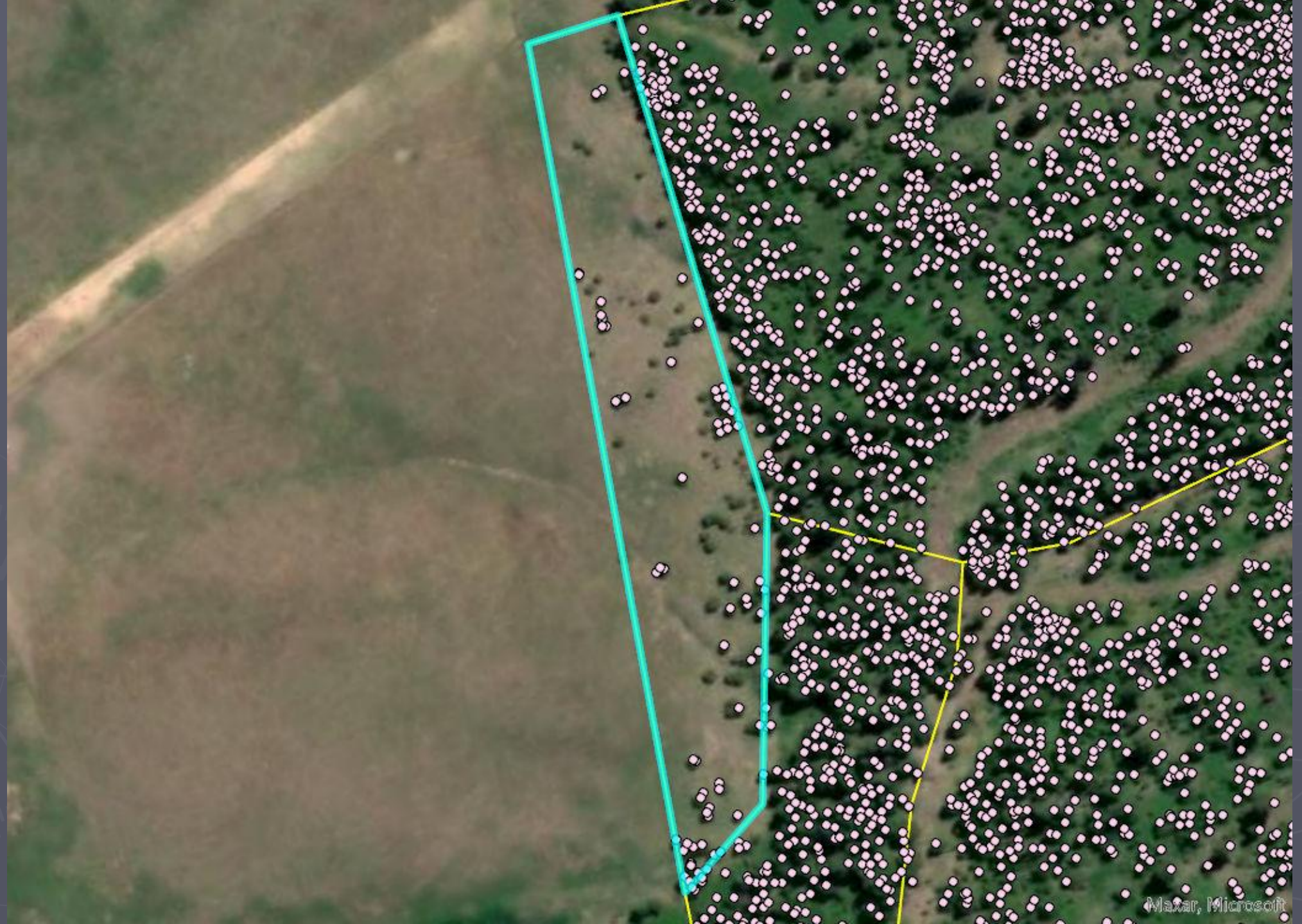
Task 2. Simplify the process for growing single-tree inventories that have XY coordinates

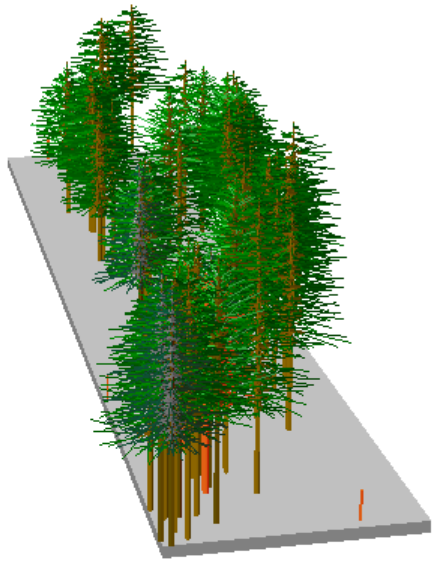
Historically the XY columns in FPS were implemented to process data from research-grade permanent plots where tree locations were measured "in the field"

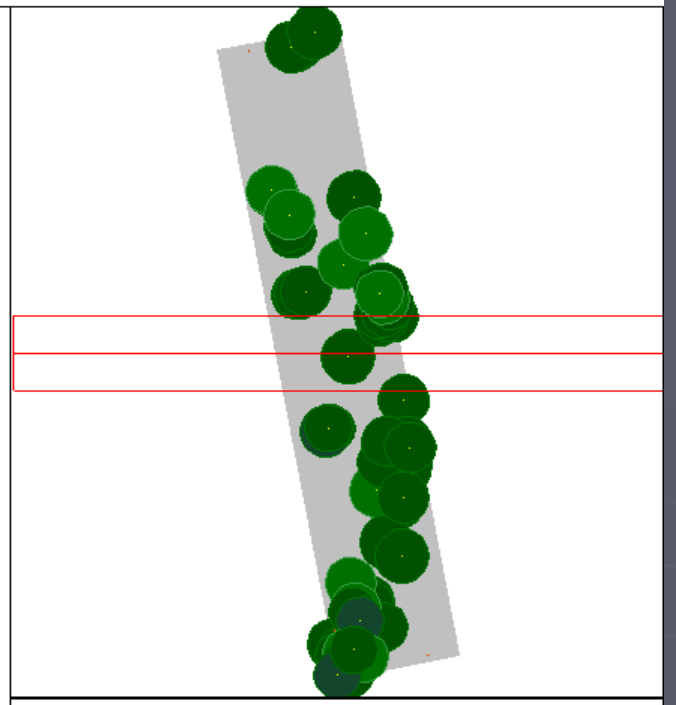
The process works, but it is cumbersome – it must be simplified so it can be used on an operational basis with single tree inventories


Maxar, Microsoft

StdID:0000000041 Regm: BASE Year: 2059 0000041D.SVS

Stand	41			
Year	TREES	DBH	BASAL	BoardGrs
2019	21	4.5	2.3	0
2029	21	7.0	5.5	71
2039	21	10.5	12.6	685
2049	21	13.8	21.6	1,273
2059	21	16.0	29.1	2,602

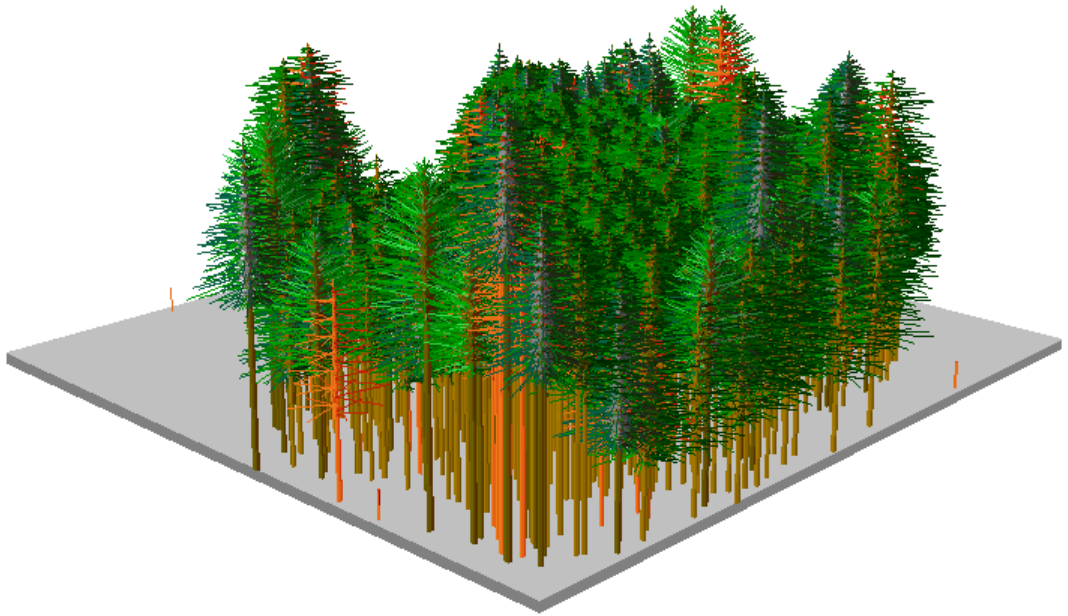


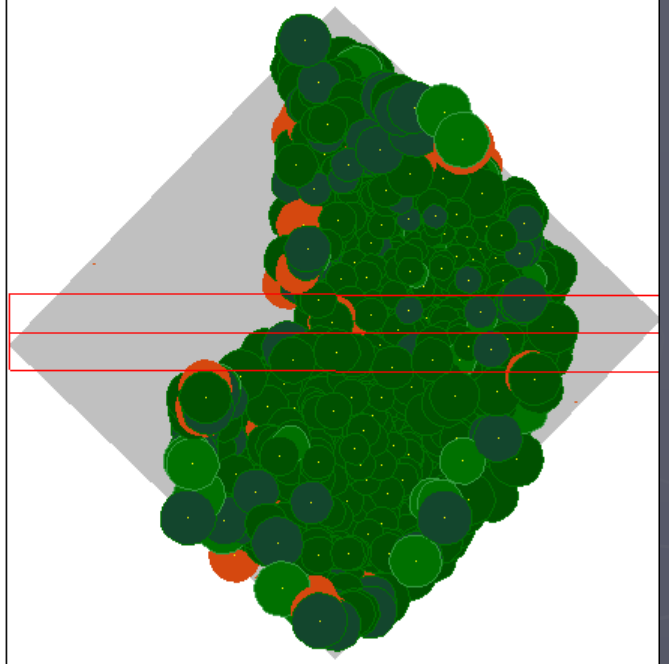


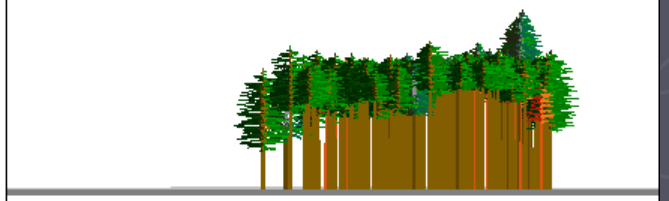

Maxar, Microsoft

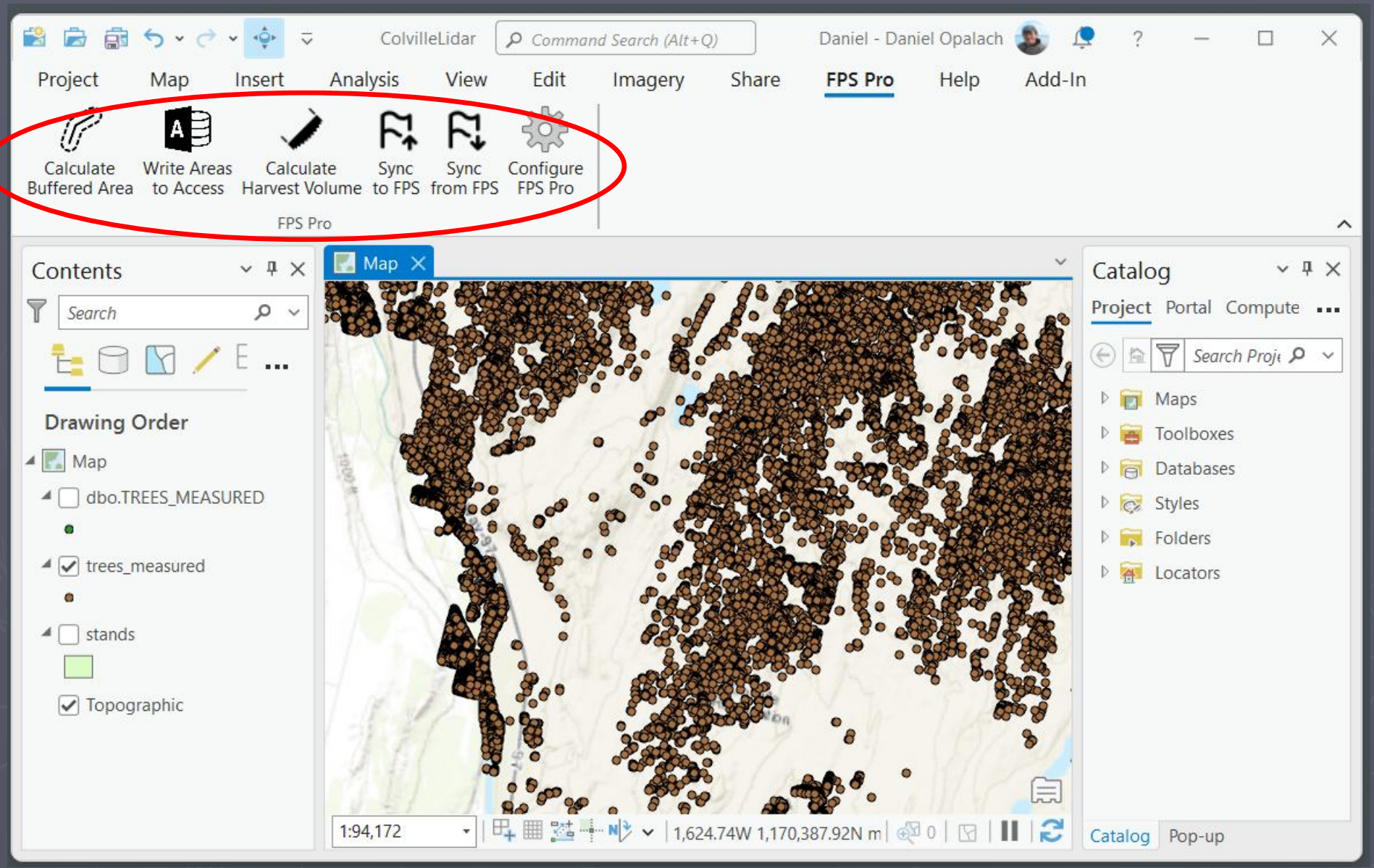
StdID:0000000019 Regm: BASE Year: 2059 0000019D.SVS

Stand	19			
Year	TREES	DBH	BASAL	BoardGrs
2019	174	5.9	33.0	723
2029	173	8.2	63.4	2,307
2039	171	10.2	96.6	7,053
2049	171	12.0	133.7	11,389
2059	168	13.1	157.5	18,080



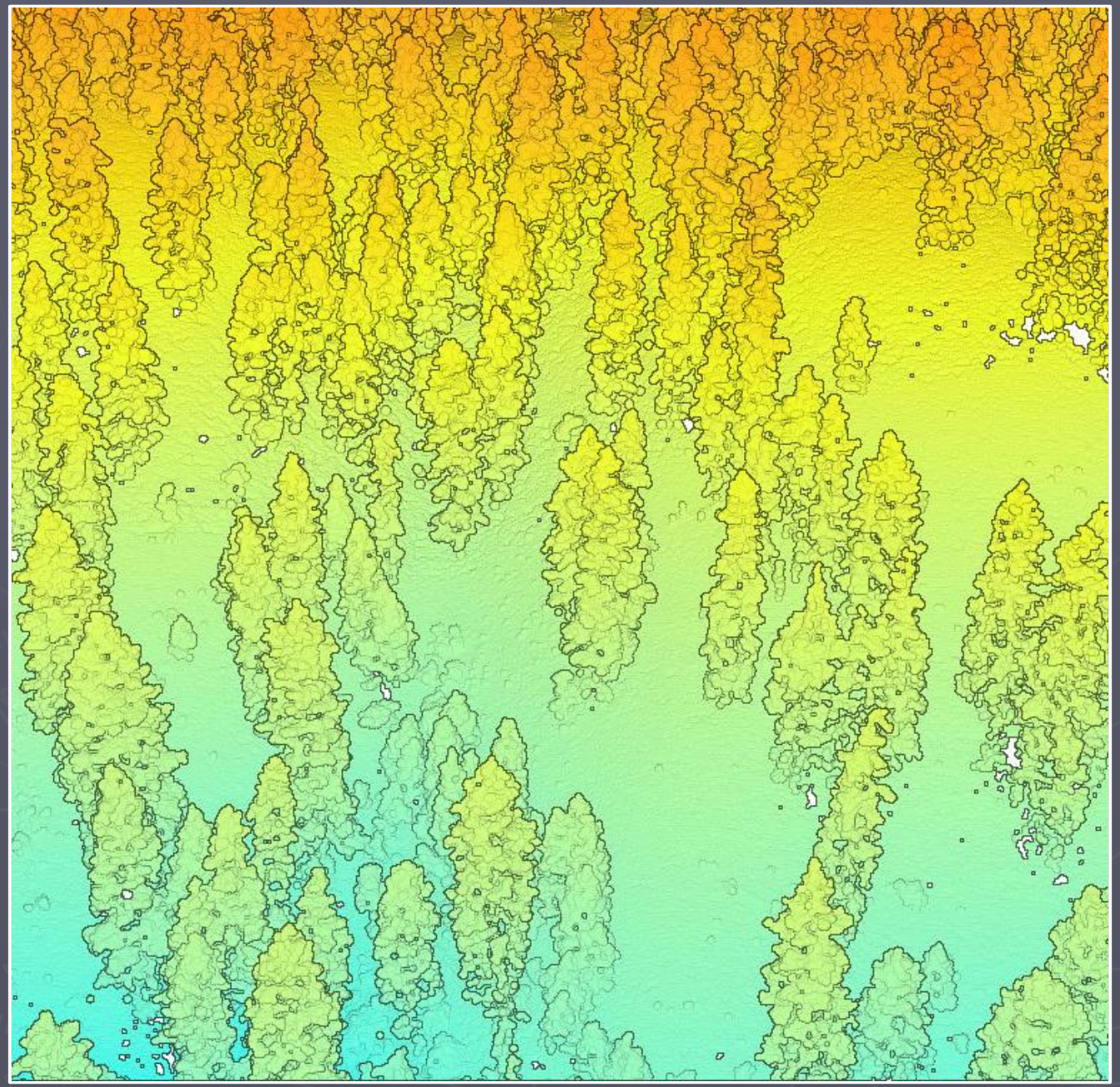






Task 2. Simplify the process for growing single-tree inventories that have XY coordinates

Next steps—Work with Kerry Halligan and WSG to add a tool to the FPS Pro add-in to run the simplified process



Small Landowner Carbon Project with Forest CO_2

Task 3. Forest Inventory Generation

FBRI will use lidar data to generate forest inventories for the small landowner carbon program

Task 4. Management Planning for Carbon

FBRI will develop silvicultural regimes and management scenarios for small landowners to plan for sustainable forest growth and carbon sequestration

Pilot Project and Program Expansion

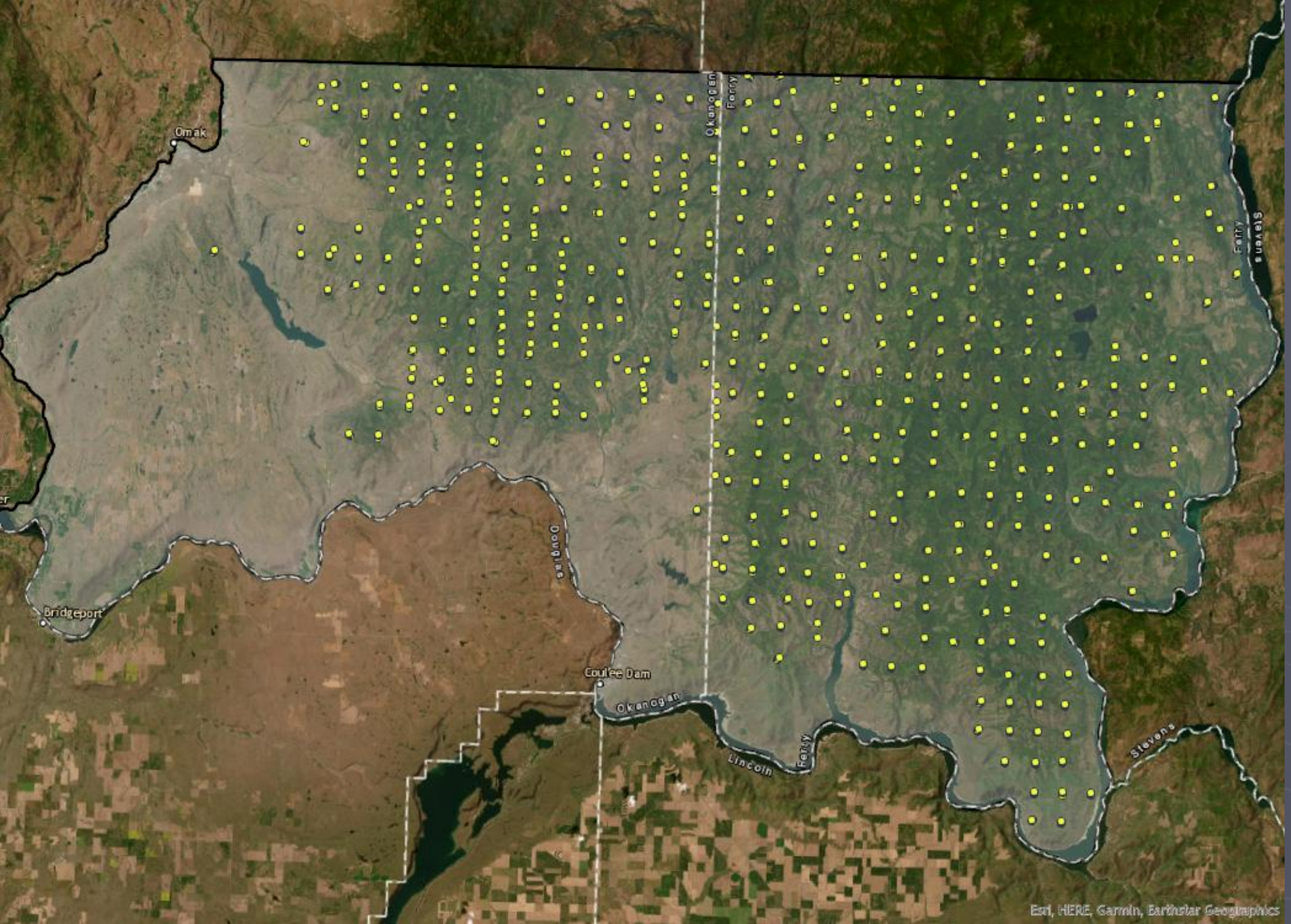
FBRI and Forest CO_2 will partner on a pilot project in 2026 to validate workflows, allowing expansion to more landowners with continuous technical support from FBRI

Site Productivity Mapping Project for the Colville Tribe

Halli Hemingway

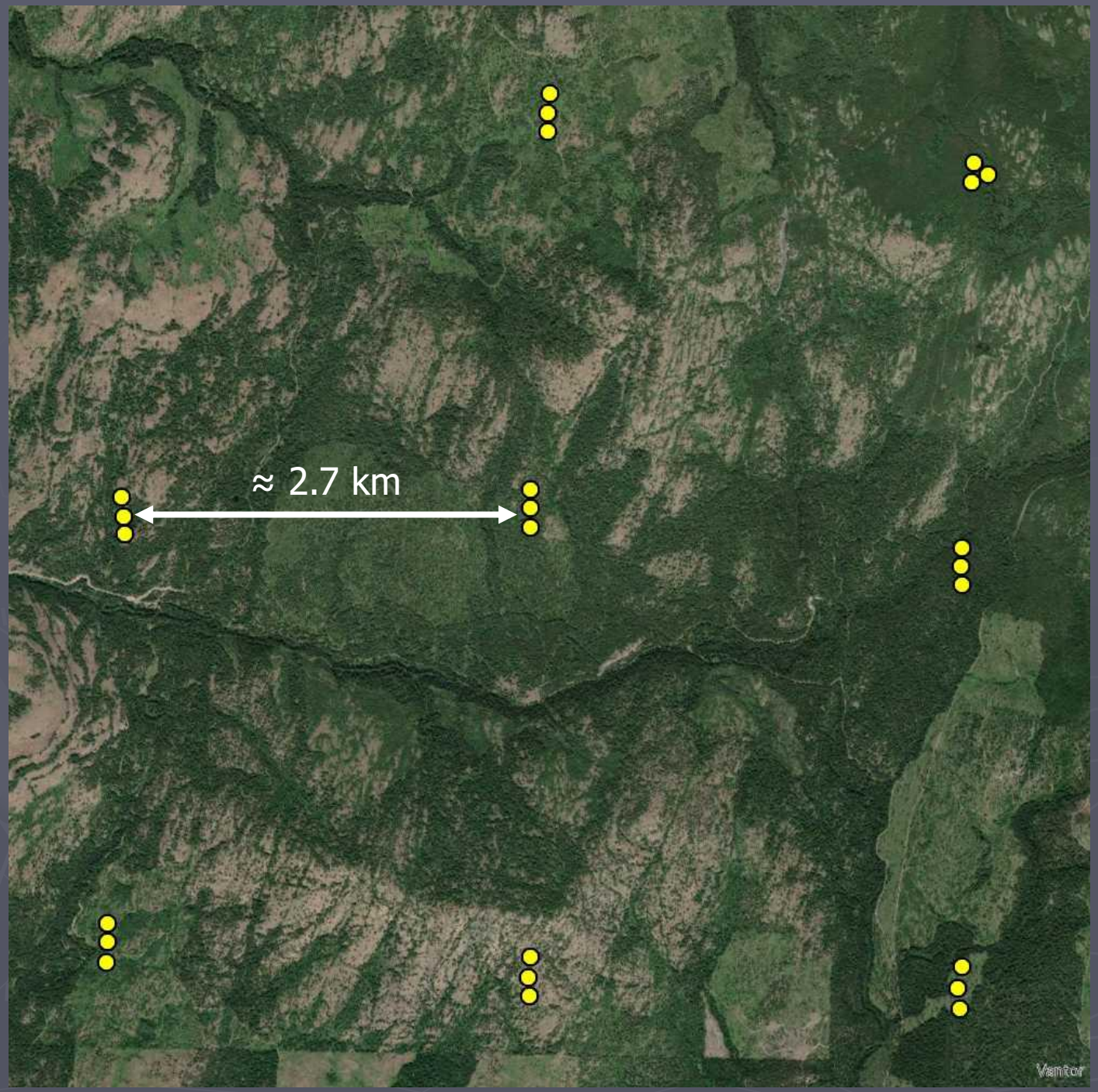
Dan Opalach

- The Colville Reservation has 1.2 million acres of forest land in northeastern Washington
- The goal was to develop a GIS point layer with site index estimates at a 1-acre resolution
- Height increment data from the Tribe's Continuous Forest Inventory (CFI) plots were used to calculate site index for six tree species



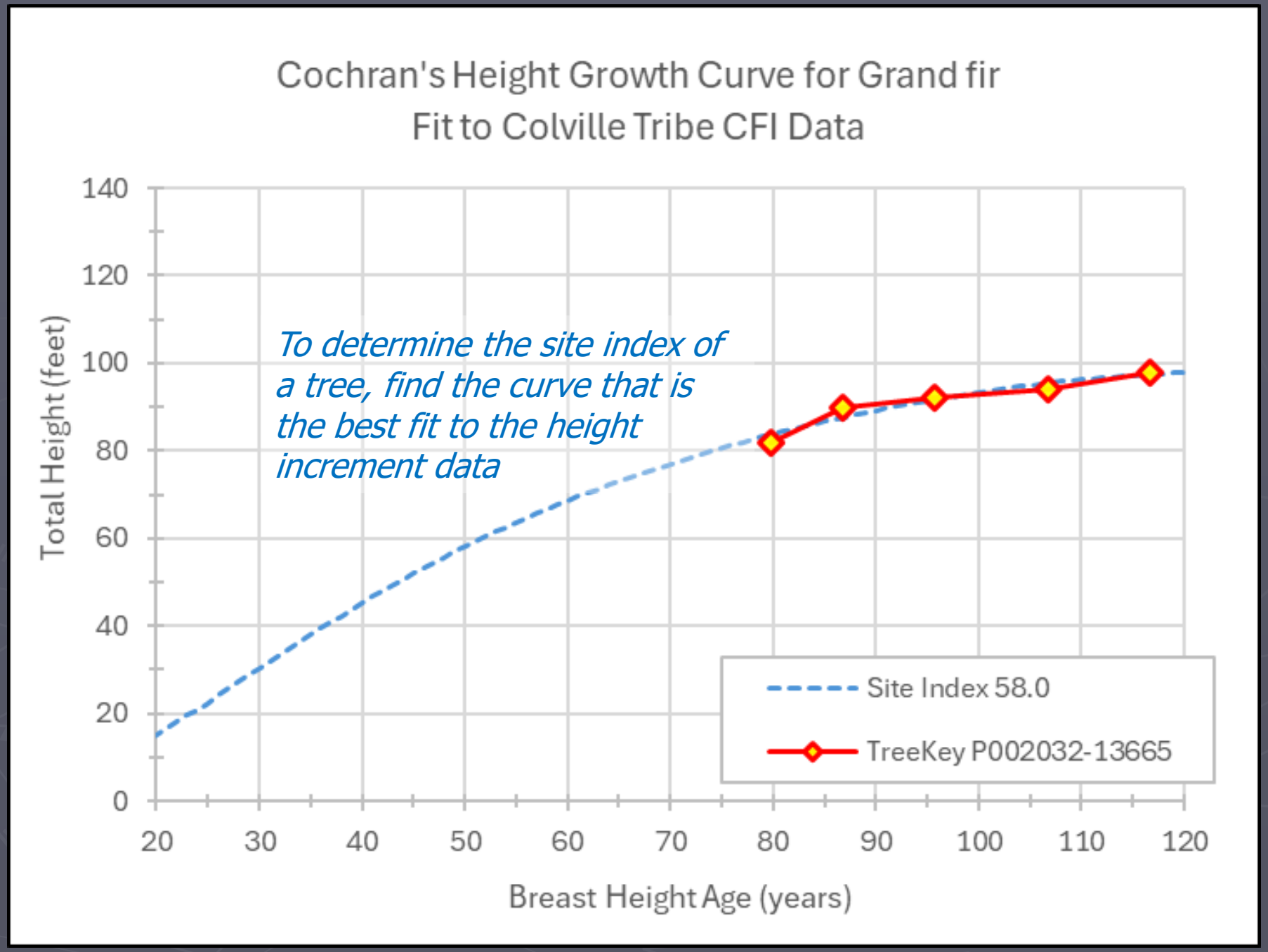
CFI Plot Data

- The Tribe has CFI plots systematically located over their forest land
- The oldest plots were remeasured five times covering a time span of 40 years
- Age data was not collected for trees so traditional estimates of site index can not be calculated
- Instead, we used height increment data to calculate the site index of dominant trees

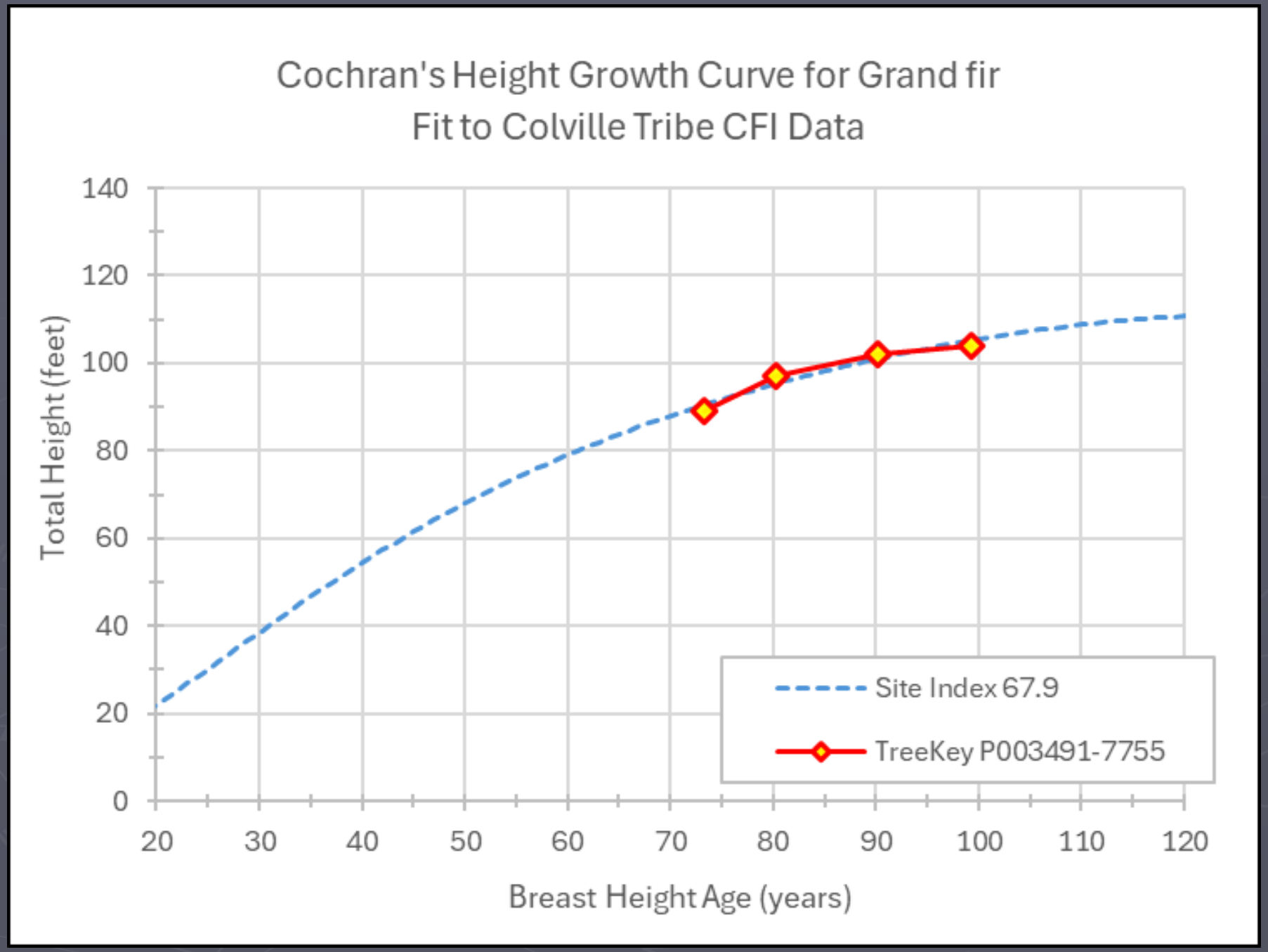


CFI Plot Data

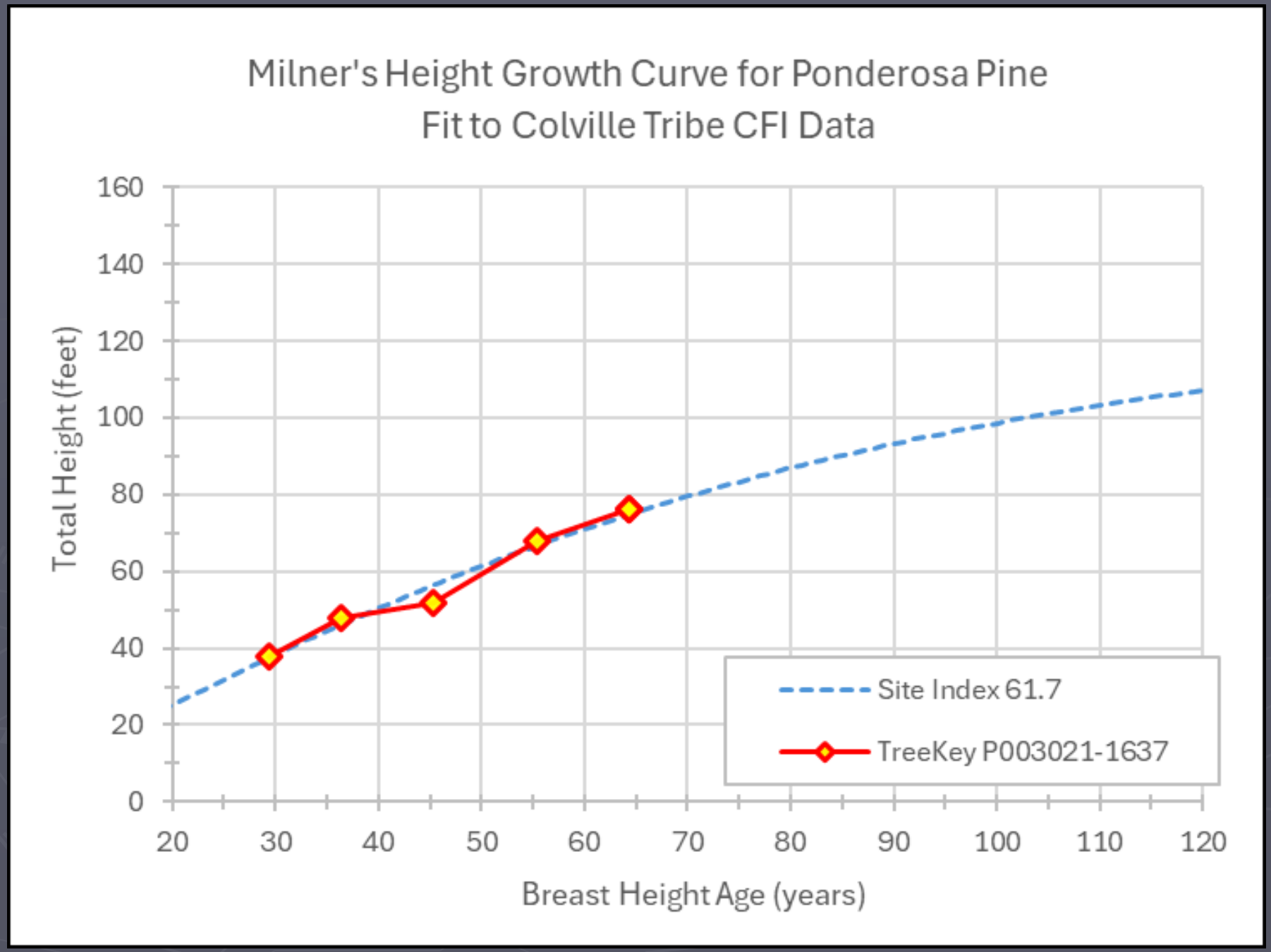
- Most of the CFI plots were installed in clusters of three
- The clusters are about 2.7 km (≈ 8,900 feet) apart, and uniformly spaced over the forest lands
- Within the clusters the plots are approximately 120 m (≈ 400 feet) apart
- Site index was calculated using height increment data for each dominant tree on a plot



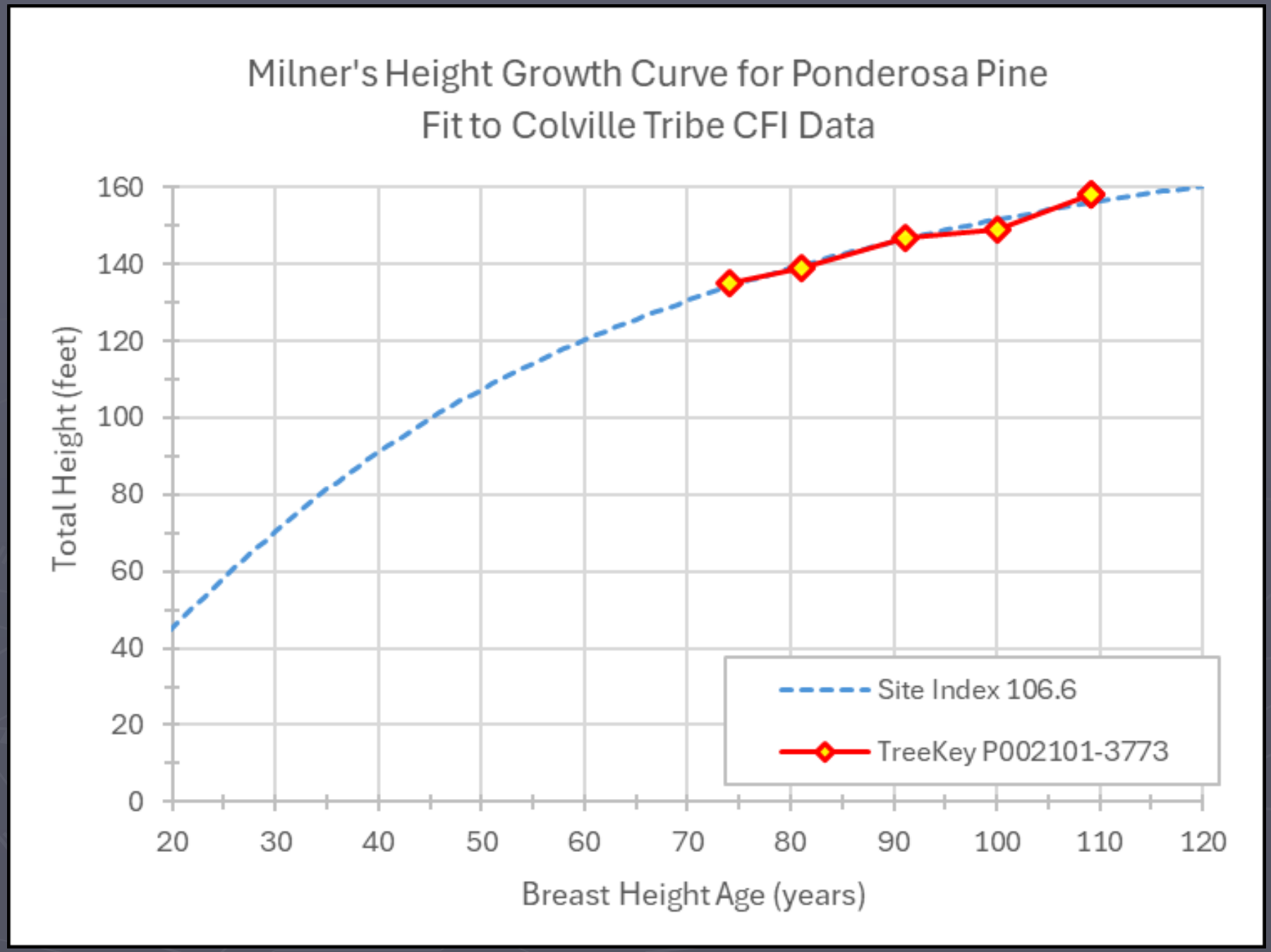
CFI Plot 2032
Tree 13665
Grand fir



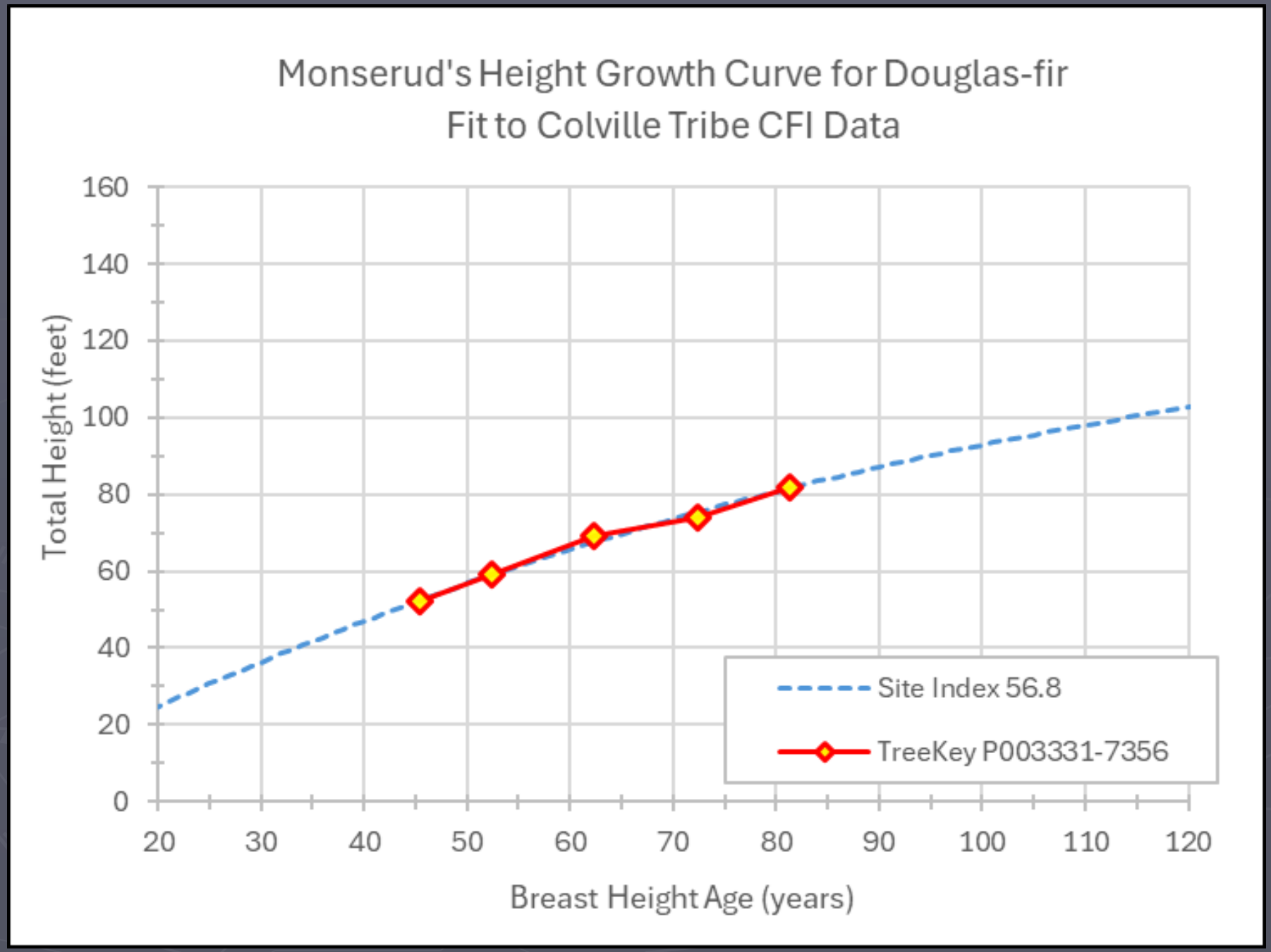
CFI Plot 3491
Tree 7755
Grand fir



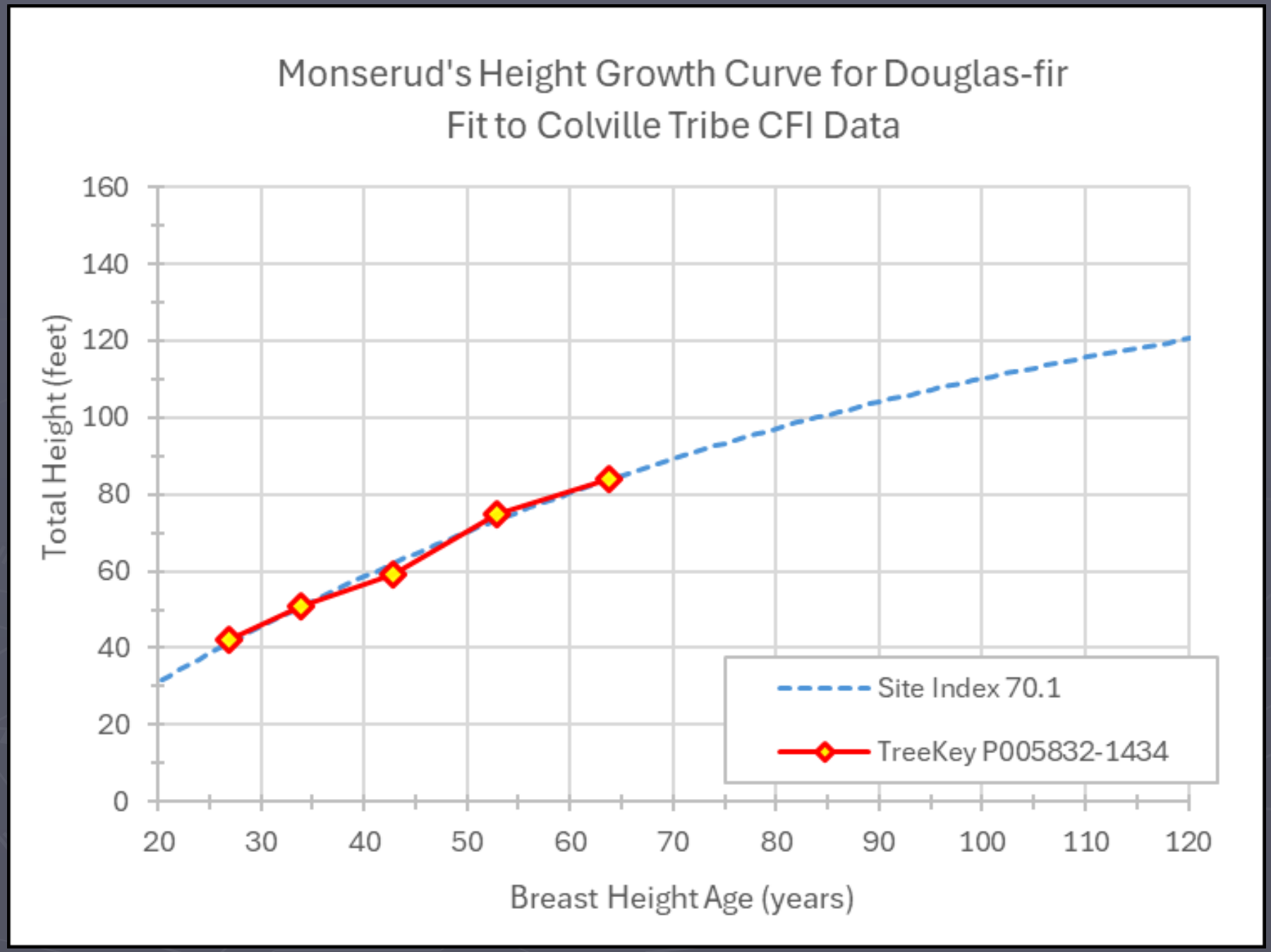
CFI Plot 3021
Tree 1637
Ponderosa Pine



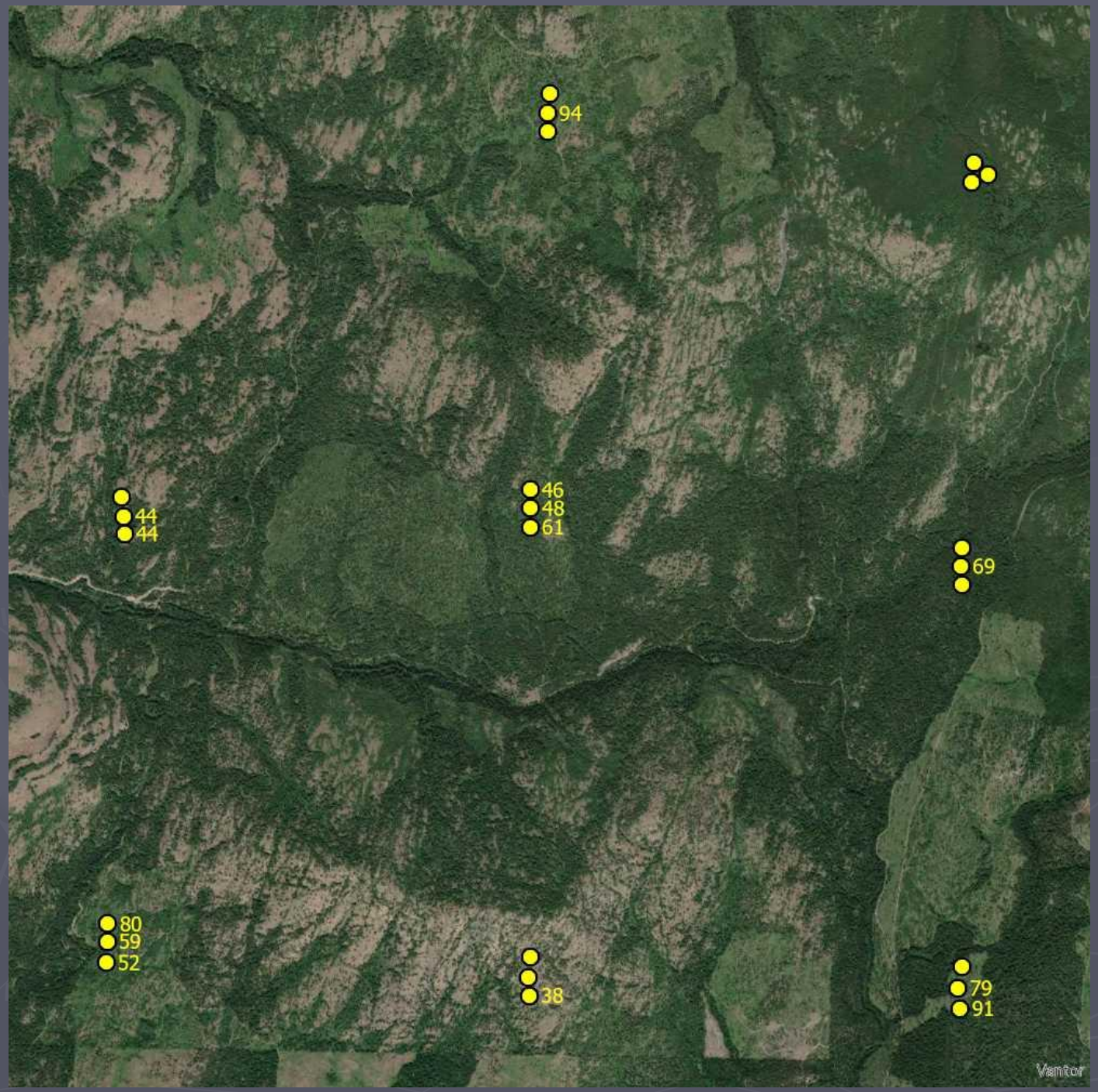
CFI Plot 2101
Tree 3773
Ponderosa Pine



CFI Plot 3331
Tree 7356
Douglas-fir

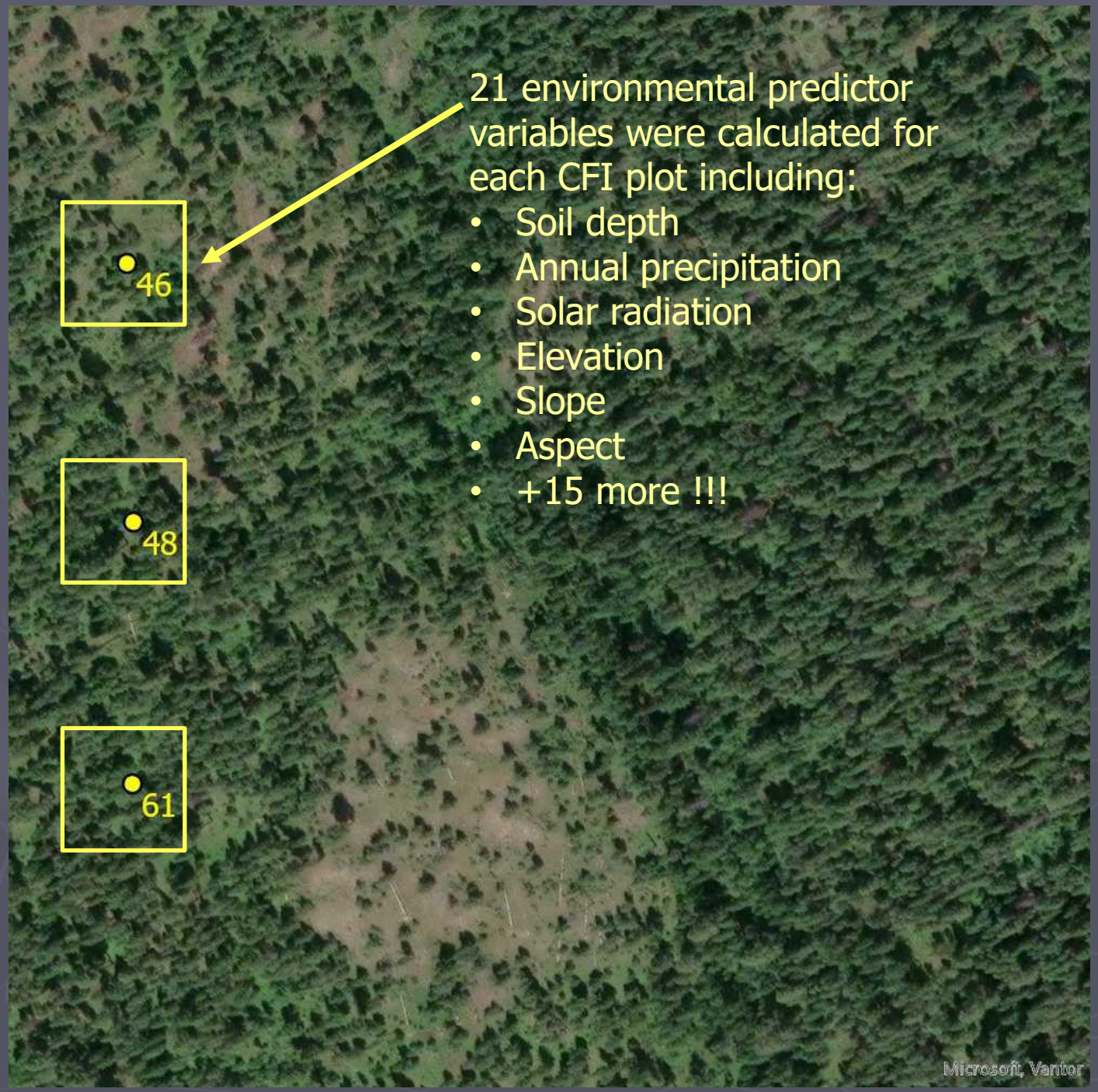


CFI Plot 5832
Tree 1434
Douglas-fir



Site Index of a Plot

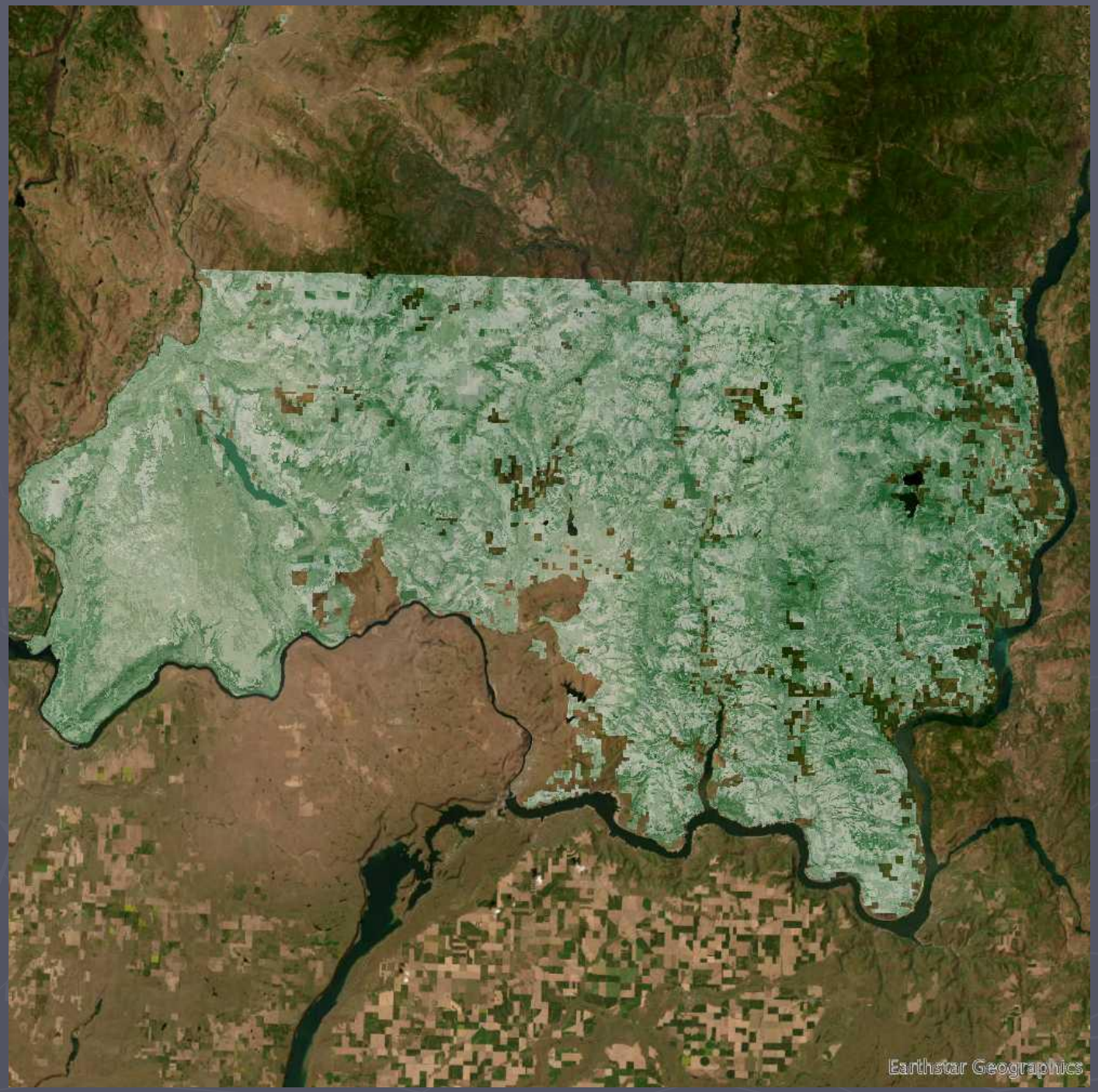
- There were a total of 1,120 site index trees on 697 CFI plots
- The site index of a plot was the average of the dominant trees on the plot



Predicting Site Index with Machine Learning Models

Halli Hemingway

- The modeling data set contained site index values and 21 environmental predictor variables for 697 CFI plots
- Machine learning models (e.g.,Random Forest, XGBoost) were developed to predict site index
- Preliminary results are promising
  - Models explain over 80% of the variation in site index ($R^2 > 0.80$)

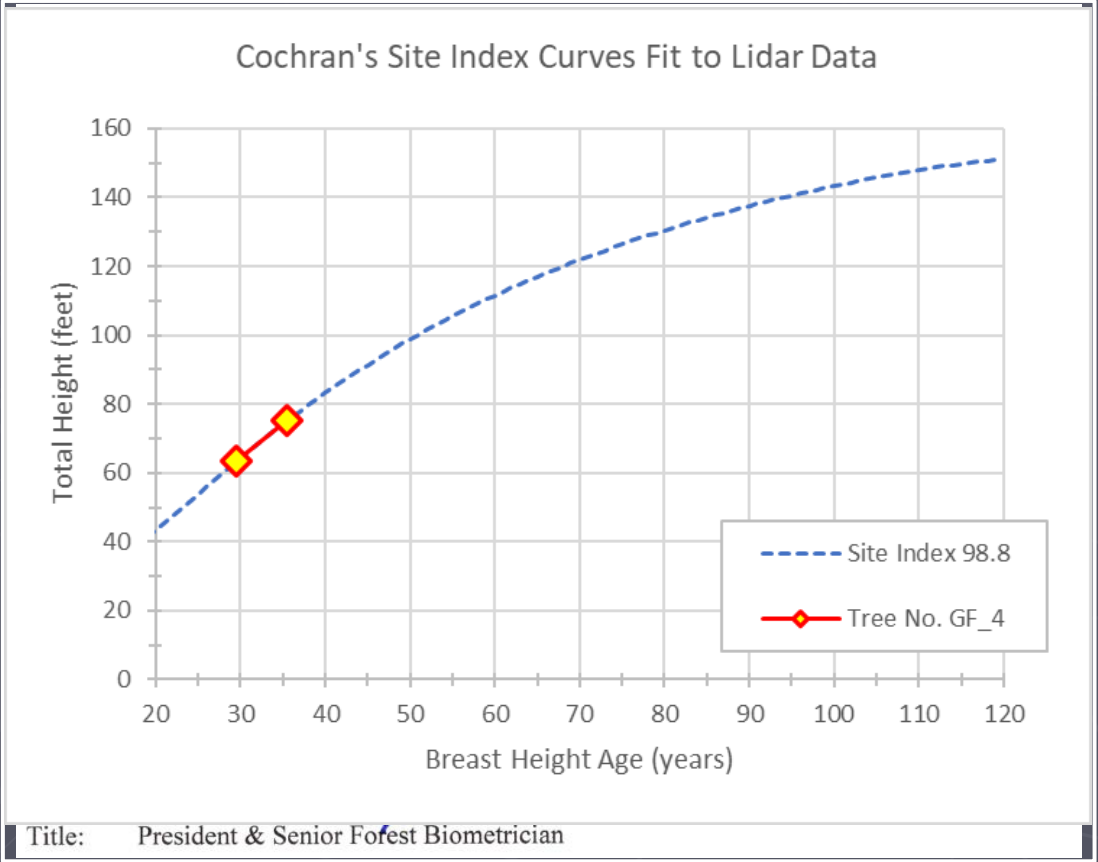


Predicting Site Index with Machine Learning Models

Halli Hemingway

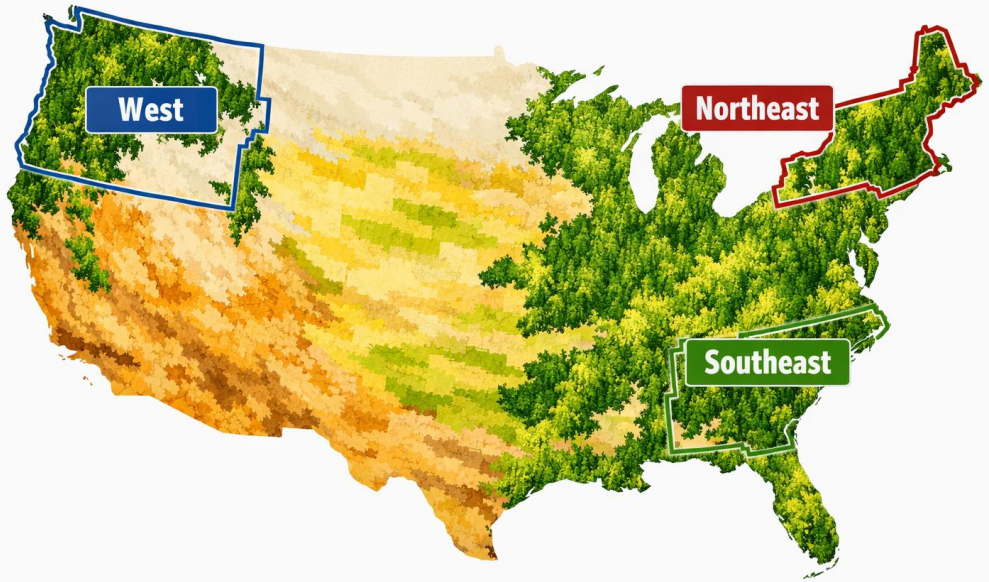
- ✓ Application of the model and preliminary results !!!
- ✓ The model is applied to a 1-acre grid to estimate the site index for each acre of forest land in the reservation
- ✓ Grids shaded darker green indicate a higher site index
- ✓ Halli will be presenting these results later this year at the annual meeting of the Western Mensurationists in Vancouver, BC

USDA-NRCS Site Productivity Research Effort with Dr. Mark Kimsey



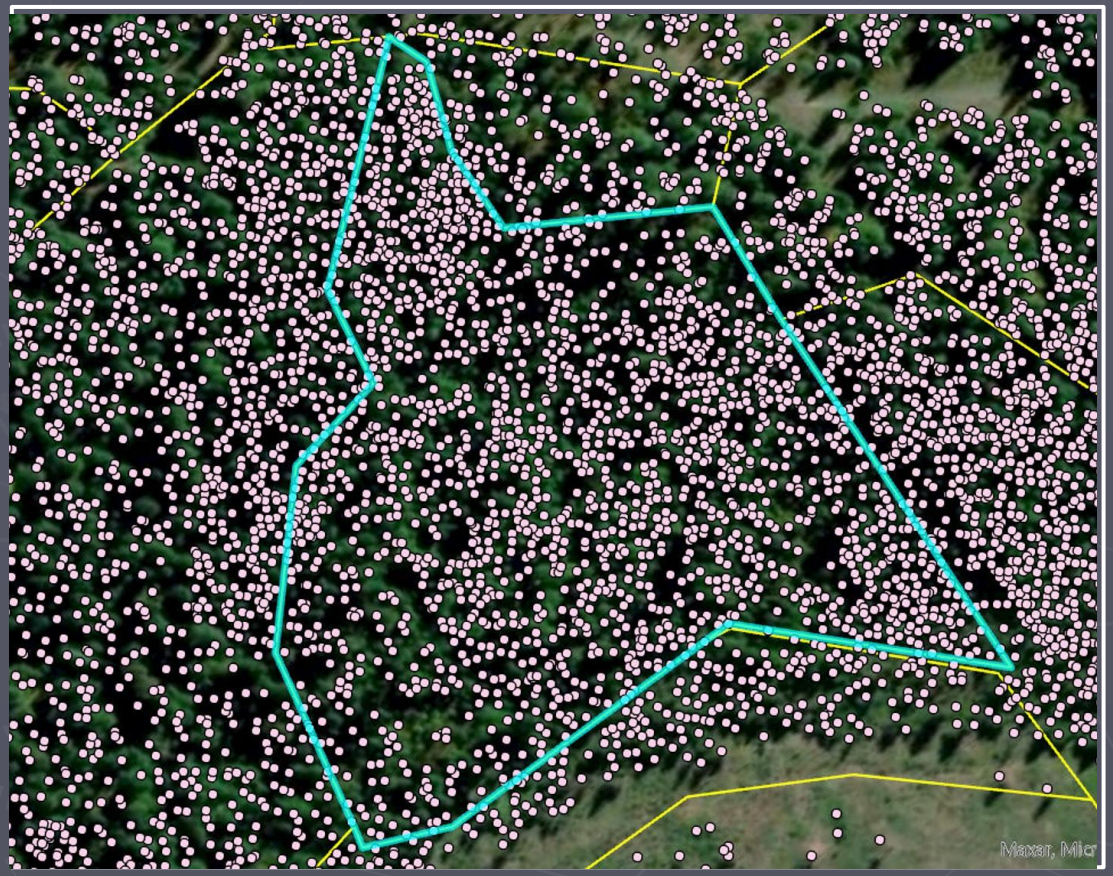
- Dr. Kimsey secured the USDA-NRCS grant to support this research in 2024
- The goal is to develop forest site productivity models (site index maps) based on remotely-sensed data
- This is a collaborative pilot project between the University of Idaho (U of I), Forest Inventory and Analysis (FIA) program, and FBRI
- The first task (and the most important!) is to assemble height data at ***two points in time!*** Dr. Ed Flathers and Mr. Steevensen Alcius (U of I) are working on this task.
- The second task is to determine site index given the repeat height data. FBRI will perform those calculations.

USDA-NRCS Site Productivity Research Effort with Dr. Mark Kimsey



- This pilot project covers three study areas: the West, Northeast, and Southeast
- Site index values will be calculated for up to five species in each area based on existing well-known site index systems (e.g., Monserud's for inland Douglas-fir)
- This project will give FBRI an opportunity to test its procedure for calculating site index (from height increments) on tree species in other regions including, hopefully, some hardwoods
- If the pilot project is wildly successful Dr. Kimsey may seek additional funding to develop a site productivity map that covers the United States and can be incorporated into the Web Soil Survey

FBRI to Assist Idaho Department of Lands (IDL) with Lidar Data Integration into FPS



Data Integration Agreement

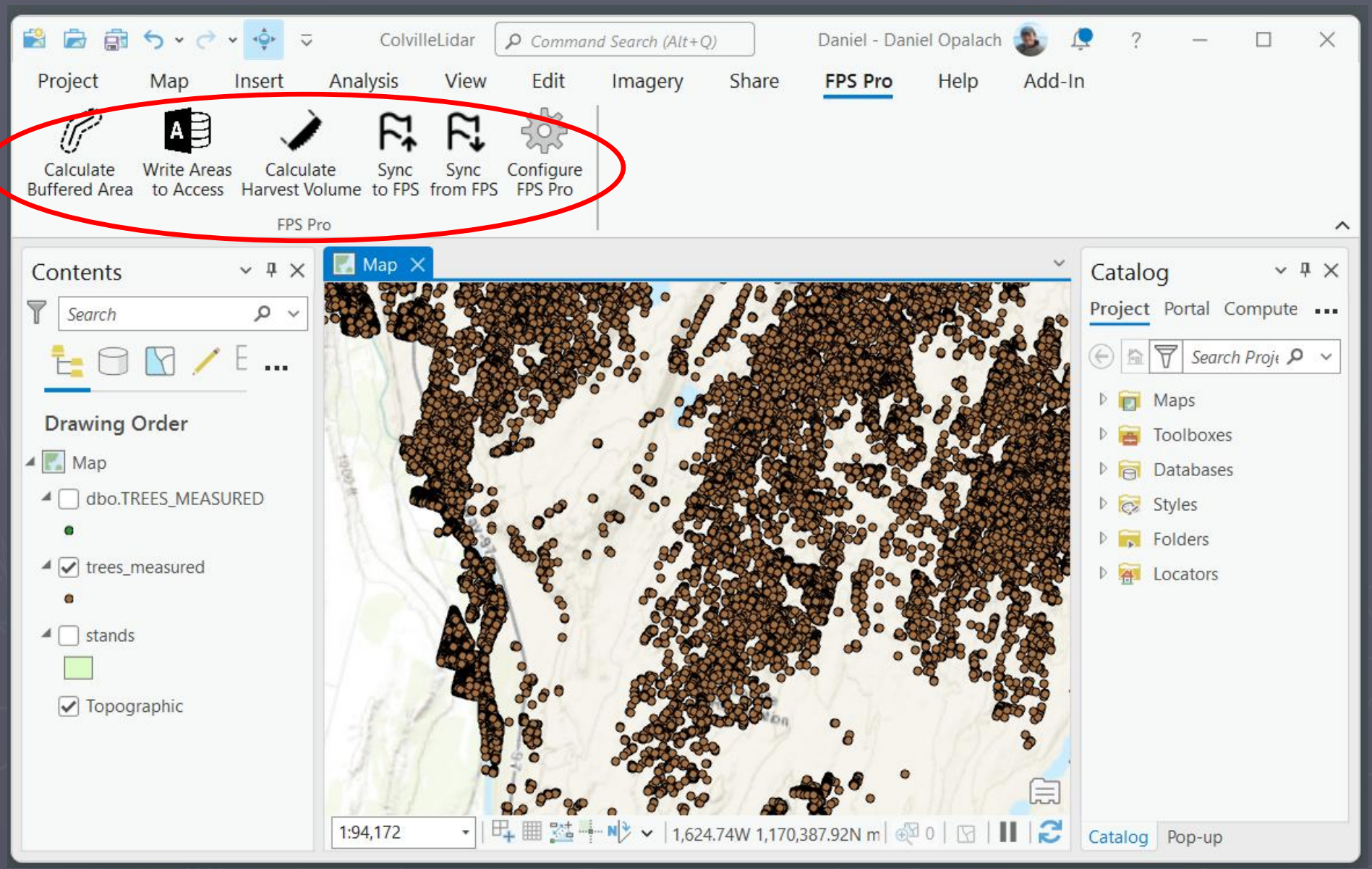
IDL has developed a Lidar-based single-tree inventory that it wants to integrate into FPS. FBRI will develop custom instructions, aka a users guide, on how to input IDL's unique single-tree inventory into FPS databases connected to Microsoft SQL Server.

IDL's Lidar Tree Database

IDL will provide a "sample" file geodatabase to FBRI containing 50 million lidar trees for loading into the ADMIN, CRUISE, and PLOTS tables. This is a fraction of IDL's trees.

A Users Guide for IDL

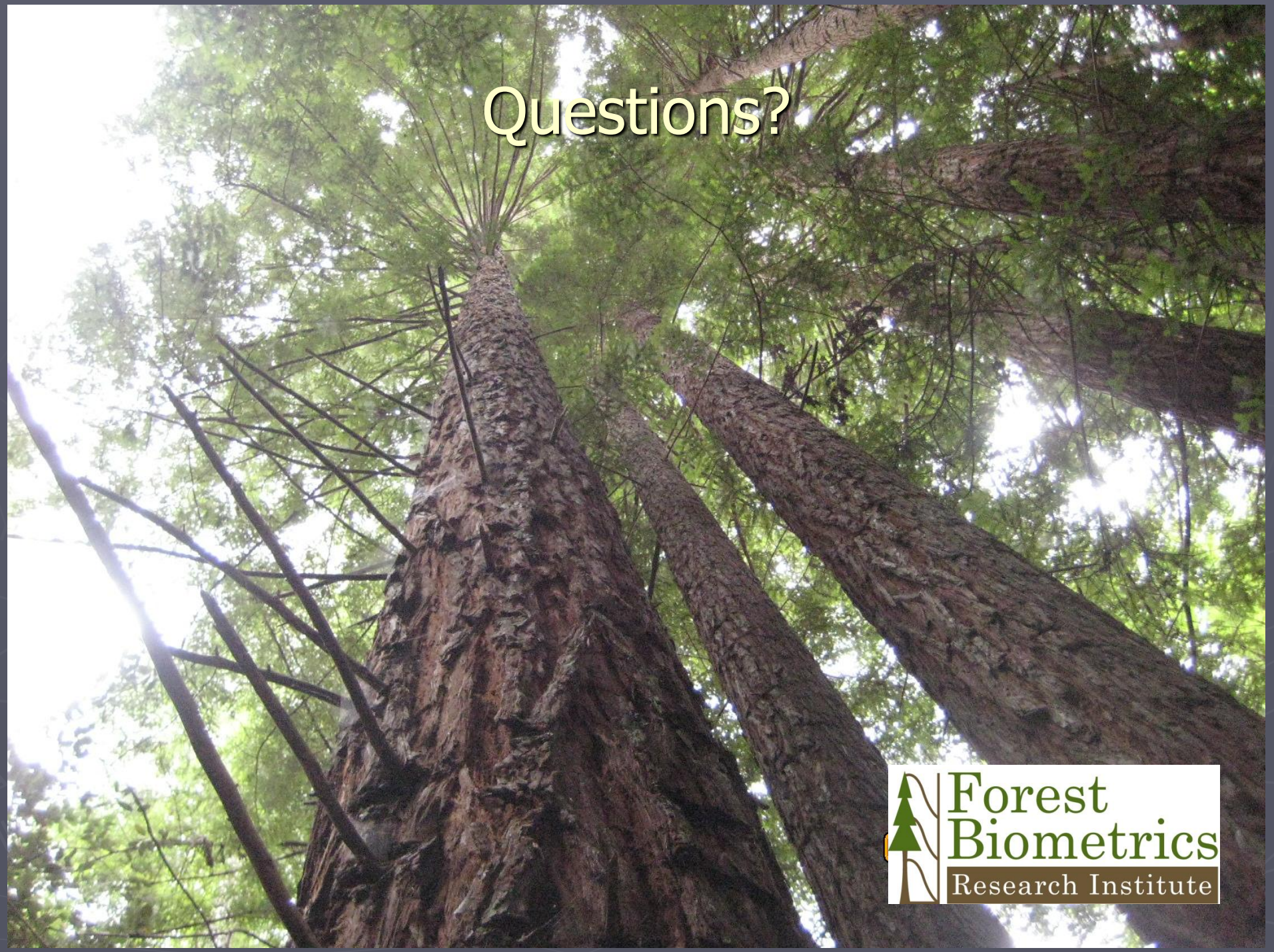
FBRI will prepare a detailed users guide for IDL that contains step by step instructions on how to input tree attribute data from its custom Esri file geodatabases into FPS tables connected to Microsoft SQL Server databases. Instructions will be included on how to compile and grow these massive single-tree inventories with FPS. Armed with this users guide, Nate Cook (IDL's Inventory Forester) will be able to input billions of trees into FPS.



Simplify the process for inputting single-tree inventories into FPS Pro

Next steps—Work with Kerry Halligan and WSG to add a tool to the FPS Pro add-in to run the simplified process

Questions?



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