FBRI/FPS Update

2025 Growth Model Users Group Meeting
Water Resources Education Center
Vancouver, Washington
April 16, 2025

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, small private, and 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

The Agenda For Today
FBRI/FPS Update

- FPS Pro – The next generation of FPS
- FPS Technical Support program
- Fortran programming – Improvements to FPS and bug fixes
- Enterprise Services update – Additional forest biometrics services that FBRI provides to its members

FPS Pro

- FPS Pro is the name for the next generation of FPS
  - Dr. Jim Arney referred to the current version of FPS as a 4th generation forest management application because it was the fourth computerized growth model he had built during his career
- FBRI has a contract with Dr. Kerry Halligan with Woodland Solutions Group (WSG) to help us "evolve" FPS over time into FPS Pro—currently we have two projects underway with WSG:
  - Project 1: FPS Architecture Review
  - Project 2: ArcGIS Pro add-in for FPS Pro

Project 1: FPS Architecture Review

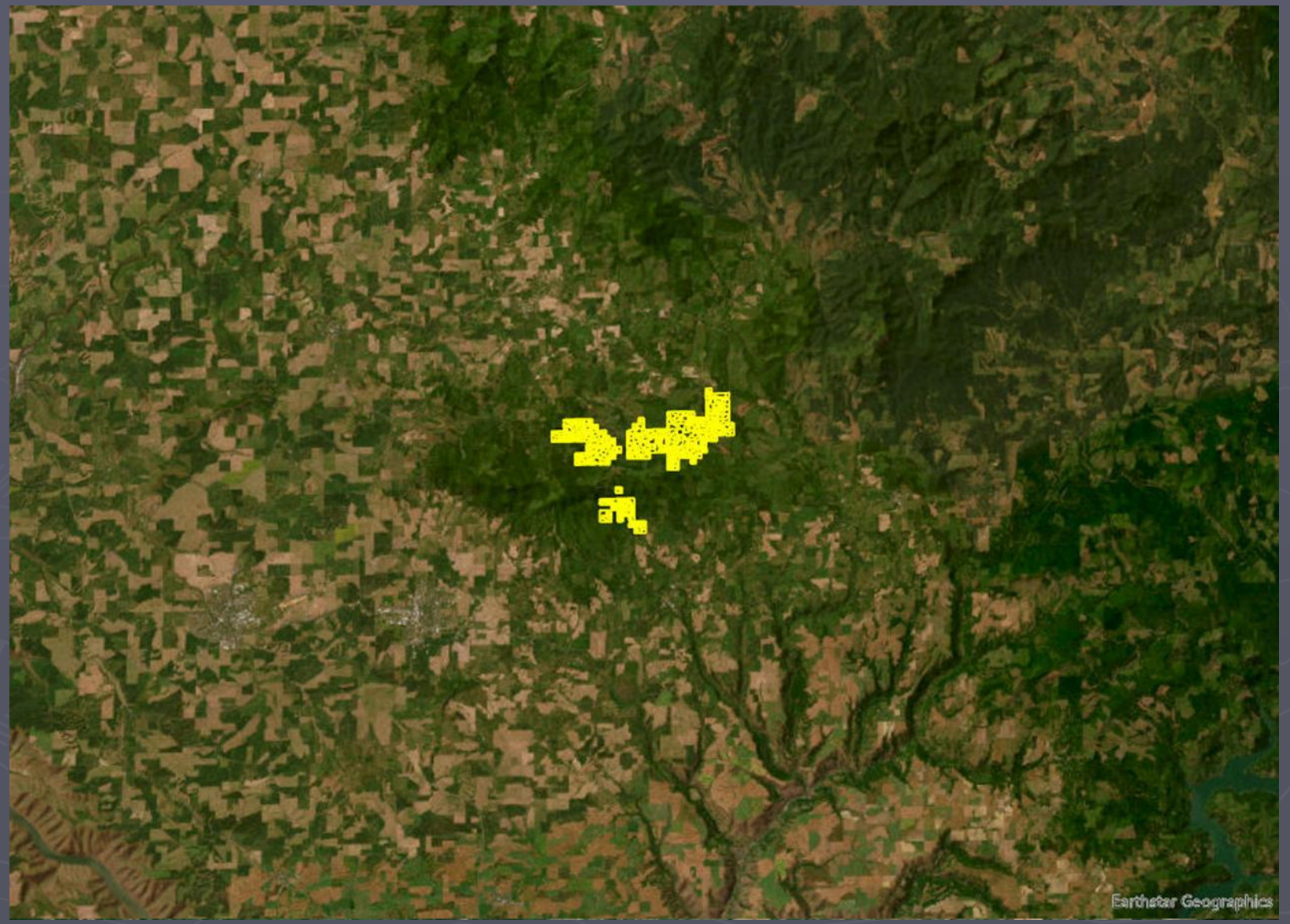
- Project goal — Review the existing architecture of FPS 7.60 and propose options for a technology update that could address some or all the following issues:
  - FPS bugs
  - Microsoft Access 2 GB file size limitation
  - Unshackle FPS from Microsoft Access
  - Provide users with options regarding data storage
  - Improve integration with GIS software
  - Speed up FPS applications
  - Process census-level forest inventory data

FPS Pro Case Studies – Census-Level Inventories

- University of Idaho Experimental Forest
  - 1 million lidar trees on 8,200 acres
  - The data was stored in SQL Server Express
    - SQL Server Express maximum database size: 10 GB
    - Pretty much needed all of it to store 1 million lidar trees
- Colville Reservation
  - 288 million lidar trees on 1.2 million acres
  - The data was stored in SQL Server
    - SQL Server maximum database size: 524,272,000 GB
    - Only needed 500 GB to store the 288 million lidar trees

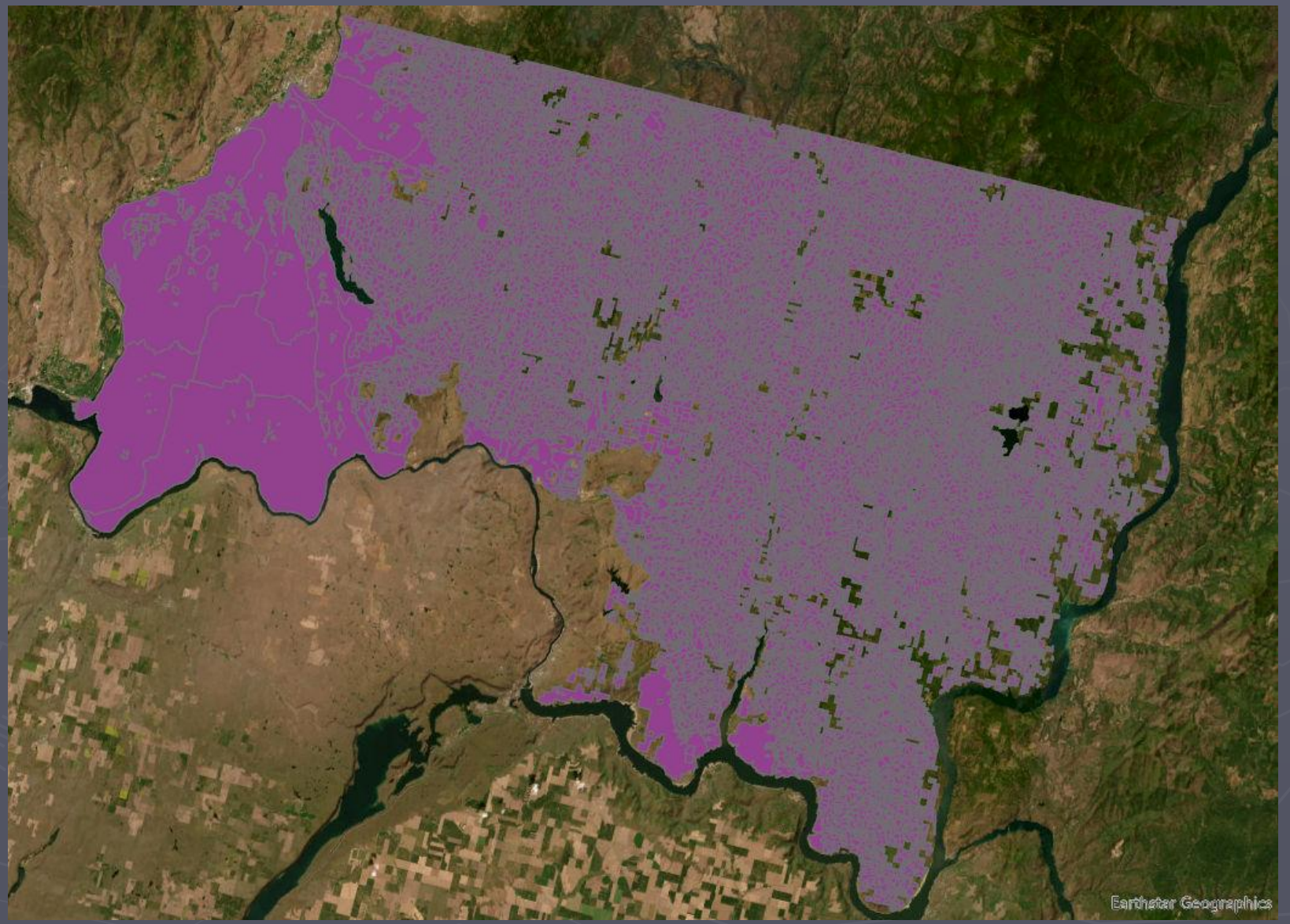
University of Idaho Experimental Forest – 1 Million Lidar Trees

8,200 Acres



Colville Reservation – 288 Million Lidar Trees

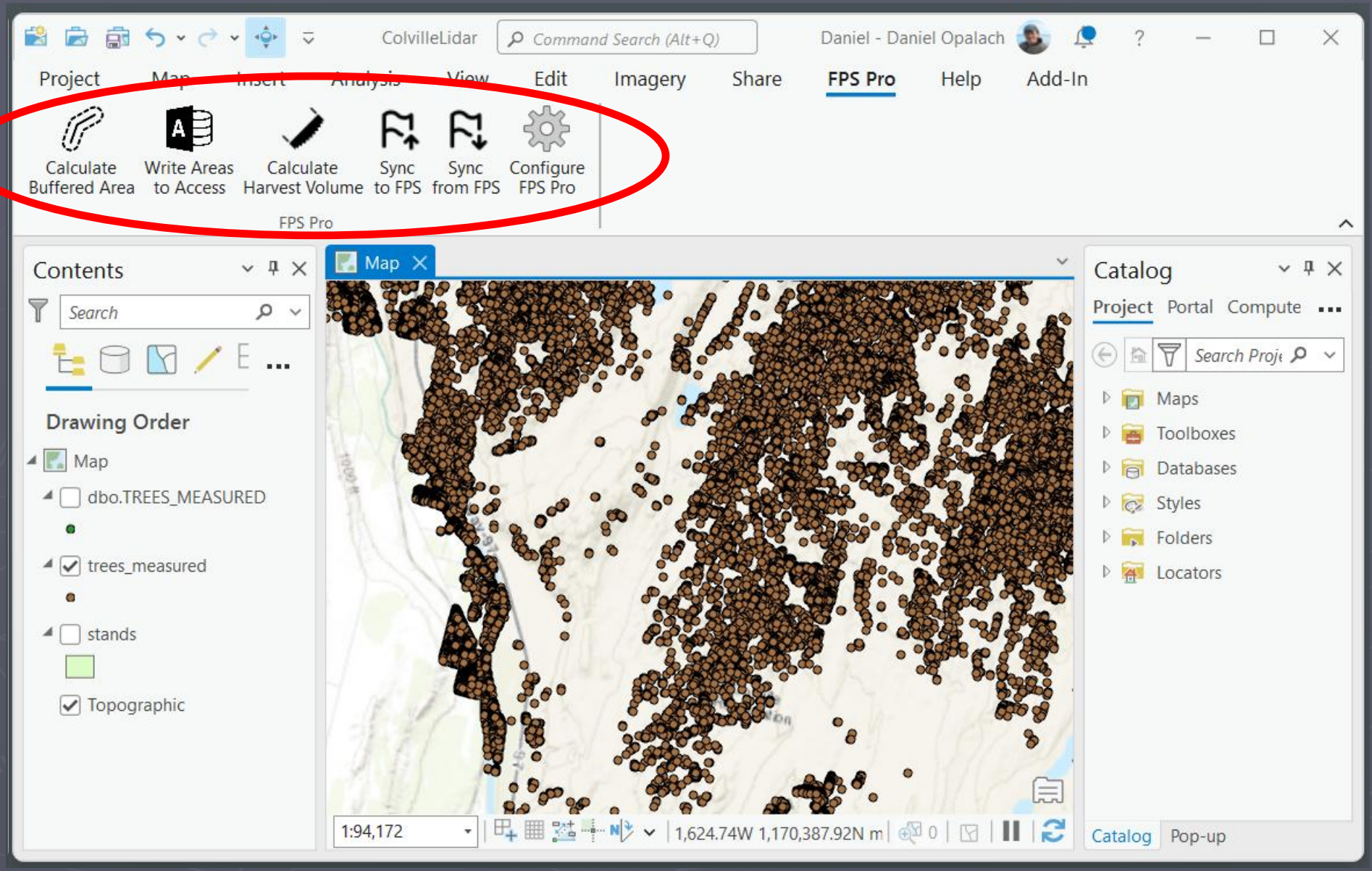
1.2 Million Acres



Project 2: ArcGIS Pro add-in for FPS Pro

- Project goal — Develop a timber harvest planning add-in for ArcGIS Pro
  - Project partners
    - FBRI, Portland, Oregon
    - Idaho Department of Lands (IDL), Boise, Idaho
    - Lone Rock Timber, Roseburg, Oregon
  - The purpose of the add-in is to assist FPS Pro users with timber harvest planning and annual depletion/inventory updates
  - In the current Microsoft Access version of FPS 7.60 this is called the lump/split tool

ArcGIS Pro Add-in for FPS Pro



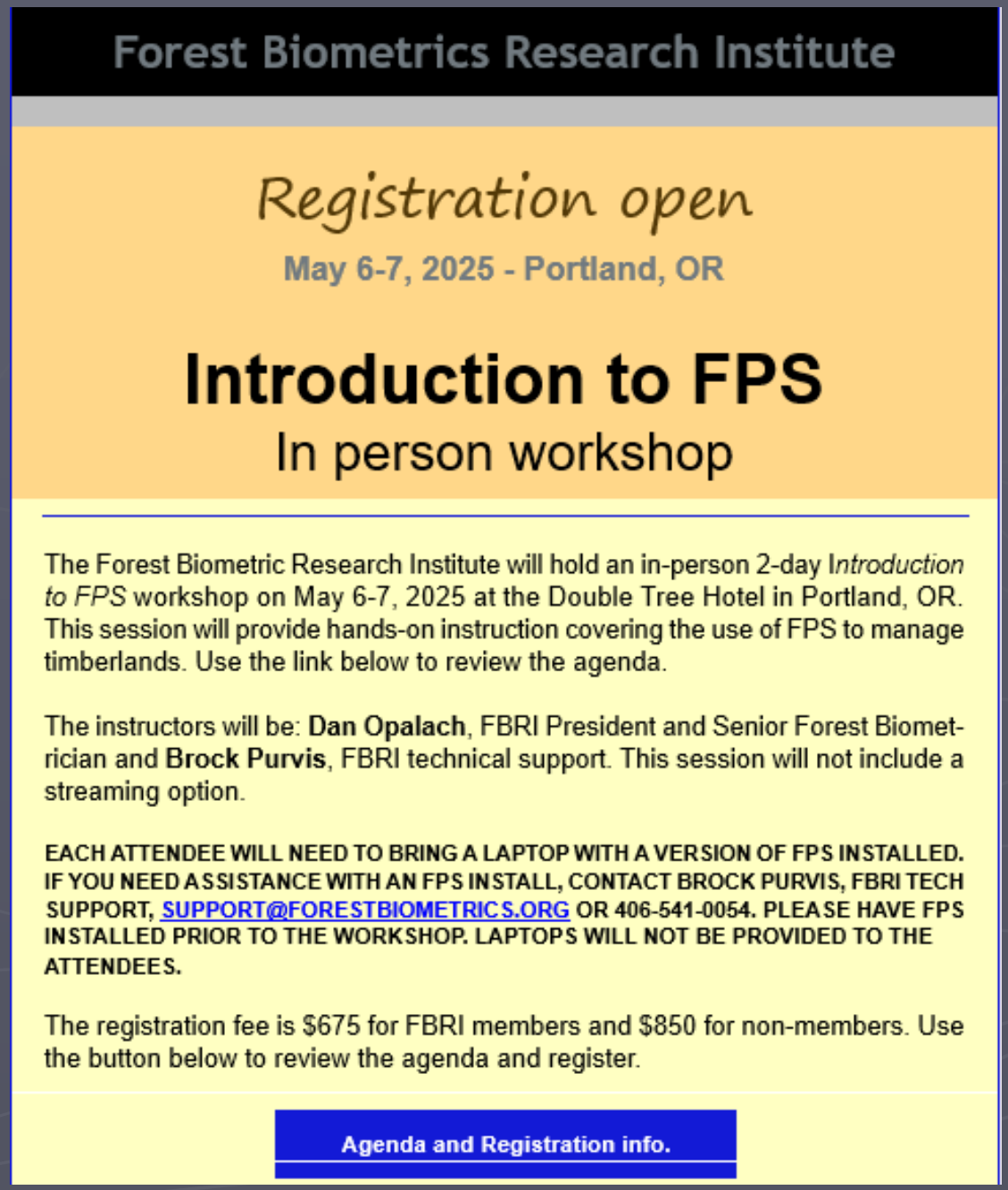
FPS Technical Support Program
Many Aspects

Brock Purvis

- Brock Purvis is FBRI's Technical Support Manager
  - Responds to support requests within 24 hours
  - Convenes quarterly on-line user group meetings (aka BUGS meetings)
  - Conducts in-person FPS training workshops
    - FPS Forest Inventory Basics – May 6 & 7, 2025, Portland, Oregon
    - FPS Advanced Silviculture Workshop – November 5 & 6, 2025, Portland, Oregon
  - Develops FPS training webinars and makes them available on FBRI's web site
  - Conducts site visits to FBRI member companies as requested
  - Works on FBRI Enterprise Services agreements
    - Customized FPS training sessions
    - FPS audits
    - SiteGrid localization projects
    - Long-term harvest planning

Introduction to FPS
May 6 & 7, 2025

- Agenda
  - FPS File Structure
  - FPS Table Review
  - Compiling Timber Cruises
  - Log Rules
  - Growing Stands
  - Site Index
  - Expanding to Uncruised Stands
  - Selecting Stands for Timber Cruising
  - Compiling Census-Level Tree Data
  - Tips for Managing Dead Trees & Snags
  - Entering Plantation Data
  - Understanding the SILVICS Table
  - Simulating Silvicultural Treatments
  - Lots more!!!



Forest Biometrics Research Institute

Registration open

May 6-7, 2025 - Portland, OR

Introduction to FPS

In person workshop

The Forest Biometric Research Institute will hold an in-person 2-day *Introduction to FPS* workshop on May 6-7, 2025 at the Double Tree Hotel in Portland, OR. This session will provide hands-on instruction covering the use of FPS to manage timberlands. Use the link below to review the agenda.

The instructors will be: **Dan Opalach**, FBRI President and Senior Forest Biometrician and **Brock Purvis**, FBRI technical support. This session will not include a streaming option.

EACH ATTENDEE WILL NEED TO BRING A LAPTOP WITH A VERSION OF FPS INSTALLED. IF YOU NEED ASSISTANCE WITH AN FPS INSTALL, CONTACT BROCK PURVIS, FBRI TECH SUPPORT, SUPPORT@FORESTBIOMETRICS.ORG OR 406-541-0054. PLEASE HAVE FPS INSTALLED PRIOR TO THE WORKSHOP. LAPTOPS WILL NOT BE PROVIDED TO THE ATTENDEES.

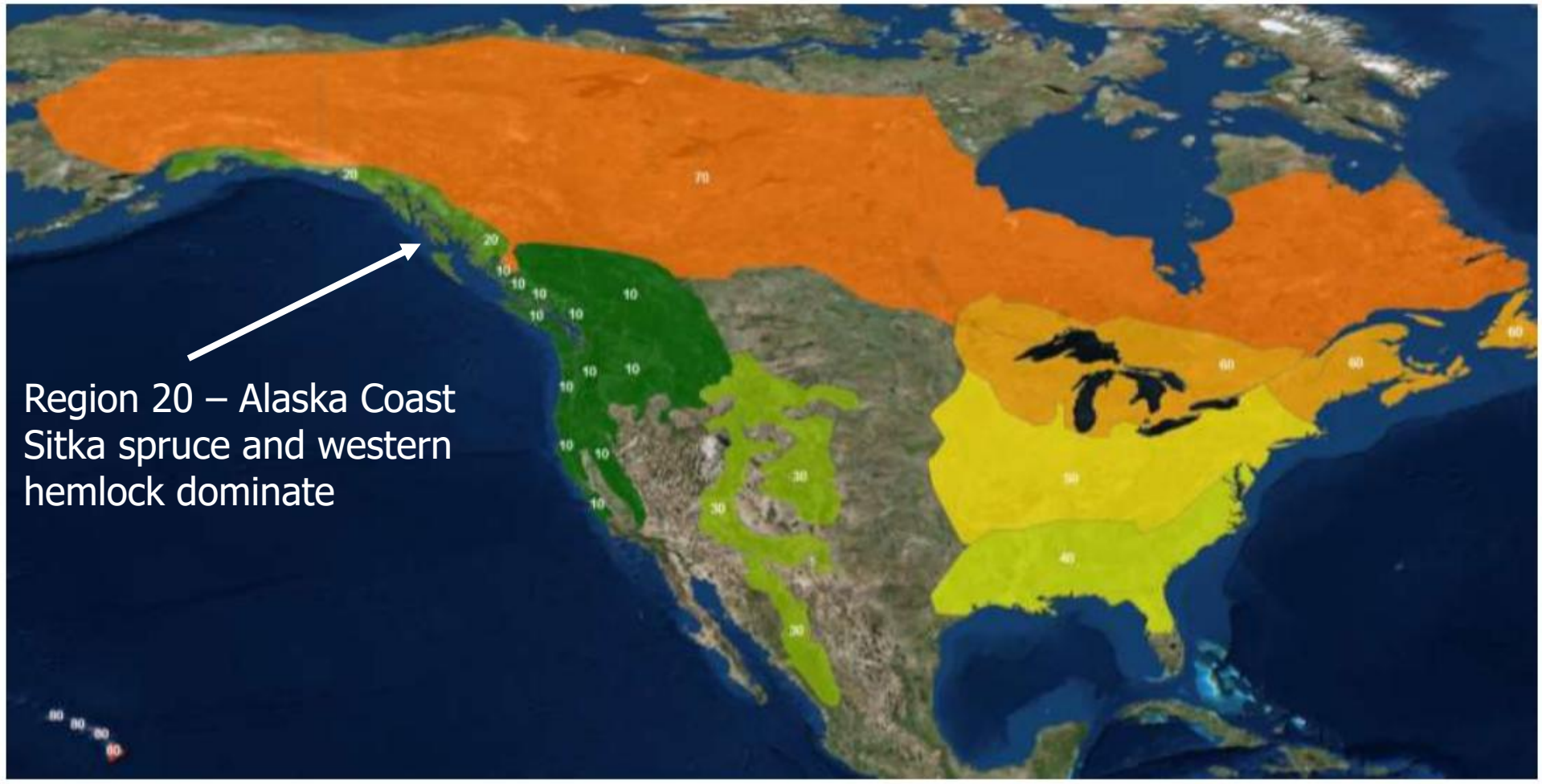
The registration fee is $675 for FBRI members and $850 for non-members. Use the button below to review the agenda and register.

Agenda and Registration info.

Fortran Programming

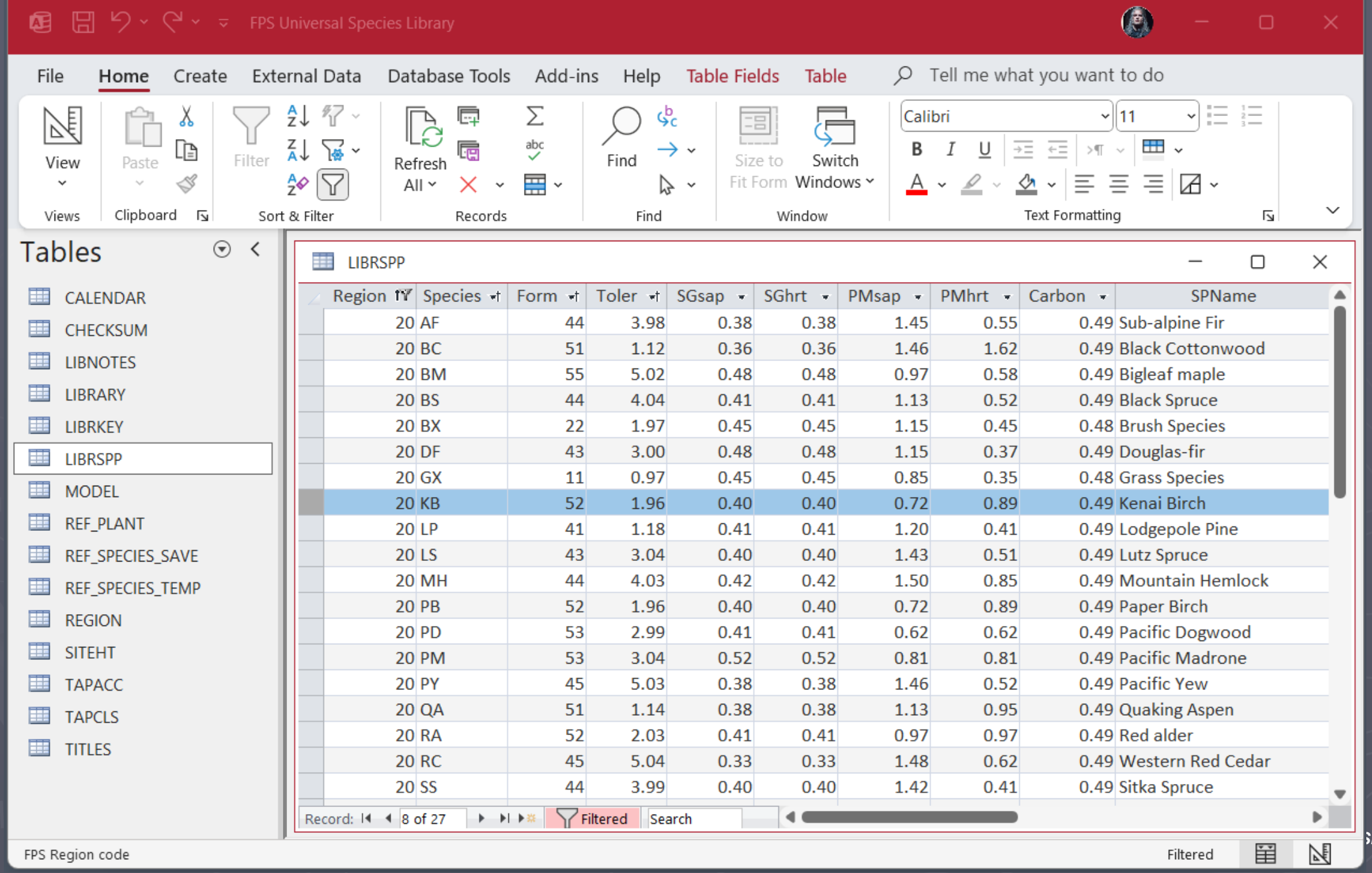
- Additional species added to the Region 20 library tables
- Maximum stand size increased to 1,000 acres
  - Maximum number of trees per species increased to 100,000
- Corrected a bug in the code used to generate SVS input files

Additional Species Added to Region 20

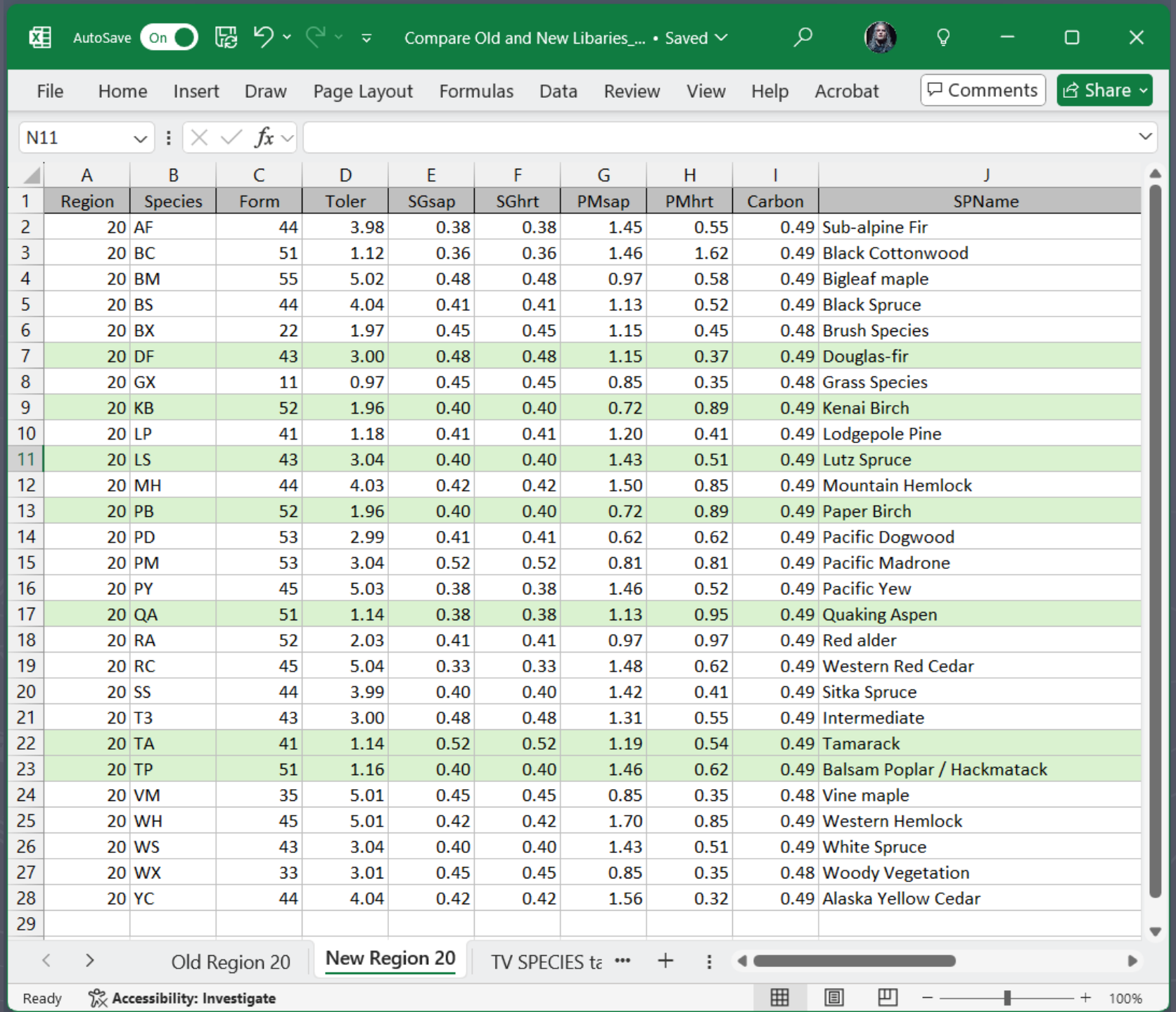


FPS Macro-Regions:

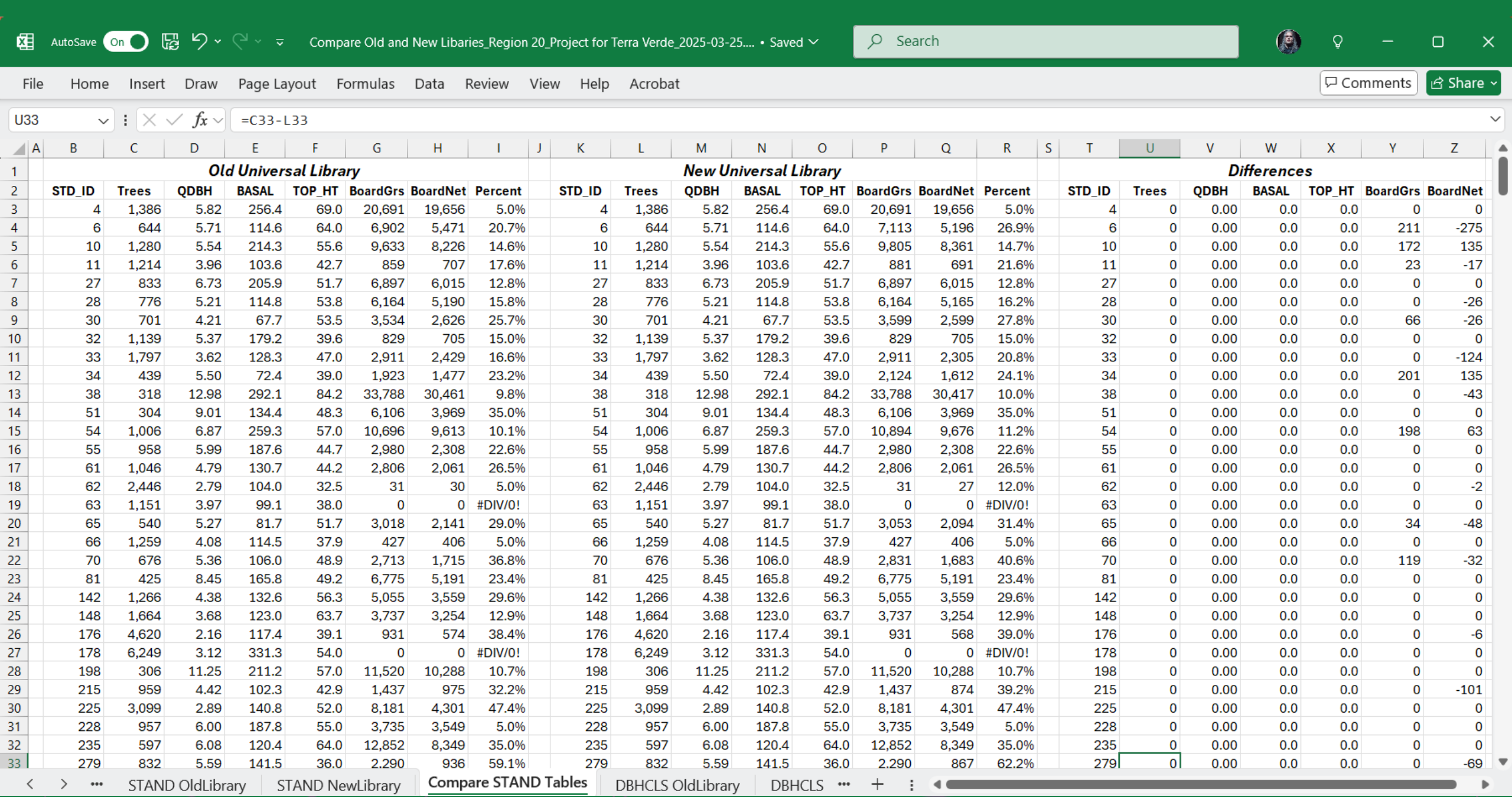
10 = West Coast,	**20 = Alaska Coast,**	**30 = Western Interior,**	**40 = Southeast,**
50 = MidWest,	**60 = Great Lakes,**	**70 = Canadian Shield,**	**80 = Pacific Islands**



Region	Species	Form	Toler	SGsap	SGhrt	PMsap	PMhrt	Carbon	SPName
20	AF	44	3.98	0.38	0.38	1.45	0.55	0.49	Sub-alpine Fir
20	BC	51	1.12	0.36	0.36	1.46	1.62	0.49	Black Cottonwood
20	BM	55	5.02	0.48	0.48	0.97	0.58	0.49	Bigleaf maple
20	BS	44	4.04	0.41	0.41	1.13	0.52	0.49	Black Spruce
20	BX	22	1.97	0.45	0.45	1.15	0.45	0.48	Brush Species
20	DF	43	3.00	0.48	0.48	1.15	0.37	0.49	Douglas-fir
20	GX	11	0.97	0.45	0.45	0.85	0.35	0.48	Grass Species
20	KB	52	1.96	0.40	0.40	0.72	0.89	0.49	Kenai Birch
20	LP	41	1.18	0.41	0.41	1.20	0.41	0.49	Lodgepole Pine
20	LS	43	3.04	0.40	0.40	1.43	0.51	0.49	Lutz Spruce
20	MH	44	4.03	0.42	0.42	1.50	0.85	0.49	Mountain Hemlock
20	PB	52	1.96	0.40	0.40	0.72	0.89	0.49	Paper Birch
20	PD	53	2.99	0.41	0.41	0.62	0.62	0.49	Pacific Dogwood
20	PM	53	3.04	0.52	0.52	0.81	0.81	0.49	Pacific Madrone
20	PY	45	5.03	0.38	0.38	1.46	0.52	0.49	Pacific Yew
20	QA	51	1.14	0.38	0.38	1.13	0.95	0.49	Quaking Aspen
20	RA	52	2.03	0.41	0.41	0.97	0.97	0.49	Red alder
20	RC	45	5.04	0.33	0.33	1.48	0.62	0.49	Western Red Cedar
20	SS	44	3.99	0.40	0.40	1.42	0.41	0.49	Sitka Spruce



	A	B	C	D	E	F	G	H	I	J
1	Region	Species	Form	Toler	SGsap	SGhrt	PMsap	PMhrt	Carbon	SPName
2	20	AF	44	3.98	0.38	0.38	1.45	0.55	0.49	Sub-alpine Fir
3	20	BC	51	1.12	0.36	0.36	1.46	1.62	0.49	Black Cottonwood
4	20	BM	55	5.02	0.48	0.48	0.97	0.58	0.49	Bigleaf maple
5	20	BS	44	4.04	0.41	0.41	1.13	0.52	0.49	Black Spruce
6	20	BX	22	1.97	0.45	0.45	1.15	0.45	0.48	Brush Species
7	20	DF	43	3.00	0.48	0.48	1.15	0.37	0.49	Douglas-fir
8	20	GX	11	0.97	0.45	0.45	0.85	0.35	0.48	Grass Species
9	20	KB	52	1.96	0.40	0.40	0.72	0.89	0.49	Kenai Birch
10	20	LP	41	1.18	0.41	0.41	1.20	0.41	0.49	Lodgepole Pine
11	20	LS	43	3.04	0.40	0.40	1.43	0.51	0.49	Lutz Spruce
12	20	MH	44	4.03	0.42	0.42	1.50	0.85	0.49	Mountain Hemlock
13	20	PB	52	1.96	0.40	0.40	0.72	0.89	0.49	Paper Birch
14	20	PD	53	2.99	0.41	0.41	0.62	0.62	0.49	Pacific Dogwood
15	20	PM	53	3.04	0.52	0.52	0.81	0.81	0.49	Pacific Madrone
16	20	PY	45	5.03	0.38	0.38	1.46	0.52	0.49	Pacific Yew
17	20	QA	51	1.14	0.38	0.38	1.13	0.95	0.49	Quaking Aspen
18	20	RA	52	2.03	0.41	0.41	0.97	0.97	0.49	Red alder
19	20	RC	45	5.04	0.33	0.33	1.48	0.62	0.49	Western Red Cedar
20	20	SS	44	3.99	0.40	0.40	1.42	0.41	0.49	Sitka Spruce
21	20	T3	43	3.00	0.48	0.48	1.31	0.55	0.49	Intermediate
22	20	TA	41	1.14	0.52	0.52	1.19	0.54	0.49	Tamarack
23	20	TP	51	1.16	0.40	0.40	1.46	0.62	0.49	Balsam Poplar / Hackmatack
24	20	VM	35	5.01	0.45	0.45	0.85	0.35	0.48	Vine maple
25	20	WH	45	5.01	0.42	0.42	1.70	0.85	0.49	Western Hemlock
26	20	WS	43	3.04	0.40	0.40	1.43	0.51	0.49	White Spruce
27	20	WX	33	3.01	0.45	0.45	0.85	0.35	0.48	Woody Vegetation
28	20	YC	44	4.04	0.42	0.42	1.56	0.32	0.49	Alaska Yellow Cedar
29										



	Old Universal Library								New Universal Library								Differences						
	STD_ID	Trees	QDBH	BASAL	TOP_HT	BoardGrs	BoardNet	Percent	STD_ID	Trees	QDBH	BASAL	TOP_HT	BoardGrs	BoardNet	Percent	STD_ID	Trees	QDBH	BASAL	TOP_HT	BoardGrs	BoardNet
3	4	1,386	5.82	256.4	69.0	20,691	19,656	5.0%	4	1,386	5.82	256.4	69.0	20,691	19,656	5.0%	4	0	0.00	0.0	0.0	0	0
4	6	644	5.71	114.6	64.0	6,902	5,471	20.7%	6	644	5.71	114.6	64.0	7,113	5,196	26.9%	6	0	0.00	0.0	0.0	211	-275
5	10	1,280	5.54	214.3	55.6	9,633	8,226	14.6%	10	1,280	5.54	214.3	55.6	9,805	8,361	14.7%	10	0	0.00	0.0	0.0	172	135
6	11	1,214	3.96	103.6	42.7	859	707	17.6%	11	1,214	3.96	103.6	42.7	881	691	21.6%	11	0	0.00	0.0	0.0	23	-17
7	27	833	6.73	205.9	51.7	6,897	6,015	12.8%	27	833	6.73	205.9	51.7	6,897	6,015	12.8%	27	0	0.00	0.0	0.0	0	0
8	28	776	5.21	114.8	53.8	6,164	5,190	15.8%	28	776	5.21	114.8	53.8	6,164	5,165	16.2%	28	0	0.00	0.0	0.0	0	-26
9	30	701	4.21	67.7	53.5	3,534	2,626	25.7%	30	701	4.21	67.7	53.5	3,599	2,599	27.8%	30	0	0.00	0.0	0.0	66	-26
10	32	1,139	5.37	179.2	39.6	829	705	15.0%	32	1,139	5.37	179.2	39.6	829	705	15.0%	32	0	0.00	0.0	0.0	0	0
11	33	1,797	3.62	128.3	47.0	2,911	2,429	16.6%	33	1,797	3.62	128.3	47.0	2,911	2,305	20.8%	33	0	0.00	0.0	0.0	0	-124
12	34	439	5.50	72.4	39.0	1,923	1,477	23.2%	34	439	5.50	72.4	39.0	2,124	1,612	24.1%	34	0	0.00	0.0	0.0	201	135
13	38	318	12.98	292.1	84.2	33,788	30,461	9.8%	38	318	12.98	292.1	84.2	33,788	30,417	10.0%	38	0	0.00	0.0	0.0	0	-43
14	51	304	9.01	134.4	48.3	6,106	3,969	35.0%	51	304	9.01	134.4	48.3	6,106	3,969	35.0%	51	0	0.00	0.0	0.0	0	0
15	54	1,006	6.87	259.3	57.0	10,696	9,613	10.1%	54	1,006	6.87	259.3	57.0	10,894	9,676	11.2%	54	0	0.00	0.0	0.0	198	63
16	55	958	5.99	187.6	44.7	2,980	2,308	22.6%	55	958	5.99	187.6	44.7	2,980	2,308	22.6%	55	0	0.00	0.0	0.0	0	0
17	61	1,046	4.79	130.7	44.2	2,806	2,061	26.5%	61	1,046	4.79	130.7	44.2	2,806	2,061	26.5%	61	0	0.00	0.0	0.0	0	0
18	62	2,446	2.79	104.0	32.5	31	30	5.0%	62	2,446	2.79	104.0	32.5	31	27	12.0%	62	0	0.00	0.0	0.0	0	-2
19	63	1,151	3.97	99.1	38.0	0	0	#DIV/0!	63	1,151	3.97	99.1	38.0	0	0	#DIV/0!	63	0	0.00	0.0	0.0	0	0
20	65	540	5.27	81.7	51.7	3,018	2,141	29.0%	65	540	5.27	81.7	51.7	3,053	2,094	31.4%	65	0	0.00	0.0	0.0	34	-48
21	66	1,259	4.08	114.5	37.9	427	406	5.0%	66	1,259	4.08	114.5	37.9	427	406	5.0%	66	0	0.00	0.0	0.0	0	0
22	70	676	5.36	106.0	48.9	2,713	1,715	36.8%	70	676	5.36	106.0	48.9	2,831	1,683	40.6%	70	0	0.00	0.0	0.0	119	-32
23	81	425	8.45	165.8	49.2	6,775	5,191	23.4%	81	425	8.45	165.8	49.2	6,775	5,191	23.4%	81	0	0.00	0.0	0.0	0	0
24	142	1,266	4.38	132.6	56.3	5,055	3,559	29.6%	142	1,266	4.38	132.6	56.3	5,055	3,559	29.6%	142	0	0.00	0.0	0.0	0	0
25	148	1,664	3.68	123.0	63.7	3,737	3,254	12.9%	148	1,664	3.68	123.0	63.7	3,737	3,254	12.9%	148	0	0.00	0.0	0.0	0	0
26	176	4,620	2.16	117.4	39.1	931	574	38.4%	176	4,620	2.16	117.4	39.1	931	568	39.0%	176	0	0.00	0.0	0.0	0	-6
27	178	6,249	3.12	331.3	54.0	0	0	#DIV/0!	178	6,249	3.12	331.3	54.0	0	0	#DIV/0!	178	0	0.00	0.0	0.0	0	0
28	198	306	11.25	211.2	57.0	11,520	10,288	10.7%	198	306	11.25	211.2	57.0	11,520	10,288	10.7%	198	0	0.00	0.0	0.0	0	0
29	215	959	4.42	102.3	42.9	1,437	975	32.2%	215	959	4.42	102.3	42.9	1,437	874	39.2%	215	0	0.00	0.0	0.0	0	-101
30	225	3,099	2.89	140.8	52.0	8,181	4,301	47.4%	225	3,099	2.89	140.8	52.0	8,181	4,301	47.4%	225	0	0.00	0.0	0.0	0	0
31	228	957	6.00	187.8	55.0	3,735	3,549	5.0%	228	957	6.00	187.8	55.0	3,735	3,549	5.0%	228	0	0.00	0.0	0.0	0	0
32	235	597	6.08	120.4	64.0	12,852	8,349	35.0%	235	597	6.08	120.4	64.0	12,852	8,349	35.0%	235	0	0.00	0.0	0.0	0	0
33	279	832	5.59	141.5	36.0	2,290	936	59.1%	279	832	5.59	141.5	36.0	2,290	867	62.2%	279	0	0.00	0.0	0.0	0	-69

New Region 20 Library

- Gross board foot volumes increased for all the species added to the library
- Why the increase? Because if a species is not in the library, FPS will give it a very conservative taper profile
- Projected release date:

  Q1 2026

T	U	V	W	X	Y
			Differences		
STD_ID	**Trees**	**QDBH**	**BASAL**	**TOP_HT**	**BoardGrs**
4	0	0.00	0.0	0.0	0
6	0	0.00	0.0	0.0	211
10	0	0.00	0.0	0.0	172
11	0	0.00	0.0	0.0	23
27	0	0.00	0.0	0.0	0
28	0	0.00	0.0	0.0	0
30	0	0.00	0.0	0.0	66
32	0	0.00	0.0	0.0	0
33	0	0.00	0.0	0.0	0
34	0	0.00	0.0	0.0	201
38	0	0.00	0.0	0.0	0
51	0	0.00	0.0	0.0	0
54	0	0.00	0.0	0.0	198
55	0	0.00	0.0	0.0	0
61	0	0.00	0.0	0.0	0
62	0	0.00	0.0	0.0	0
63	0	0.00	0.0	0.0	0

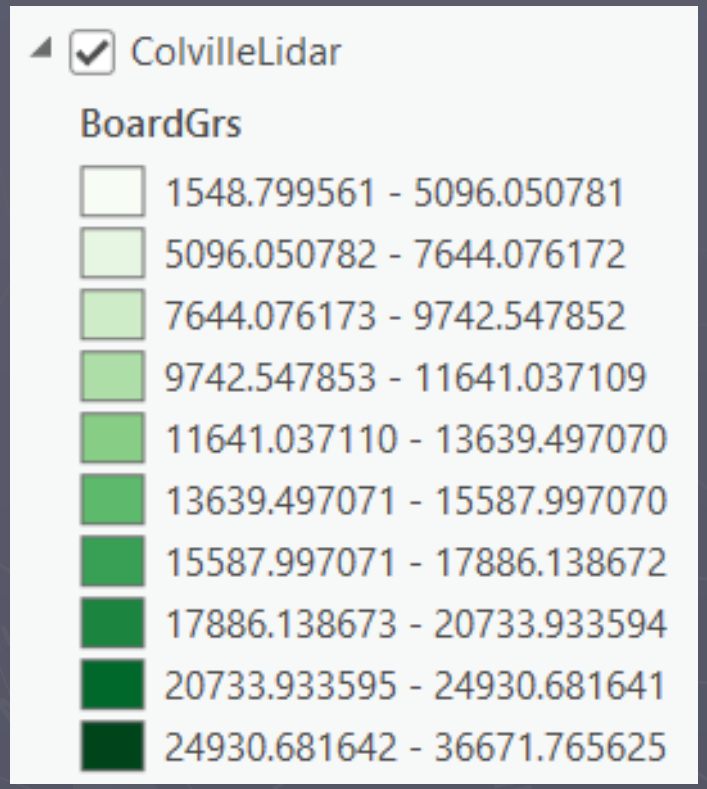
Maximum Stand Size Increased

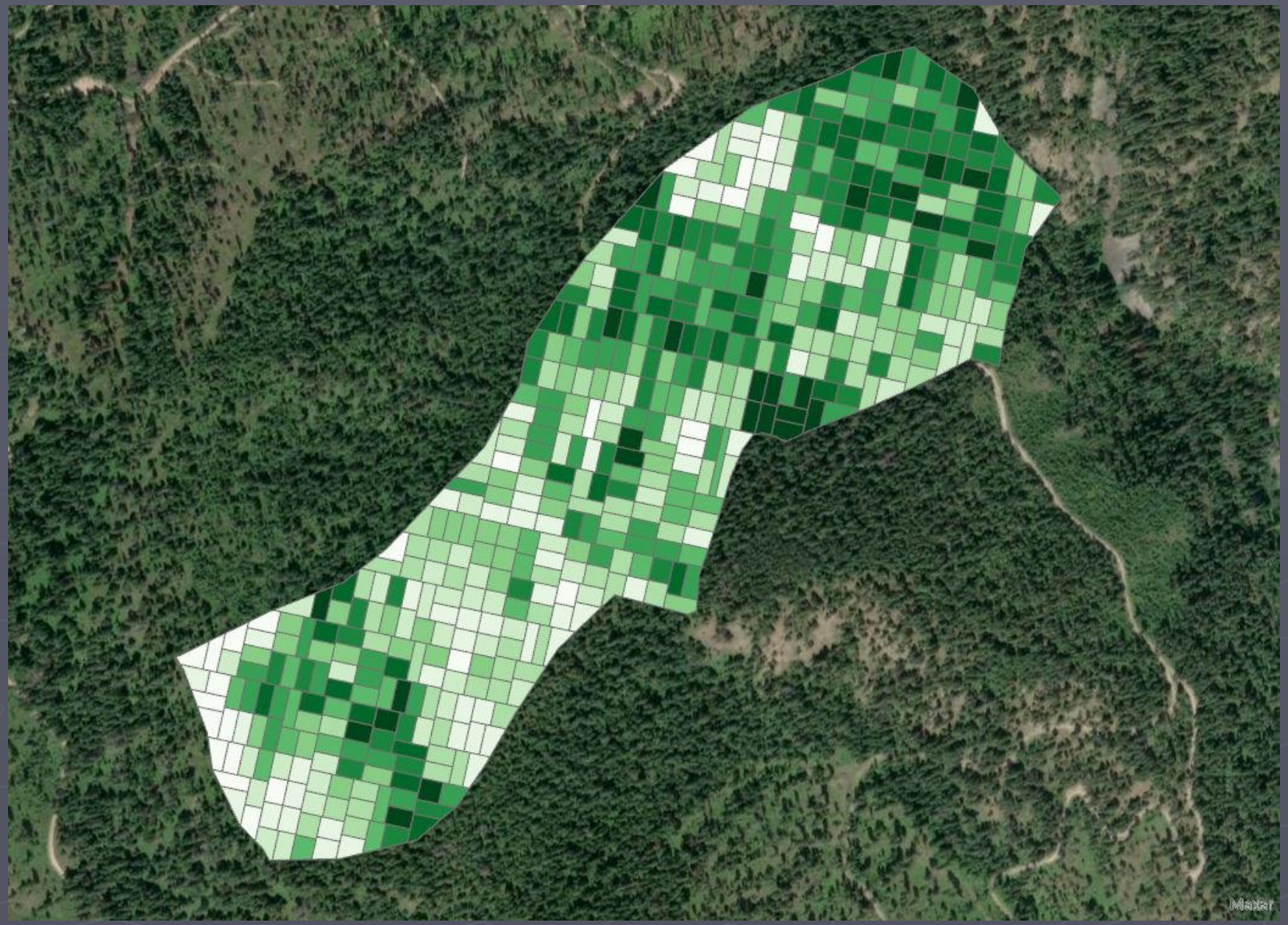
- FPS 7.60
  - Maximum stand size 100 acres
  - Maximum number of trees per species 20,000
- FPS Pro – Projected release date Q1 2026
  - Maximum stand size increased to 1,000 acres
  - Maximum number of trees per species increased to 100,000

The Colville Reservation's Lidar Trees

- Stand 547259
- 108.1 acres
- 49,440 trees
- 457 trees / acre
- 7.6 in. DBH_q
- 180 sq ft / acre
- 94 ft top height
- 14,156 bd ft / acre

Volume Heat Map





Bug Corrected in Fortran Code that Generates SVS Input Files

- SVS input files provide FPS users with an outstanding resource to visually check growth projections for lidar data with XY coordinates
- While I was preparing my presentation for yesterday's OLI meeting, I discovered a problem with the SVS input files generated by FPS
- Stand 316 illustrates the problem quite nicely — Note that it only contains seven (7) lidar trees

PLOTS

STD_ID	PLOT	TREE	SPECIES	GRP	X_ARC	Y_DIST	MSMT	DBH	TREES	HEIGHT
316	1	689651	GF	..	34	152	2019	6.7	1	38
316	1	689652	GF	..	22	118	2019	5.4	1	30
316	1	689653	PP	..	21	106	2019	5.5	1	30
316	1	689654	PP	..	23	105	2019	4.6	1	26
316	1	689930	PP	..	2	1	2019	8	1	45
316	1	689931	PP	..	1	2.5	2019	8.8	1	49
316	1	689932	DF	..	35	14.5	2019	5.9	1	33

Record: 1 of 7 Filtered Search

Stand 316 Compiled and Grown

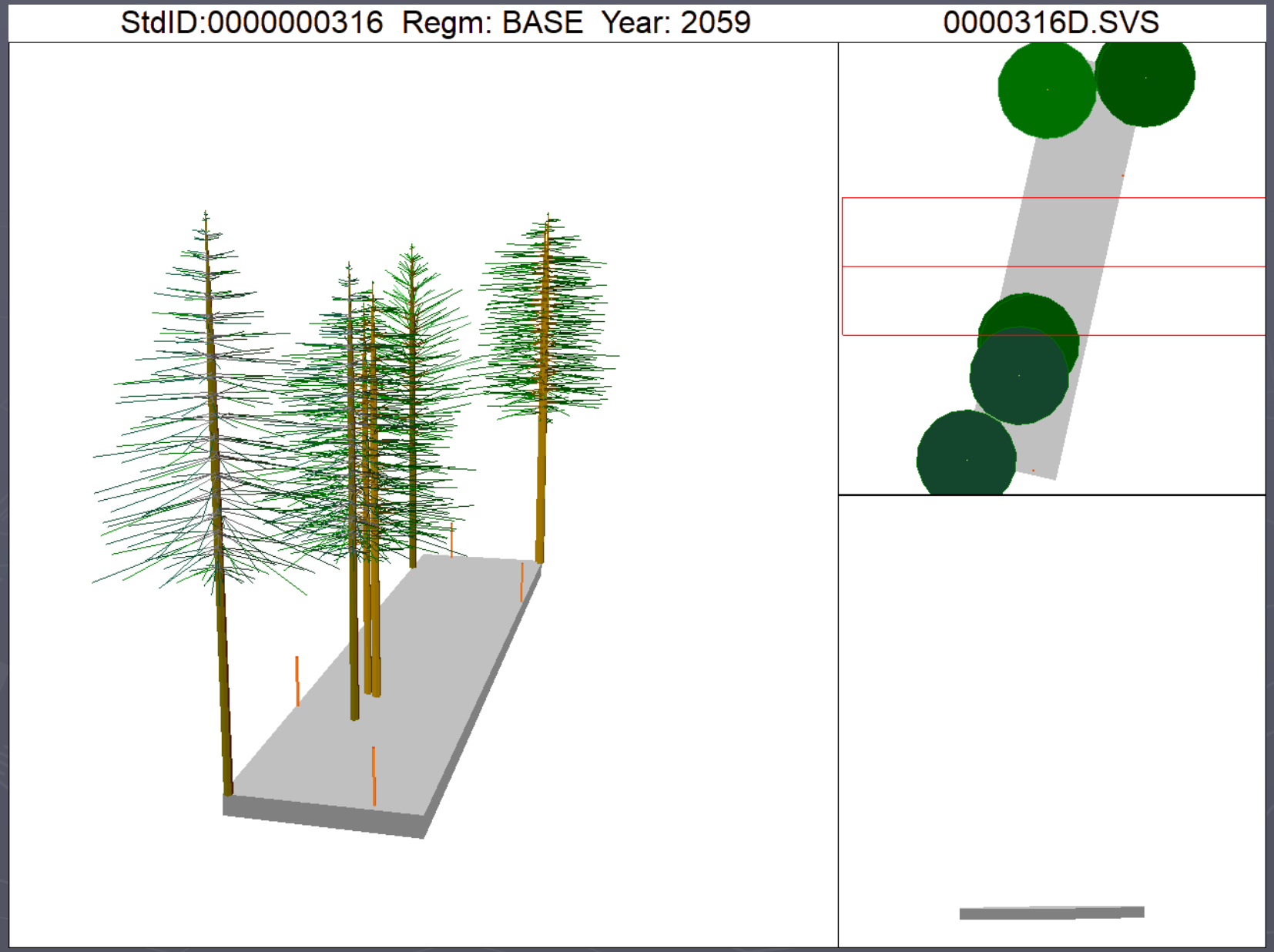
DBHCLS

STD_ID	RPT_YR	SPECIES	GRP	PlotTree	Age	TREES	DBH	BASAL	HEIGHT
316	2019	GF	..	699651	0	1.267003	6.7	0.3102091	38
316	2019	GF	..	699652	0	1.267003	5.4	0.2015081	30
316	2019	PP	..	699653	0	1.267003	5.5	0.2090404	30
316	2019	PP	..	699654	0	1.267003	4.6	0.1462247	26
316	2019	PP	..	699930	0	1.267003	8	0.4422674	45
316	2019	PP	..	699931	0	1.267003	8.8	0.5351436	49
316	2019	DF	..	699932	0	1.267003	5.9	0.240552	33
316	2029	PP	e.	95	16	1.266206	7.369919	0.3751087	37.42584
316	2029	GF	e.	114	15	1.266471	8.546523	0.5045468	43.48635
316	2029	PP	e.	115	16	1.266278	8.558829	0.5059237	42.4855
316	2029	DF	e.	124	16	1.26624	9.573959	0.6330335	48.64375
316	2029	GF	e.	124	15	1.265865	10.11024	0.7057284	54.16602
316	2029	PP	e.	134	16	1.265391	11.32812	0.885662	59.93404
316	2029	PP	e.	144	16	1.265451	11.93086	0.9824631	62.96811
316	2039	PP	e.	145	26	1.265599	11.50964	0.9144223	54.2053
316	2039	GF	e.	145	26	1.266003	12.37974	1.058242	59.78071
316	2039	GF	e.	154	26	1.26477	13.46634	1.250944	70.02714
316	2039	PP	e.	155	26	1.265731	12.53267	1.084317	58.45232
316	2039	DF	e.	155	26	1.265568	13.30525	1.221966	64.44543
316	2039	PP	e.	164	26	1.264014	14.41609	1.432763	73.63107
316	2039	PP	e.	174	26	1.264087	15.00239	1.551762	76.56758

Record: 15 of 33 | Filtered | Search

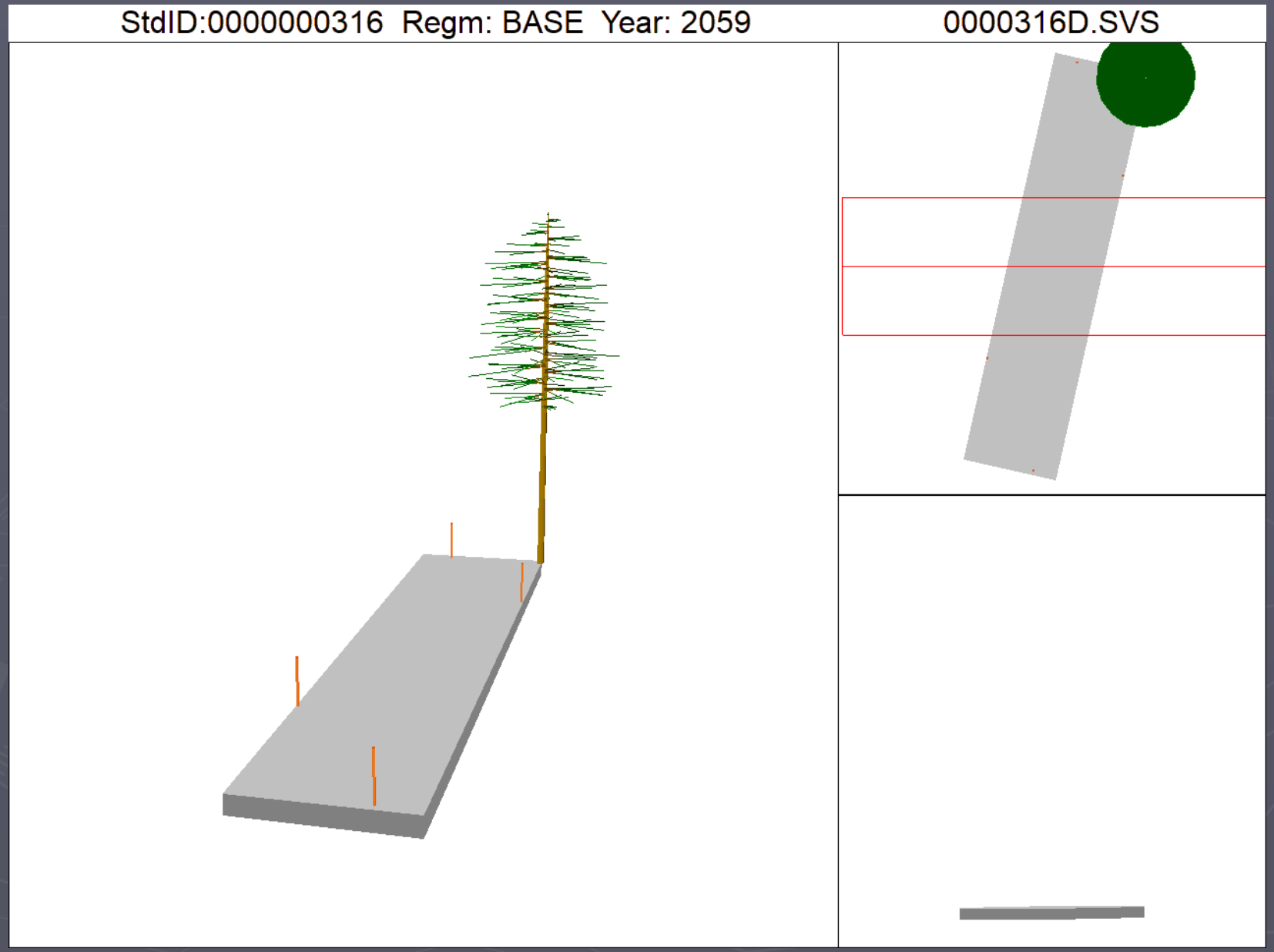
SVS Charts for Stand 316 (with bug corrected in FPS Pro)

2019 to 2059 in 10-Year Increments



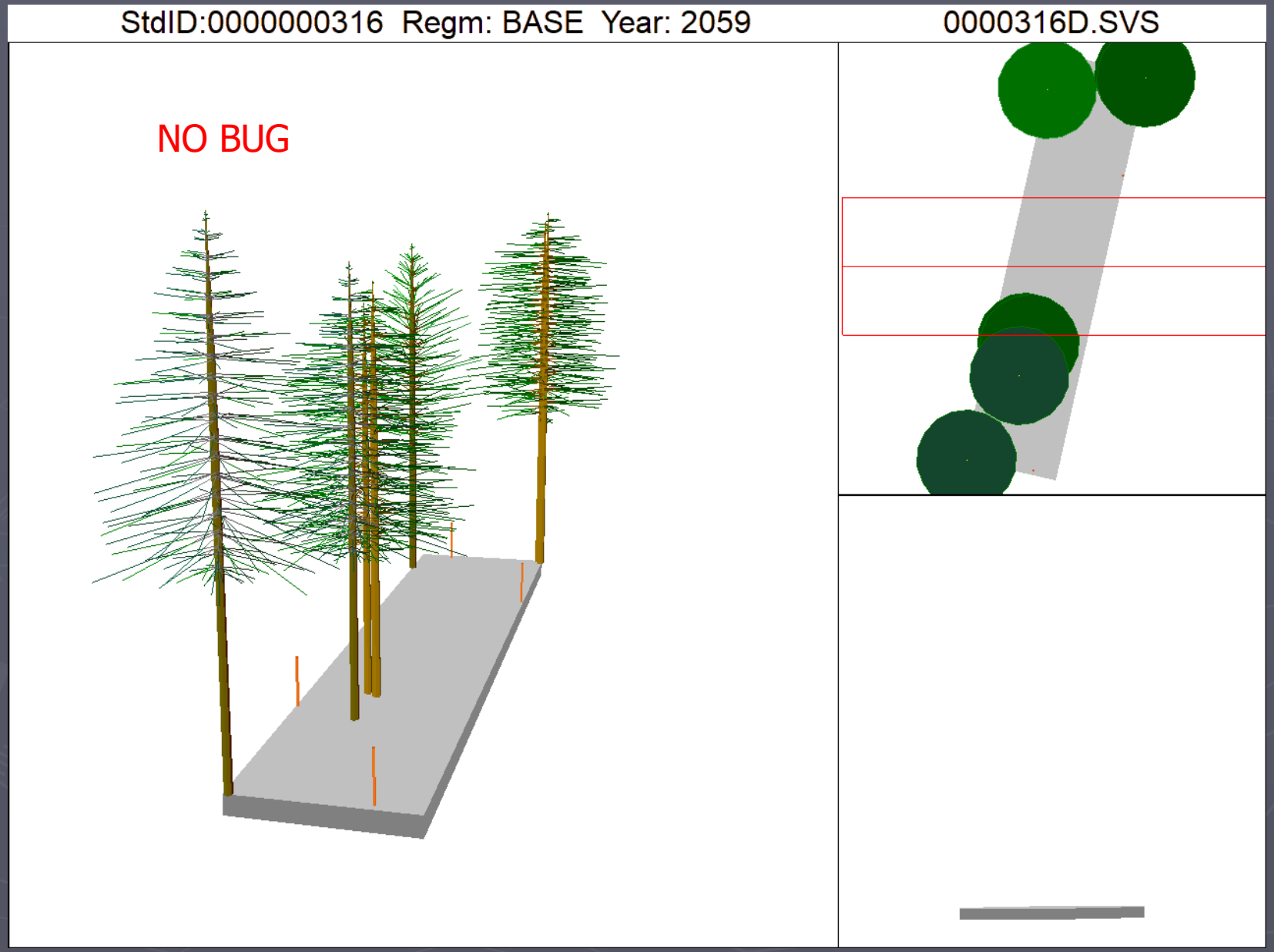
SVS Charts for Stand 316 (with the bug)

2019 to 2059 in 10-Year Increments



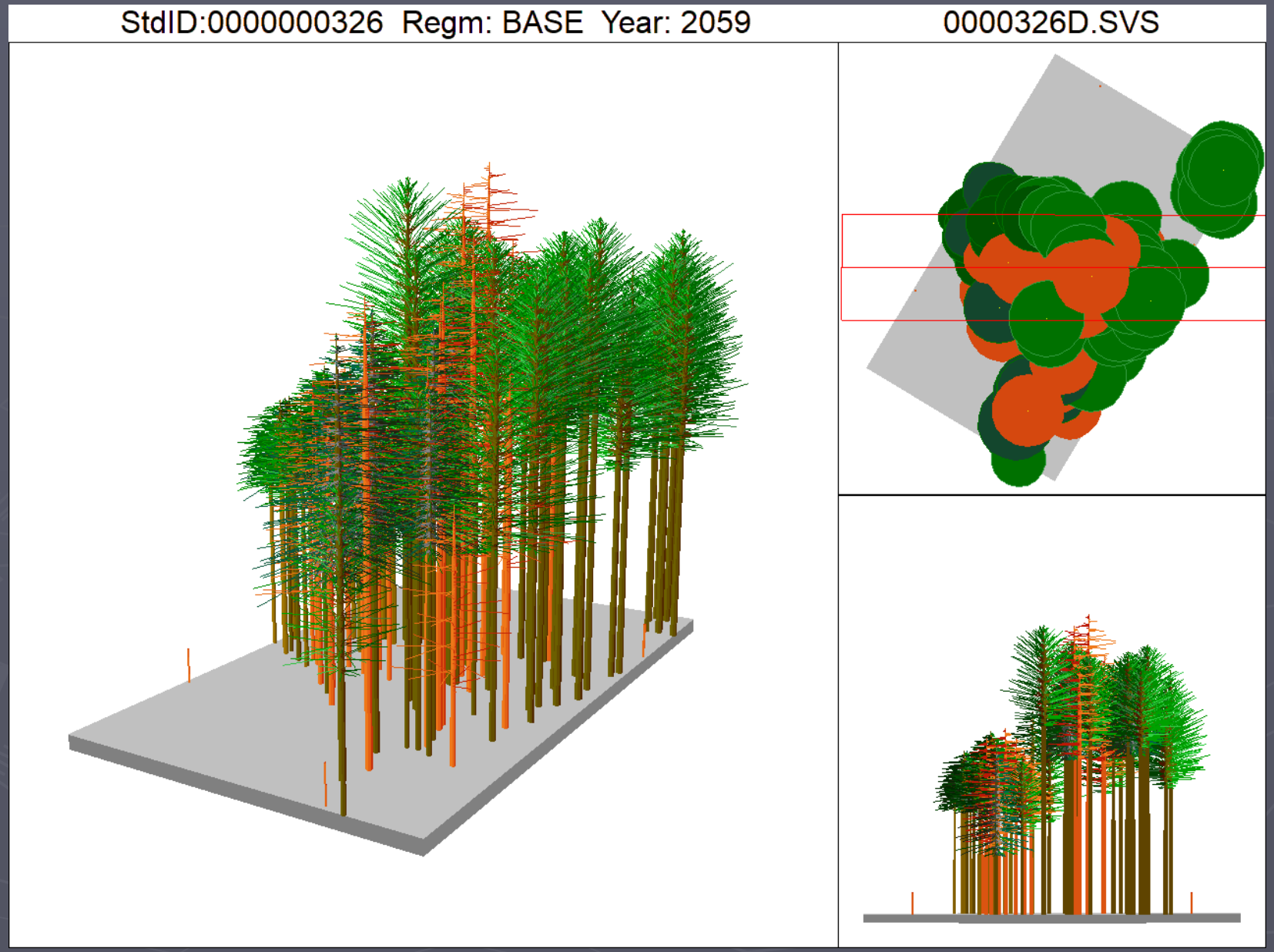
SVS Charts for Stand 316

Year 2059



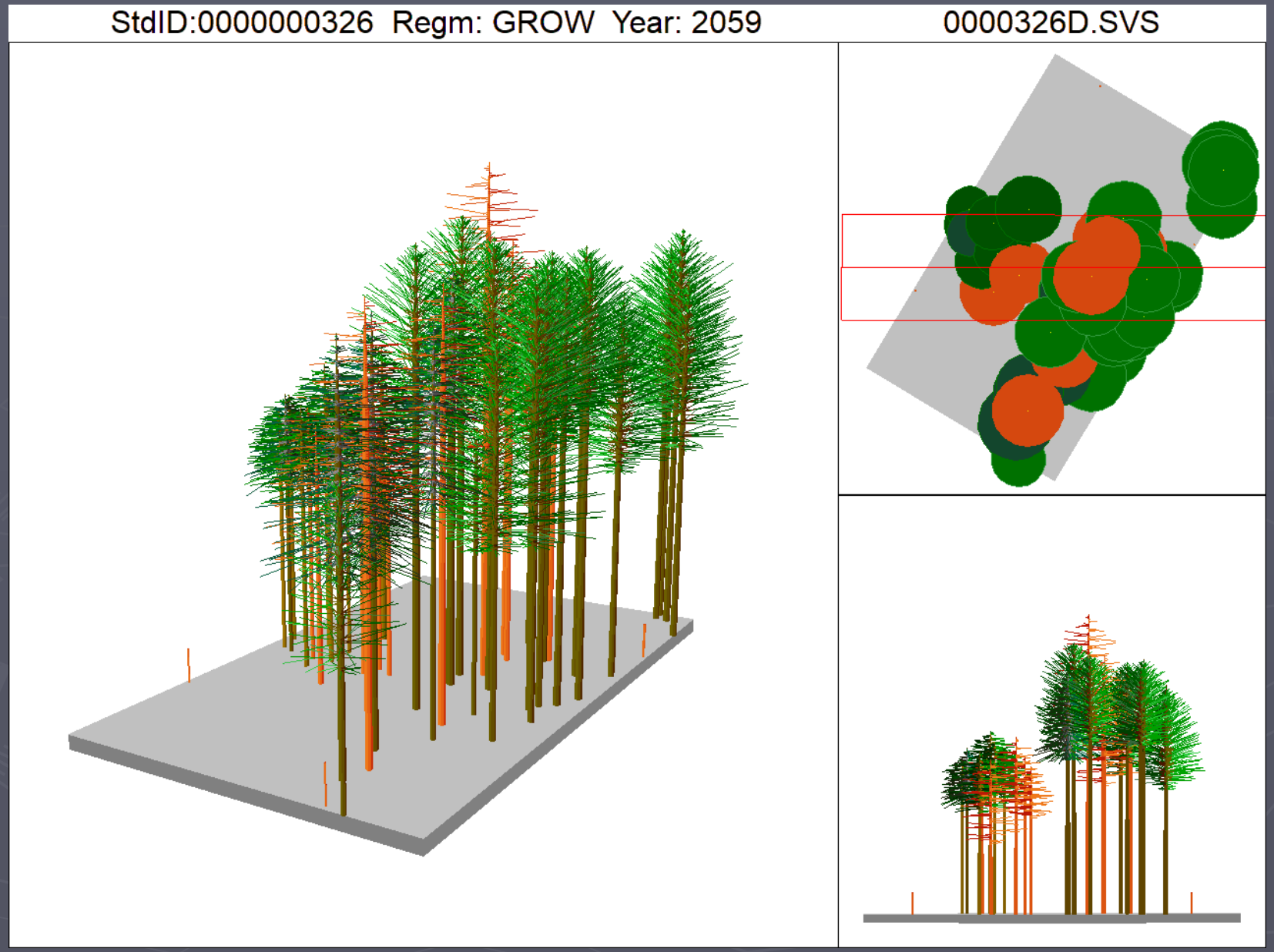
SVS Charts for Stand 326 (with bug corrected in FPS Pro)

2019 to 2059 in 10-Year Increments



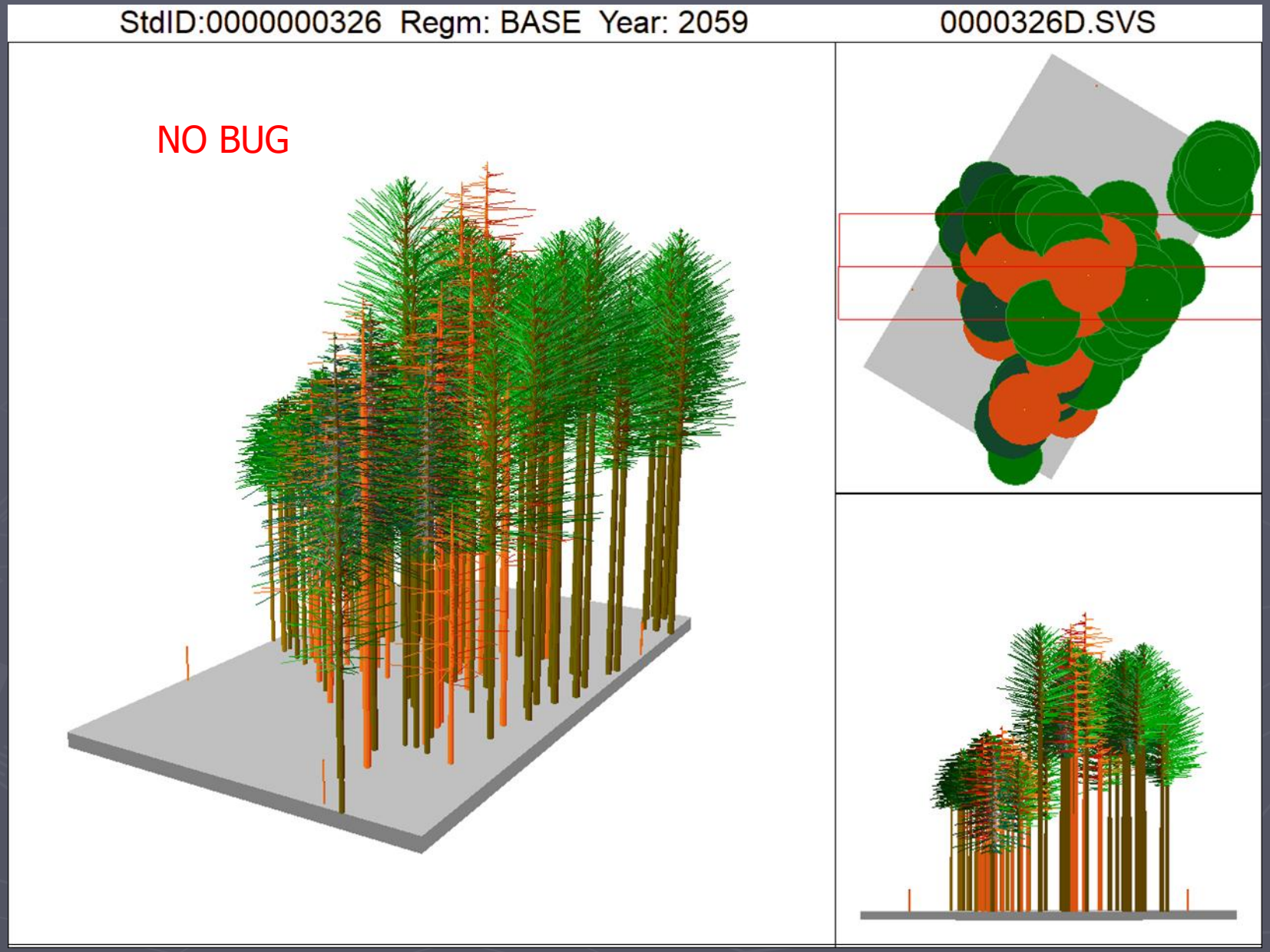
SVS Charts for Stand 326 (with the bug)

2019 to 2059 in 10-Year Increments



SVS Charts for Stand 326

Year 2059



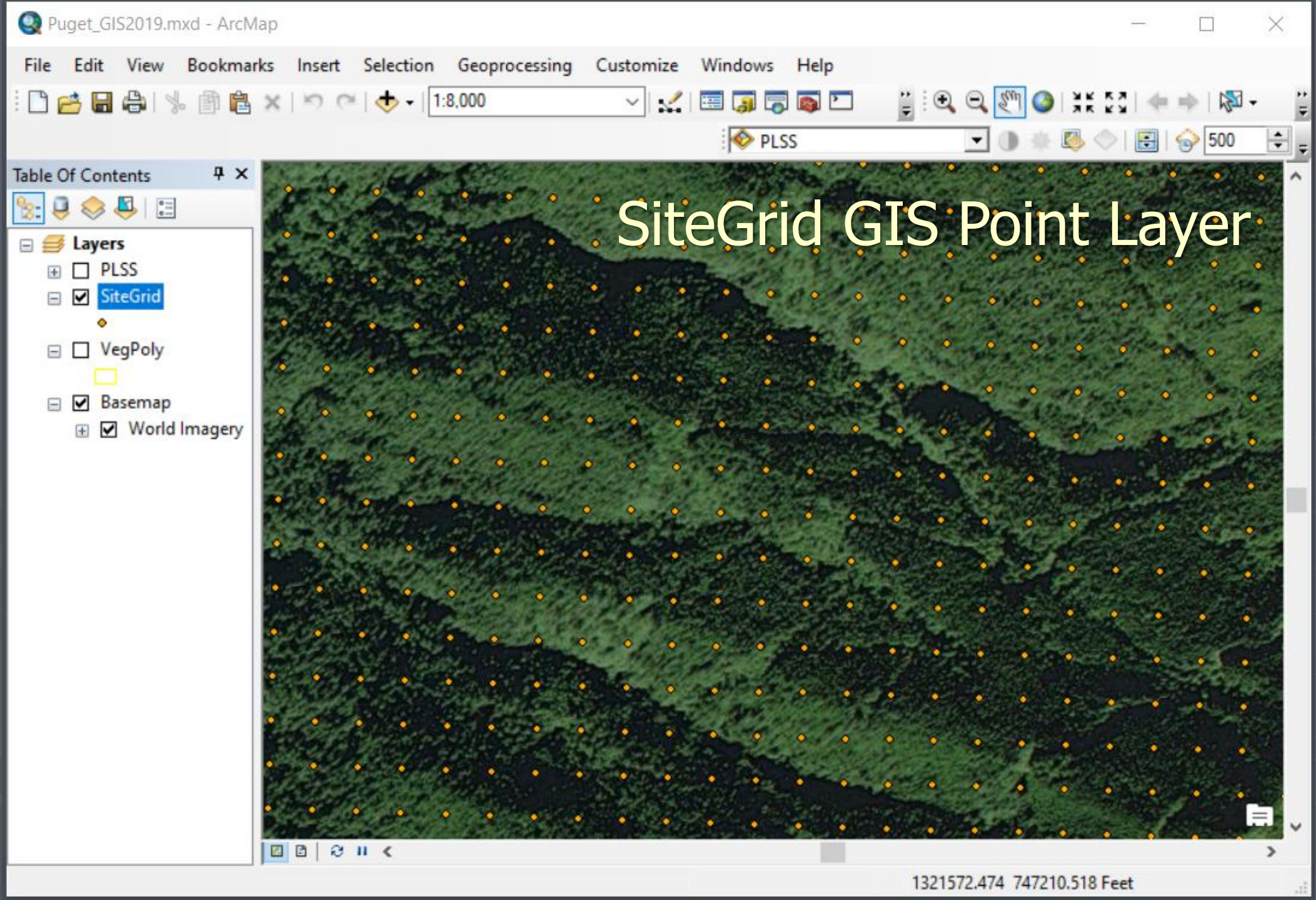
FBRI Enterprise Services

1. Conduct in-person or on-line customized FPS training sessions
2. Estimation of site index using repeat measurements
   - CFI data – we can use two or more measurements (we don't need breast height age data)
   - Lidar data – we can use two or more lidar flights
3. Localization of site productivity GIS layers (SiteGrid)
   - Can be based on felled-tree data, traditional site tree measurements, CFI data, FIA data, or lidar data
4. FPS inventory audits
5. Forest inventories developed from lidar data

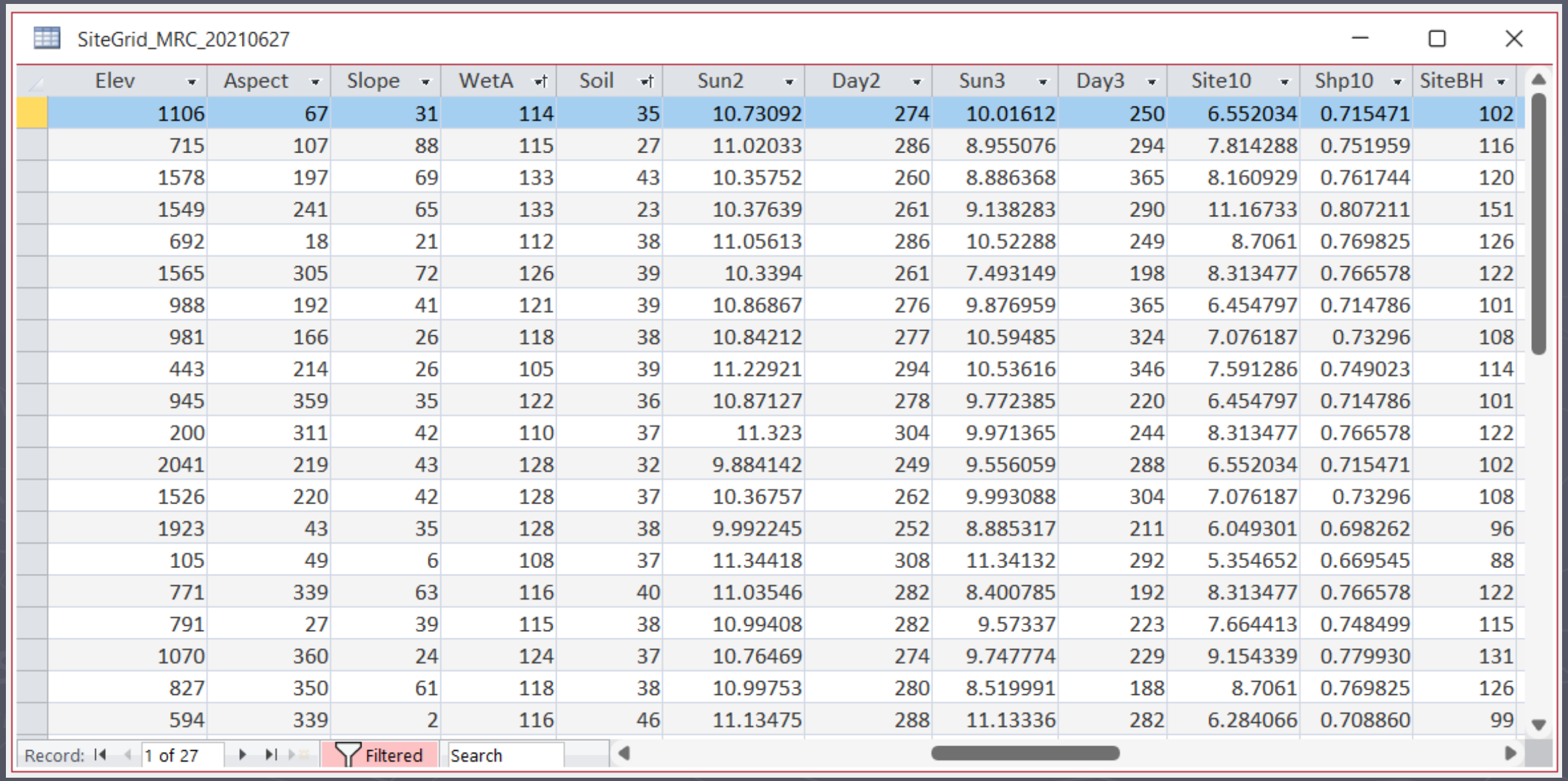
FBRI Enterprise Services

3. Localization of a Site Productivity GIS Layer

- We have a project with the Coeur d'Alene Tribe to develop a site productivity GIS layer for their reservation based on data from Continuous Forest Inventory (CFI) plots
- The GIS layer will have an estimate of Monserud's Douglas-fir site index for every acre of the reservation


Puget_GIS2019.mxd - ArcMap
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:8,000
PLSS
500
Table Of Contents
Layers
PLSS
SiteGrid
VegPoly
Basemap
World Imagery
SiteGrid GIS Point Layer
1321572.474 747210.518 Feet

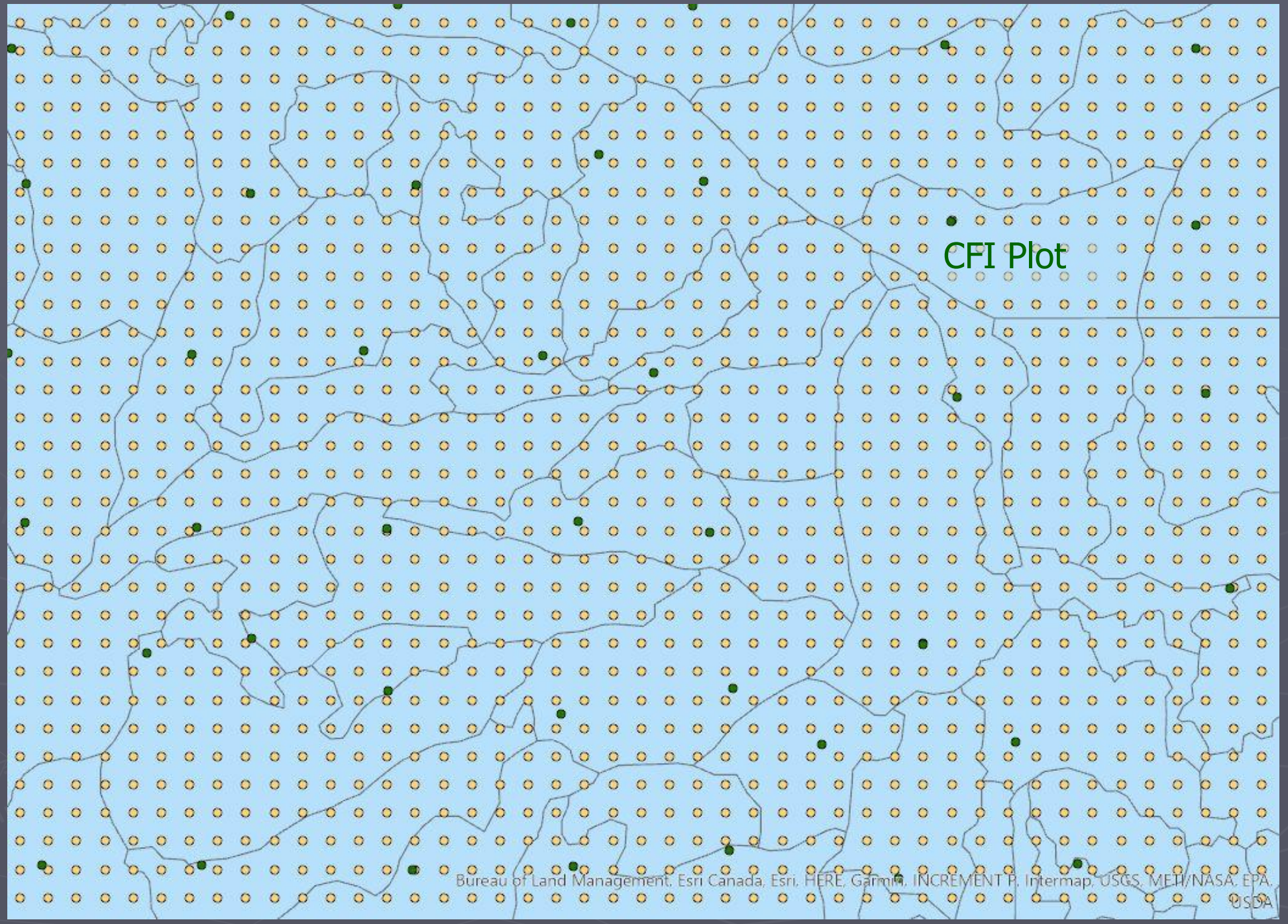
Attribute Table for the SiteGrid Point Layer


SiteGrid_MRC_20210627

Elev	Aspect	Slope	WetA	Soil	Sun2	Day2	Sun3	Day3	Site10	Shp10	SiteBH
1106	67	31	114	35	10.73092	274	10.01612	250	6.552034	0.715471	102
715	107	88	115	27	11.02033	286	8.955076	294	7.814288	0.751959	116
1578	197	69	133	43	10.35752	260	8.886368	365	8.160929	0.761744	120
1549	241	65	133	23	10.37639	261	9.138283	290	11.16733	0.807211	151
692	18	21	112	38	11.05613	286	10.52288	249	8.7061	0.769825	126
1565	305	72	126	39	10.3394	261	7.493149	198	8.313477	0.766578	122
988	192	41	121	39	10.86867	276	9.876959	365	6.454797	0.714786	101
981	166	26	118	38	10.84212	277	10.59485	324	7.076187	0.73296	108
443	214	26	105	39	11.22921	294	10.53616	346	7.591286	0.749023	114
945	359	35	122	36	10.87127	278	9.772385	220	6.454797	0.714786	101
200	311	42	110	37	11.323	304	9.971365	244	8.313477	0.766578	122
2041	219	43	128	32	9.884142	249	9.556059	288	6.552034	0.715471	102
1526	220	42	128	37	10.36757	262	9.993088	304	7.076187	0.73296	108
1923	43	35	128	38	9.992245	252	8.885317	211	6.049301	0.698262	96
105	49	6	108	37	11.34418	308	11.34132	292	5.354652	0.669545	88
771	339	63	116	40	11.03546	282	8.400785	192	8.313477	0.766578	122
791	27	39	115	38	10.99408	282	9.57337	223	7.664413	0.748499	115
1070	360	24	124	37	10.76469	274	9.747774	229	9.154339	0.779930	131
827	350	61	118	38	10.99753	280	8.519991	188	8.7061	0.769825	126
594	339	2	116	46	11.13475	288	11.13336	282	6.284066	0.708860	99

Record: 1 of 27 Filtered Search

SiteGrid Point Layer (one point per acre)



Steps to the Analysis

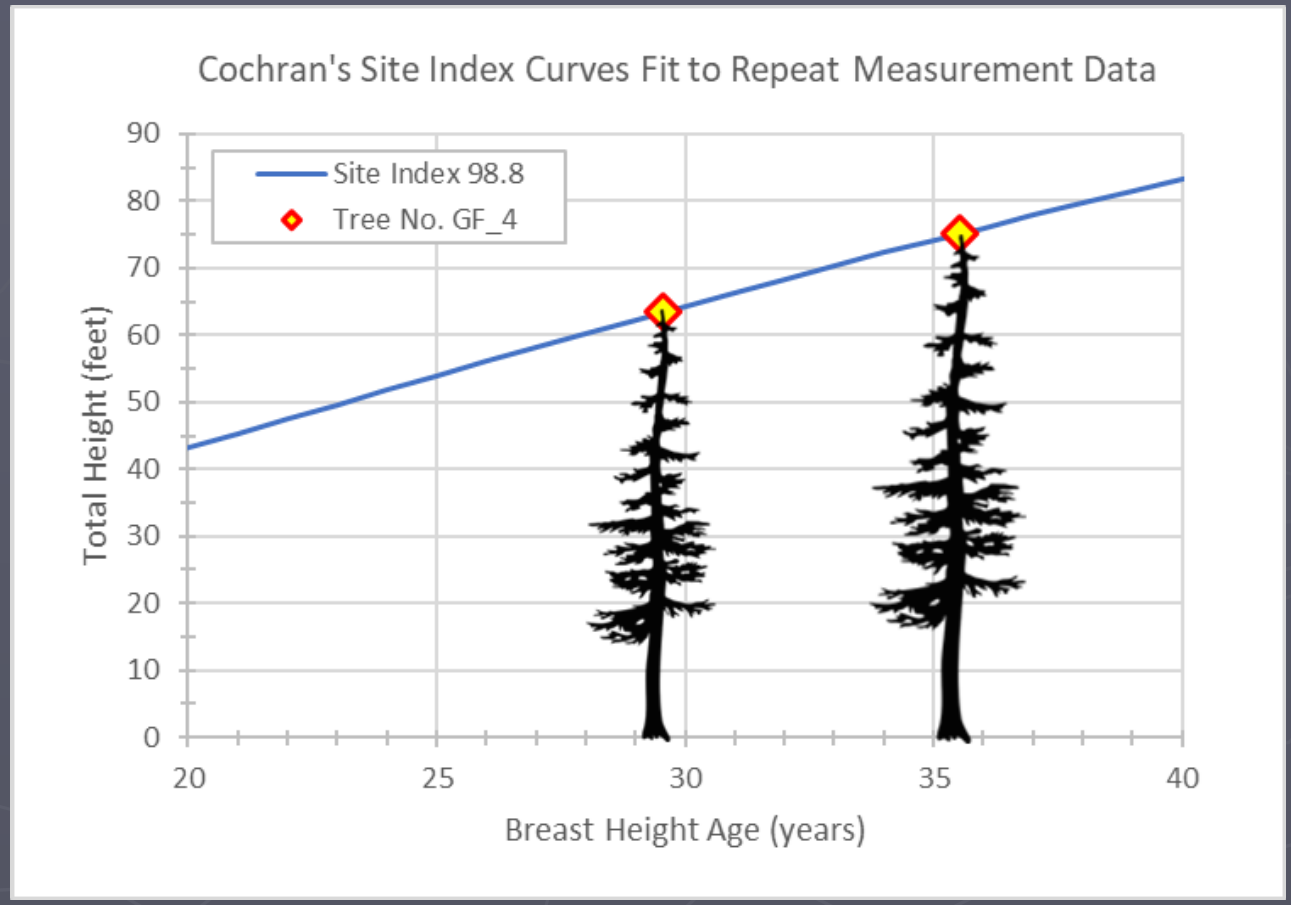
a) Determine the site index of each site tree on each CFI plot
b) Develop a model to predict site index based on environmental factors

$$SI = f(environmental\ factors)$$

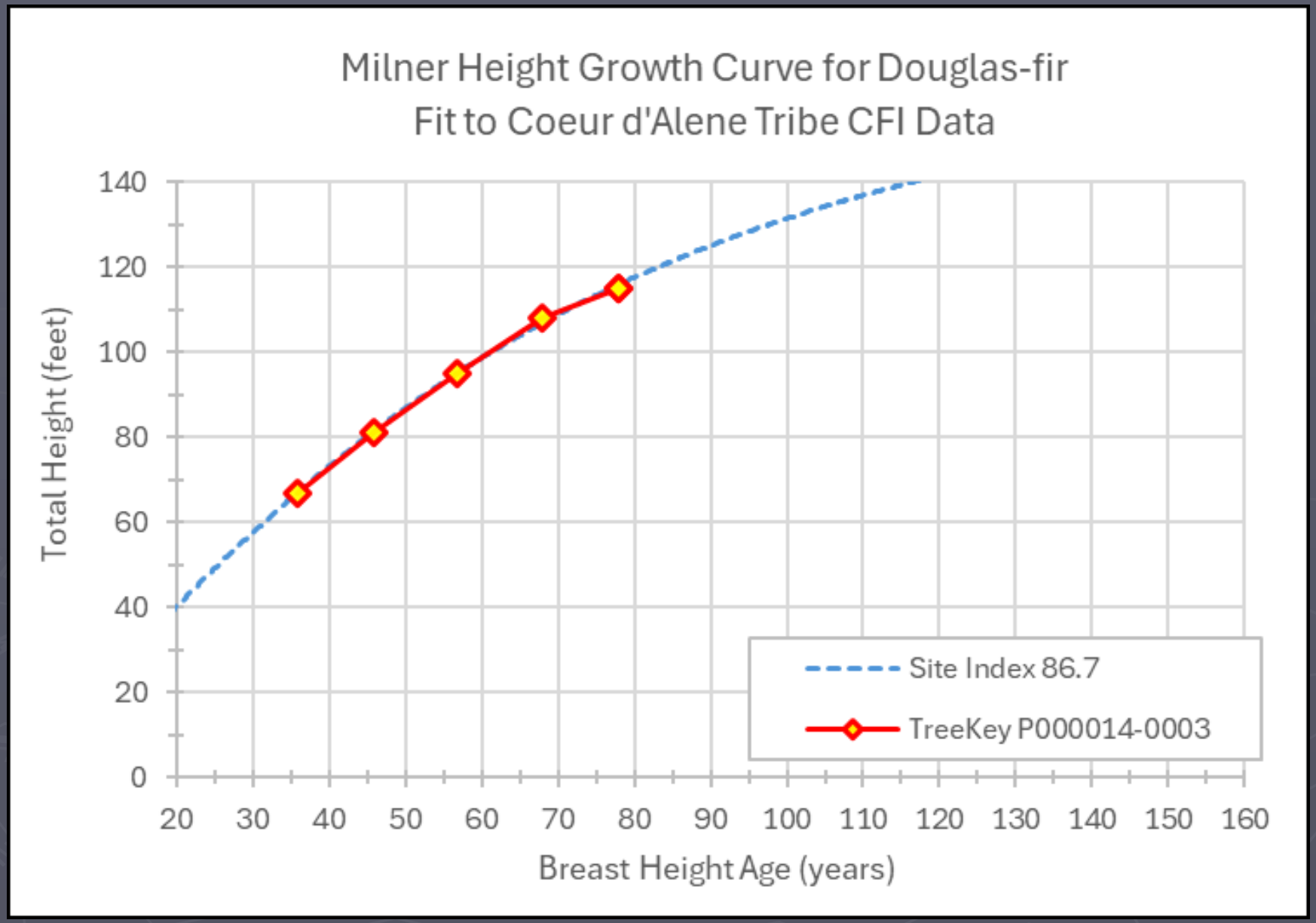
c) Apply the model to estimate site index for every 1-acre grid point that does not have a CFI plot

a) Determine the site index of each site tree on each CFI plot

- Site index will be determined from repeat measurements
- What information do we have to work with?
  - Species
  - Total height at time 1
  - Total height at time 2
  - The length of time between the two measurements
  - To be clear, breast height age is not used to determine site index
- We use a numerical method to find the site curve that fits the repeat measurements



Spoiler alert: We may have more than two measurements!

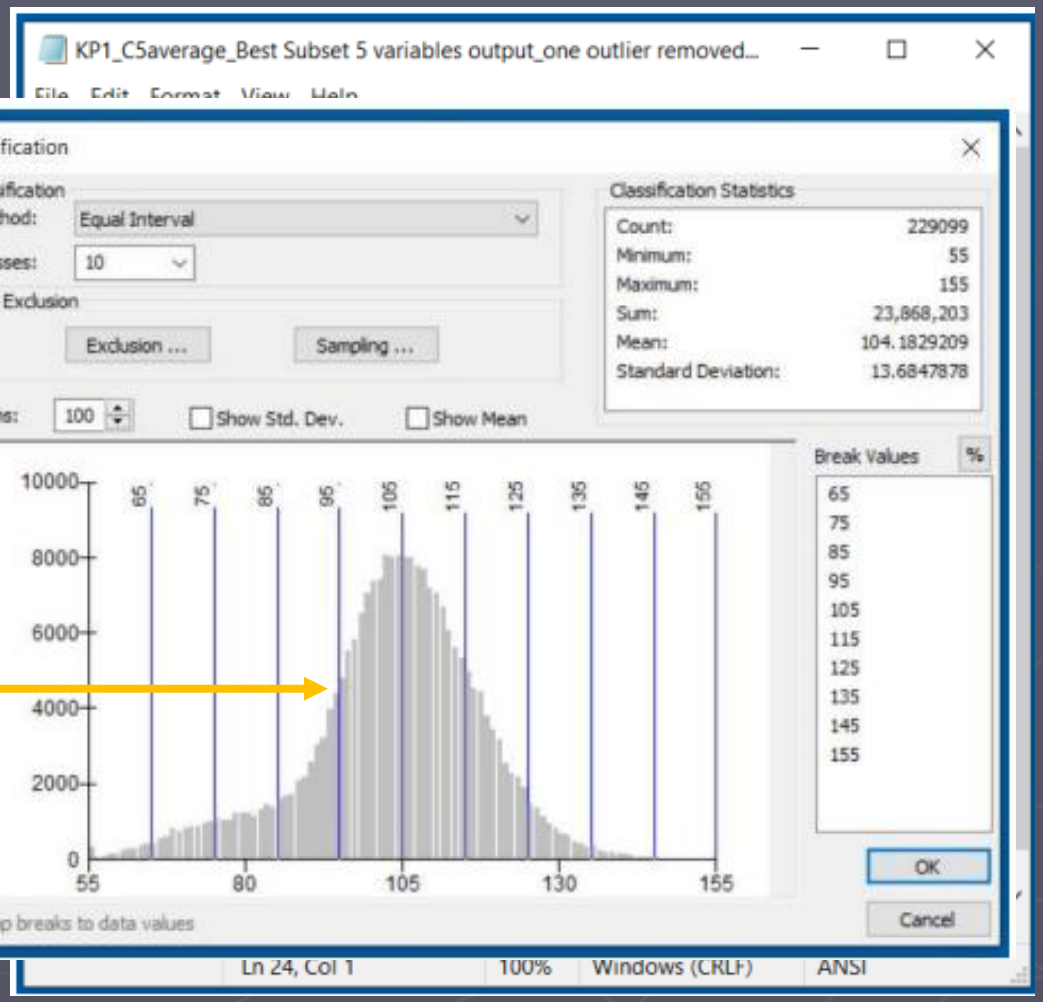

Milner Height Growth Curve for Douglas-fir
Fit to Coeur d'Alene Tribe CFI Data
Total Height (feet)
140
120
100
80
60
40
20
0
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
Breast Height Age (years)
Site Index 86.7
TreeKey P000014-0003

b) Develop a model to predict site index based on environmental factors

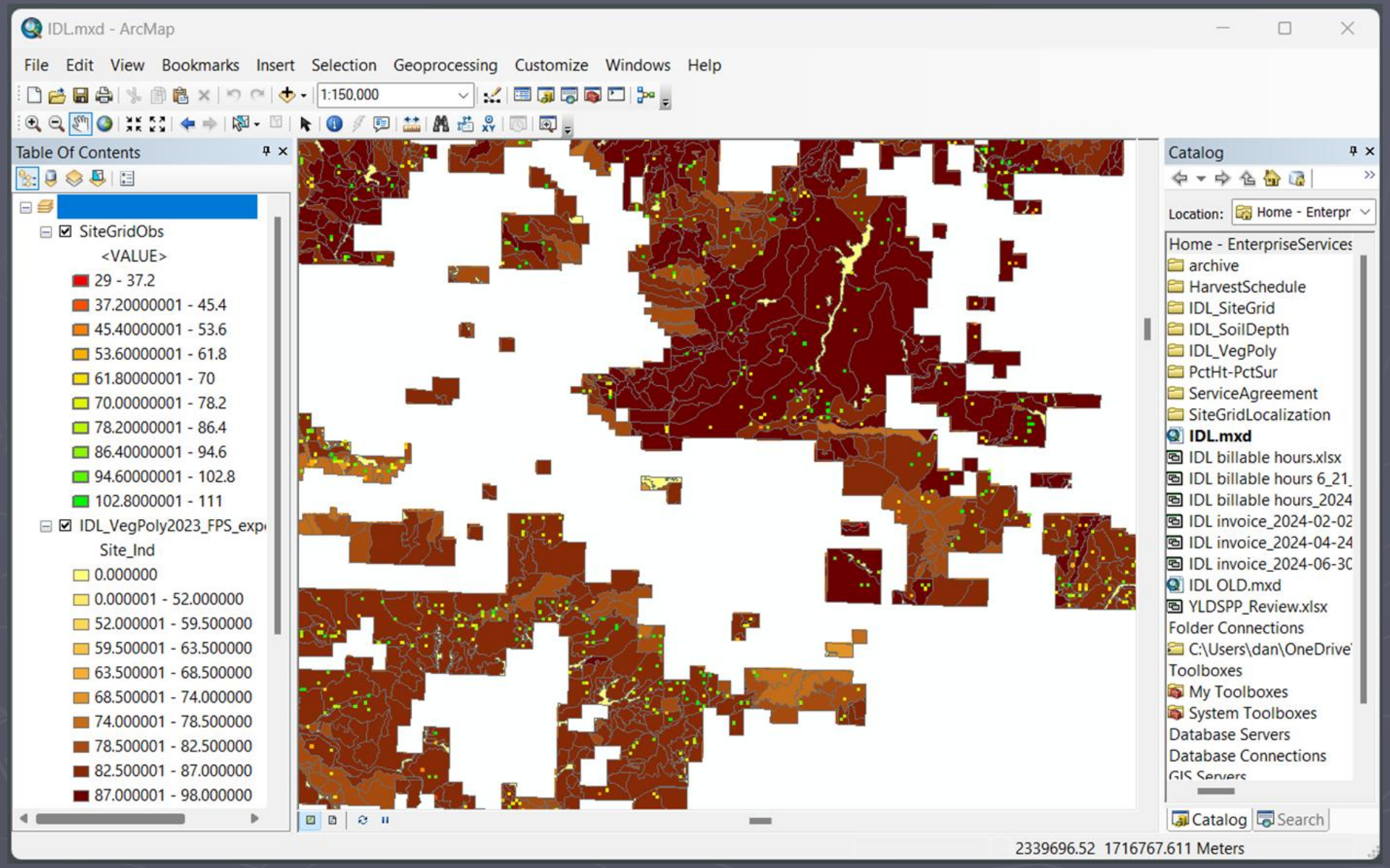
SI = f(environmental factors)

- I plan to test and compare two approaches to model building
  - Stepwise regression—traditional approach
  - Random forest regression—this will be my first foray

- Results must be heavily scrutinized
  - Does the distribution of predicted site indices seem reasonable?
  - If so, make maps and distribute to Area Foresters and solicit their feedback



c) Apply the model and distribute to Area Foresters



FBRI Enterprise Services

4. FPS Inventory Audits

FOREST BIOMETRICS RESEARCH INSTITUTE
4033 SW Canyon Road
Portland, Oregon 97221

A Non-Profit Research Corporation since 2002
For the advancement of research, education, and service in forest biometrics

September 4, 2024

A Program Review of the Forest Inventory System for

Bennett Lumber Products Inc.

by

Dan Opalach, PhD
Senior Forest Biometrician

Brock Purvis
Technical Support Manager

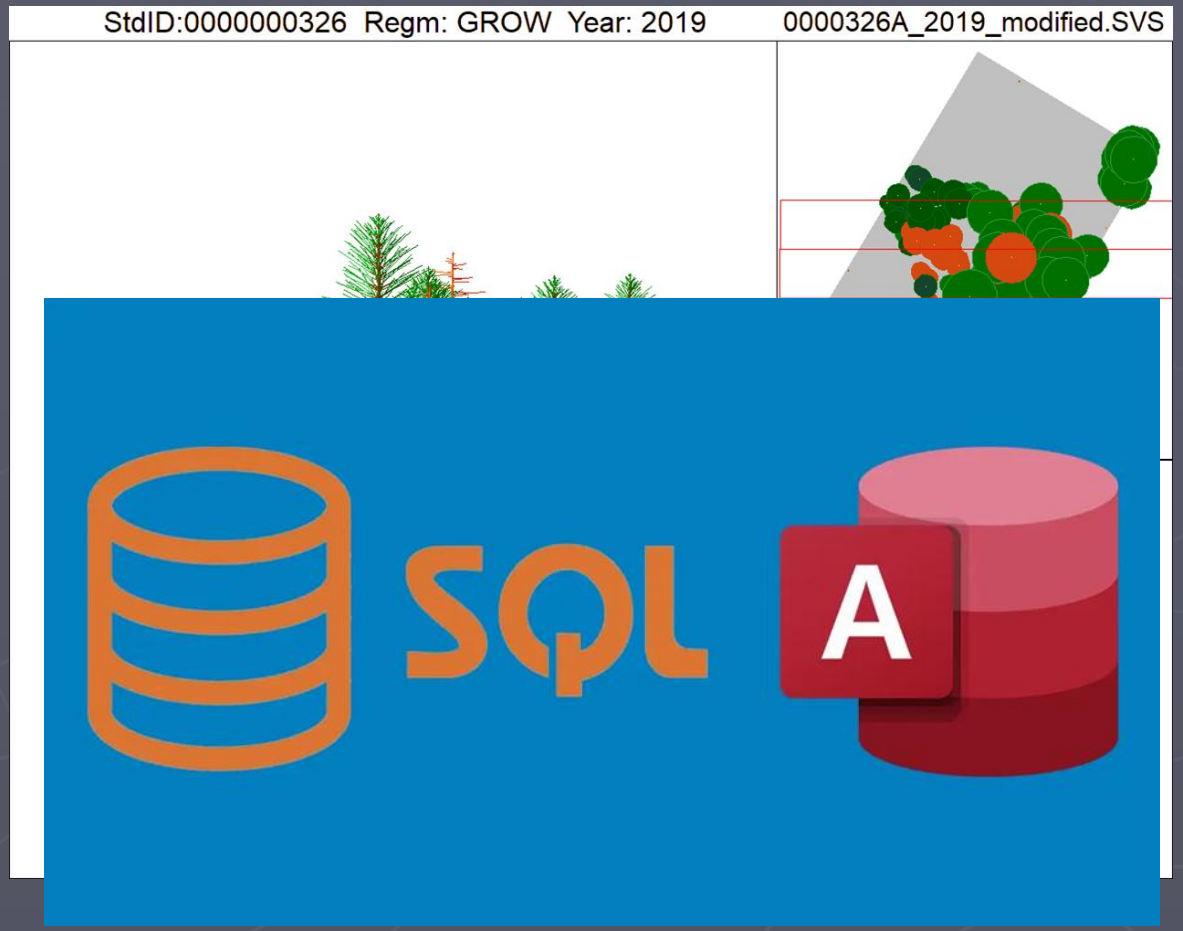
Introduction

On January 5, 2024, Bennett Lumber Products Inc. (BLPI) entered into an Enterprise Services Agreement with Forest Biometrics Research Institute (FBRI) for the purpose of providing BLPI with a program review of its forest inventory system which relies largely on Forest Projection and Planning System (FPS) software that is produced and distributed by FBRI for the benefit of its contributing members. This review consists of evaluating the inventory procedures and protocols BLPI has in place, as well as how FPS is being utilized by BLPI in the ongoing reporting,

FBRI Enterprise Services

5. Forest Inventories Developed from Lidar data

1. Obtain point clouds from clients (LAS)
2. Generate tree lists from the point clouds and satellite images, and store the results in a file geodatabase (GBD)
   - Each tree is assigned a species, height, and DBH
3. Prepare FPS Pro input tables (SQL Server)
4. Compile census-level tree lists for each stand with FPS Pro and generate output volume tables (SQL Server)
   - Calculate basal area, cubic foot volume, board foot volume, carbon metrics, etc. for every lidar tree
5. Provide client with the forest inventory in FPS Pro databases (Microsoft Access and SQL Server)



FBRI Enterprise Services

5. Forest Inventories Developed from Lidar data

- Tree lists developed from lidar point clouds and satellite images – Halli Hemingway
- Case studies
  - Bennett Lumber Products, Inc.
  - Colville Indian Reservation

Halli Hemingway

Forest Science, 2023, **XX**, 1–12
https://doi.org/10.1093/forsci/fxad047
Advance access publication 24 November 2023
Research Article

Biometrics

Integrating Lidar Canopy Height Models with Satellite-Assisted Inventory Methods: A Comparison of Inventory Estimates

Halli Hemingway,[1,*], and Daniel Opalach[2]

[1]East Fork Forestry, 6275 Highway 95 Potlatch, ID 83855, USA (eastforkforestry@gmail.com).
[2]Forest Biometrics Research Institute, 4033 SW Canyon Rd., Portland, OR 97221, USA (dan@forestbiometrics.org).
*Corresponding author email: eastforkforestry@gmail.com

Abstract

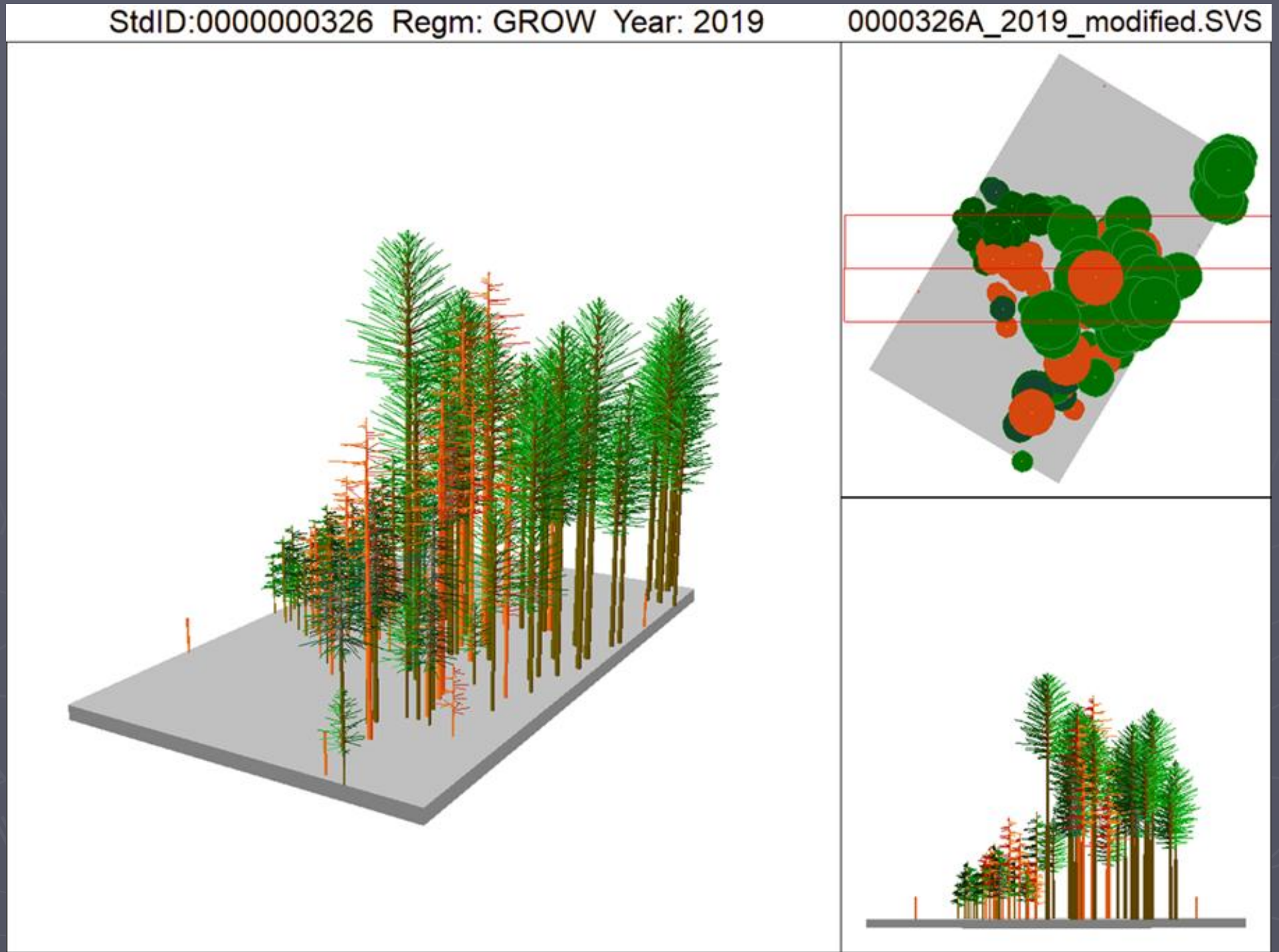
Forest management inventories are essential tools for planning, sustainability assessment, and carbon accounting. The operational difficulties and cost to obtain field measurements for large landscapes is often prohibitive. Remote sensing offers an alternative to field-based sampling but has often been used in an area-based approach. The most recent remote sensing techniques can produce a census-level tree list, but these data are monetarily and computationally expensive. This research examines two remote sensing approaches compared with field-based methods to build forest management inventories for the same forest land base in north central Idaho, USA. Estimates of volume, density, and height were compared by stand and at the total ownership level. Incorporating lidar data reduced overall error and bias when compared with using satellite data alone. The low-pulse density of the lidar data used in this analysis resulted in underprediction of density for high-density stands. Species predictions proved challenging, with accuracies of 66% at the stand level and 54% at the individual tree level. Further research to refine species predictions in complex environments is encouraged.

FBRI Enterprise Services

Forest Inventories Developed from Lidar data

Case Study: Colville Indian Reservation

Halli will be presenting the details associated with this case study at the Western Mensurationists meeting in Moscow, Idaho on June 16 & 17, 2025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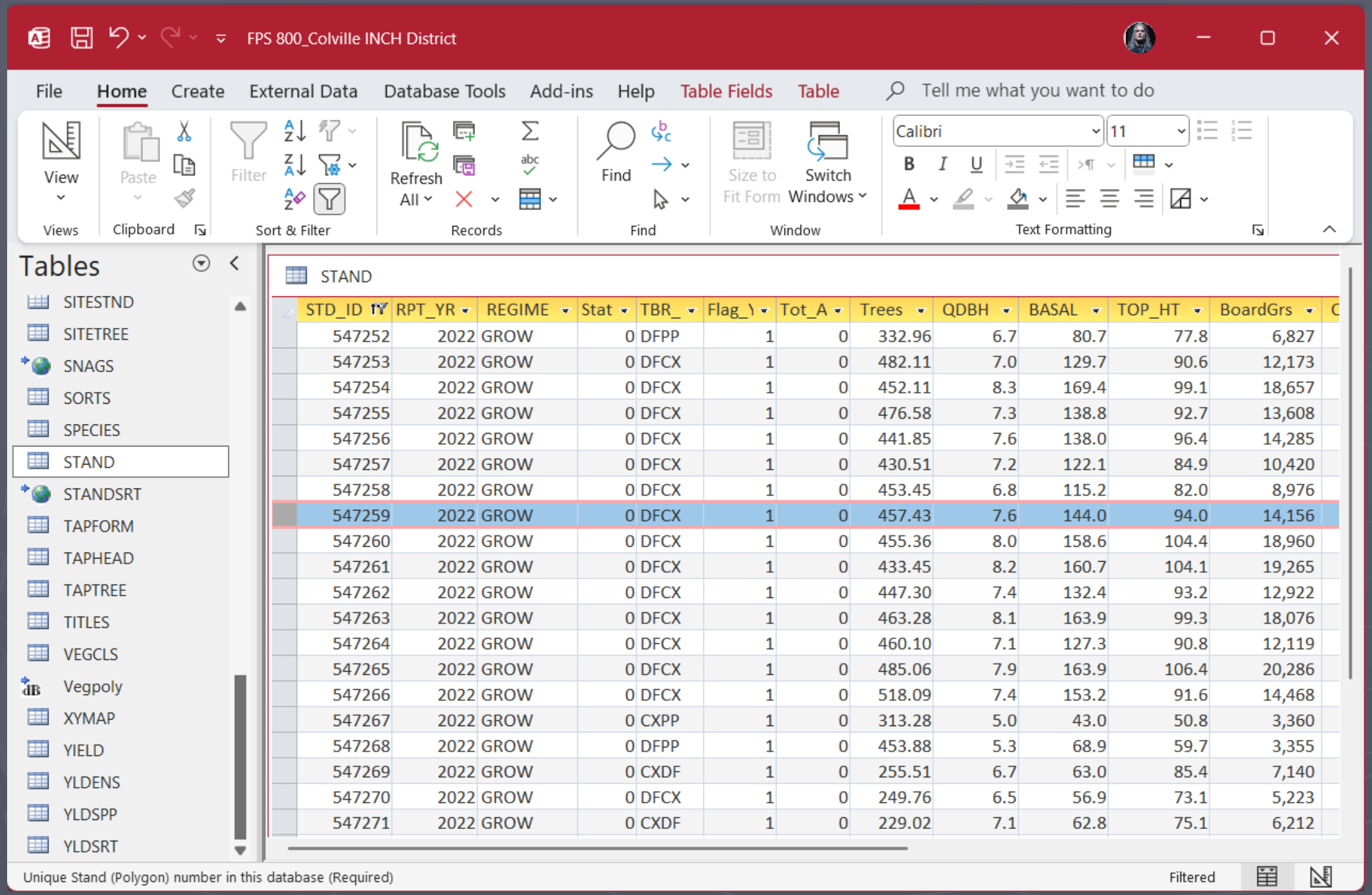
FPS 800_Colville INCH District
File Home Create External Data Database Tools Add-ins Help Table Fields Table
Tell me what you want to do
View Paste Filter Refresh All Find Size to Fit Form Switch Windows
Calibri 11
Views Clipboard Sort & Filter Records Find Window Text Formatting
Tables
SITESTND
SITETREE
SNAGS
SORTS
SPECIES
STAND
STANDSRT
TAPFORM
TAPHEAD
TAPTREE
TITLES
VEGCLS
Vegpoly
XYMAP
YIELD
YLDENS
YLDSPP
YLDSRT
STAND
STD_ID RPT_YR REGIME Stat TBR_ Flag_ Tot_A Trees QDBH BASAL TOP_HT BoardGrs
547252 2022 GROW 0 DFPP 1 0 332.96 6.7 80.7 77.8 6,827
547253 2022 GROW 0 DFCX 1 0 482.11 7.0 129.7 90.6 12,173
547254 2022 GROW 0 DFCX 1 0 452.11 8.3 169.4 99.1 18,657
547255 2022 GROW 0 DFCX 1 0 476.58 7.3 138.8 92.7 13,608
547256 2022 GROW 0 DFCX 1 0 441.85 7.6 138.0 96.4 14,285
547257 2022 GROW 0 DFCX 1 0 430.51 7.2 122.1 84.9 10,420
547258 2022 GROW 0 DFCX 1 0 453.45 6.8 115.2 82.0 8,976
547259 2022 GROW 0 DFCX 1 0 457.43 7.6 144.0 94.0 14,156
547260 2022 GROW 0 DFCX 1 0 455.36 8.0 158.6 104.4 18,960
547261 2022 GROW 0 DFCX 1 0 433.45 8.2 160.7 104.1 19,265
547262 2022 GROW 0 DFCX 1 0 447.30 7.4 132.4 93.2 12,922
547263 2022 GROW 0 DFCX 1 0 463.28 8.1 163.9 99.3 18,076
547264 2022 GROW 0 DFCX 1 0 460.10 7.1 127.3 90.8 12,119
547265 2022 GROW 0 DFCX 1 0 485.06 7.9 163.9 106.4 20,286
547266 2022 GROW 0 DFCX 1 0 518.09 7.4 153.2 91.6 14,468
547267 2022 GROW 0 CXPP 1 0 313.28 5.0 43.0 50.8 3,360
547268 2022 GROW 0 DFPP 1 0 453.88 5.3 68.9 59.7 3,355
547269 2022 GROW 0 CXDF 1 0 255.51 6.7 63.0 85.4 7,140
547270 2022 GROW 0 DFCX 1 0 249.76 6.5 56.9 73.1 5,223
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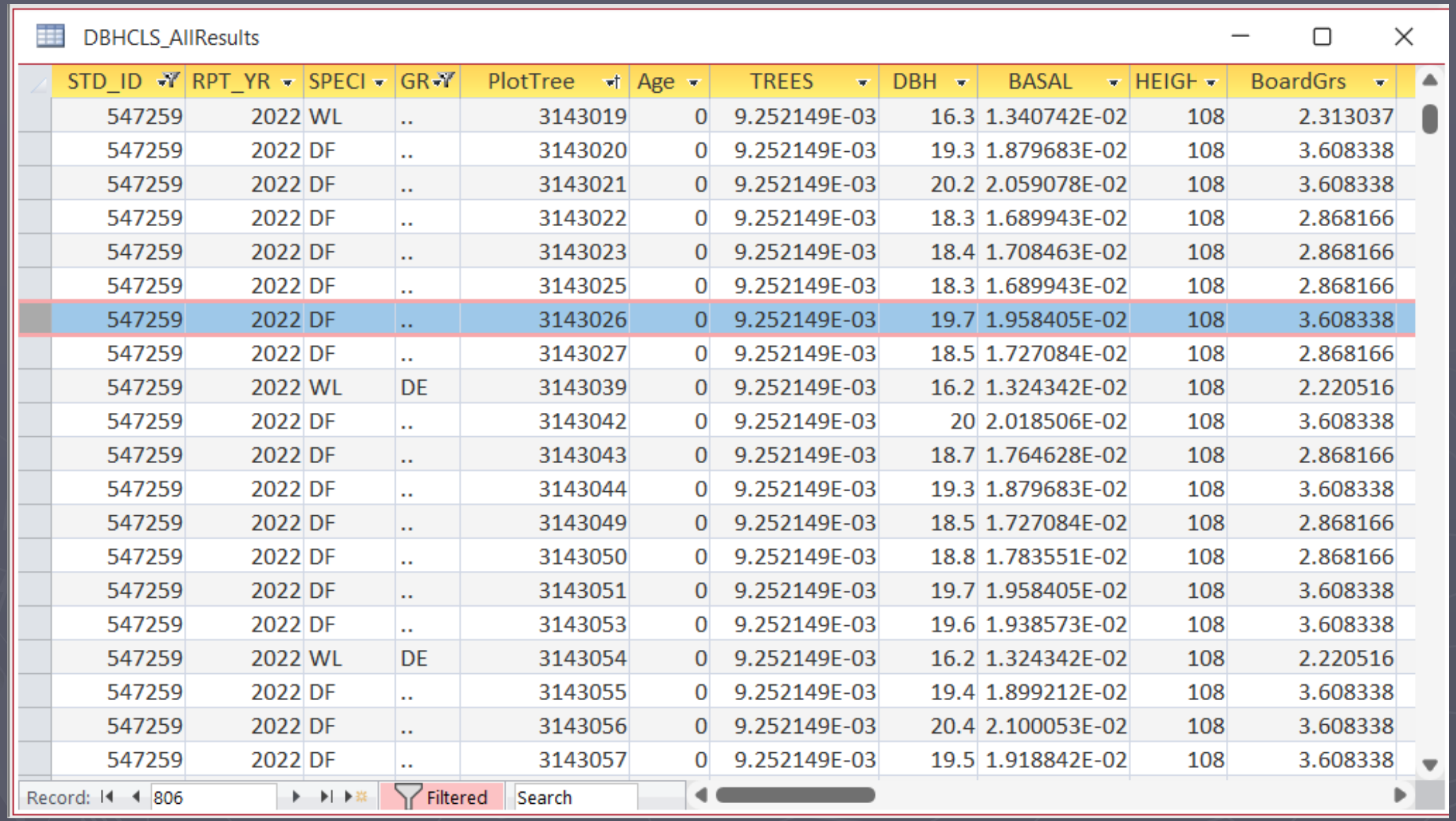
Unique Stand (Polygon) number in this database (Required)
Filtered


DBHCLS_AllResults
STD_ID RPT_YR SPECI GR PlotTree Age TREES DBH BASAL HEIGH BoardGrs
547259 2022 WL .. 3143019 0 9.252149E-03 16.3 1.340742E-02 108 2.313037
547259 2022 DF .. 3143020 0 9.252149E-03 19.3 1.879683E-02 108 3.608338
547259 2022 DF .. 3143021 0 9.252149E-03 20.2 2.059078E-02 108 3.608338
547259 2022 DF .. 3143022 0 9.252149E-03 18.3 1.689943E-02 108 2.868166
547259 2022 DF .. 3143023 0 9.252149E-03 18.4 1.708463E-02 108 2.868166
547259 2022 DF .. 3143025 0 9.252149E-03 18.3 1.689943E-02 108 2.868166
547259 2022 DF .. 3143026 0 9.252149E-03 19.7 1.958405E-02 108 3.608338
547259 2022 DF .. 3143027 0 9.252149E-03 18.5 1.727084E-02 108 2.868166
547259 2022 WL DE 3143039 0 9.252149E-03 16.2 1.324342E-02 108 2.220516
547259 2022 DF .. 3143042 0 9.252149E-03 20 2.018506E-02 108 3.608338
547259 2022 DF .. 3143043 0 9.252149E-03 18.7 1.764628E-02 108 2.868166
547259 2022 DF .. 3143044 0 9.252149E-03 19.3 1.879683E-02 108 3.608338
547259 2022 DF .. 3143049 0 9.252149E-03 18.5 1.727084E-02 108 2.868166
547259 2022 DF .. 3143050 0 9.252149E-03 18.8 1.783551E-02 108 2.868166
547259 2022 DF .. 3143051 0 9.252149E-03 19.7 1.958405E-02 108 3.608338
547259 2022 DF .. 3143053 0 9.252149E-03 19.6 1.938573E-02 108 3.608338
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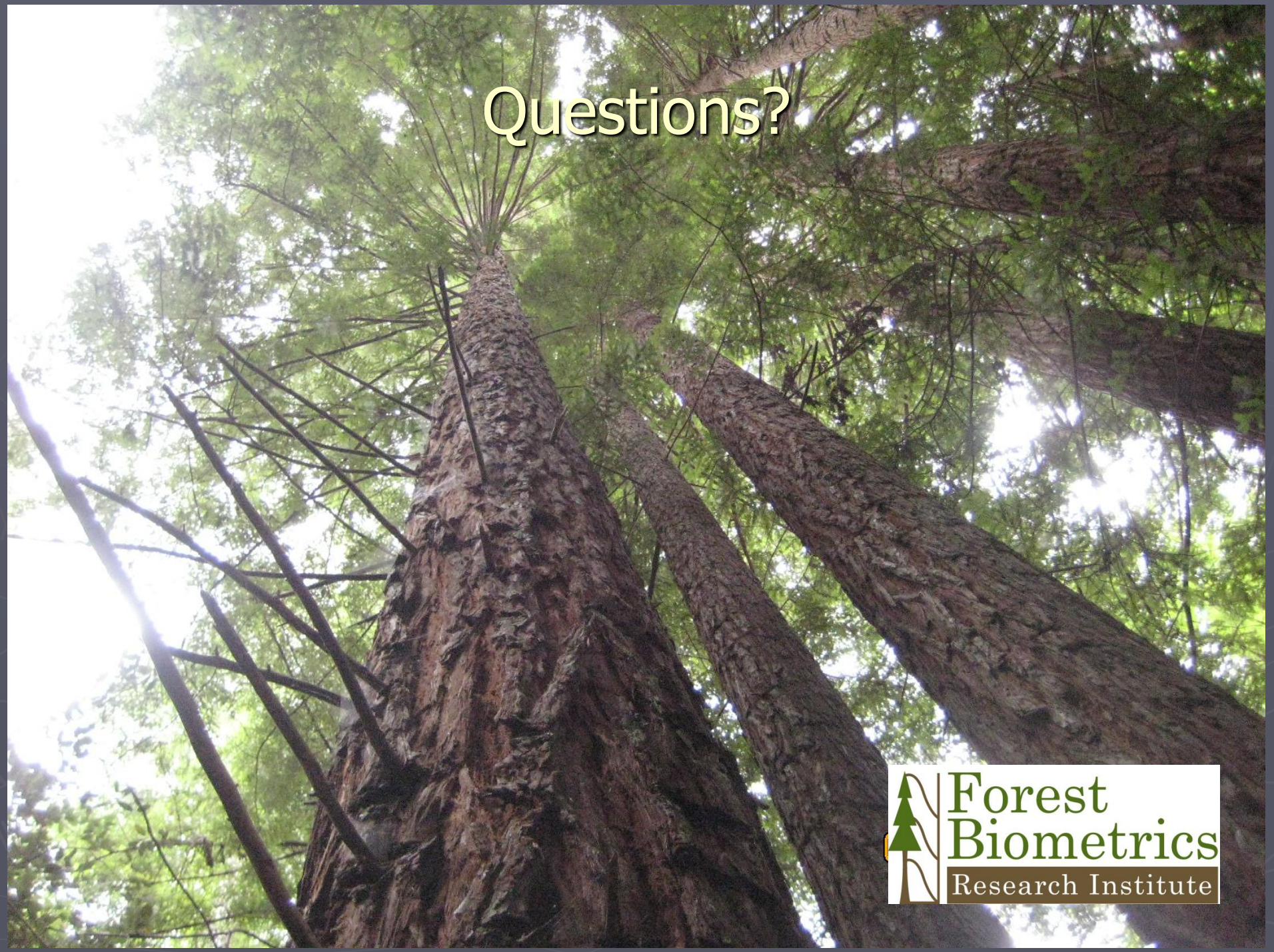
547259 2022 DF .. 3143055 0 9.252149E-03 19.4 1.899212E-02 108 3.608338
547259 2022 DF .. 3143056 0 9.252149E-03 20.4 2.100053E-02 108 3.608338
547259 2022 DF .. 3143057 0 9.252149E-03 19.5 1.918842E-02 108 3.608338
Record: 806
Filtered
Search

FBRI Strategic Planning Session

Thursday, April 17, 2025
World Forestry Center
Portland, Oregon

- 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
- Key Topics
  - The evolution of FPS into FPS Pro
  - Continued development of the ArcGIS Pro Add-In
  - Pricing of Enterprise Services
    - Lidar-based forest inventories
    - Lidar-based site index estimates from repeat measurements
  - Marketing


Questions?
Forest
Biometrics
Research Institute