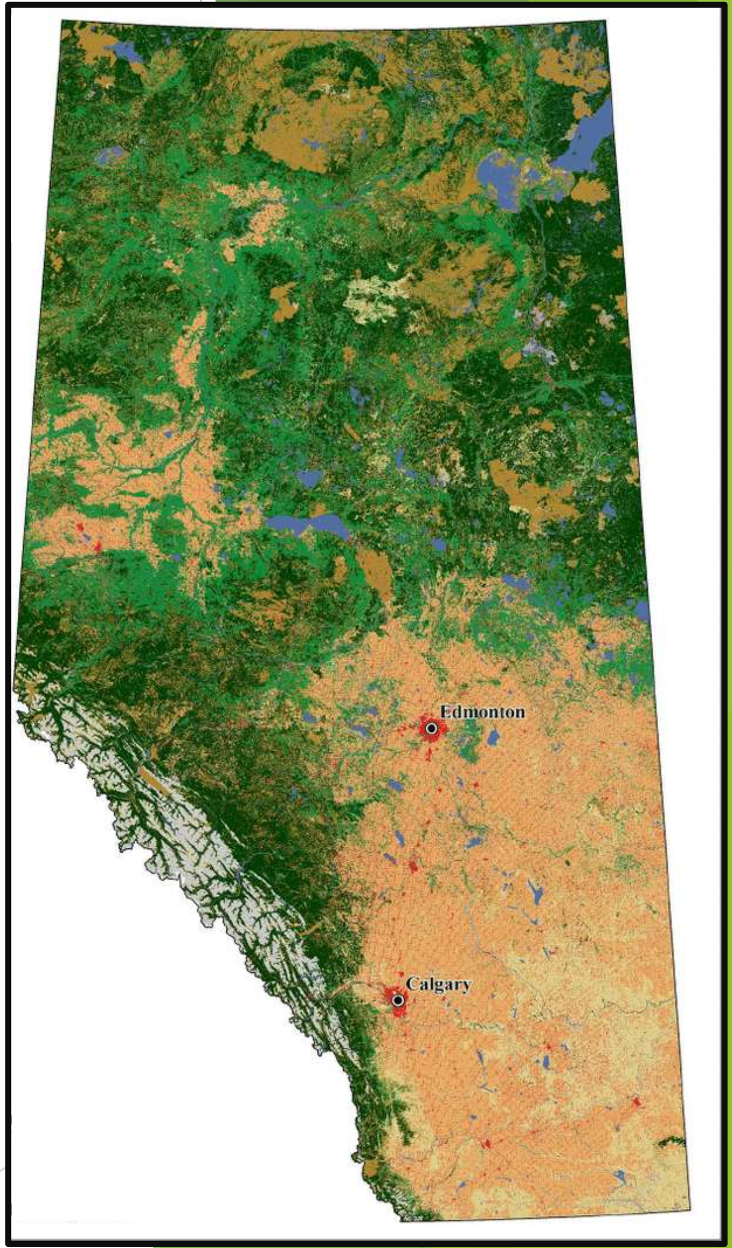
‘Census’ Growth and Yield Curves

TOC



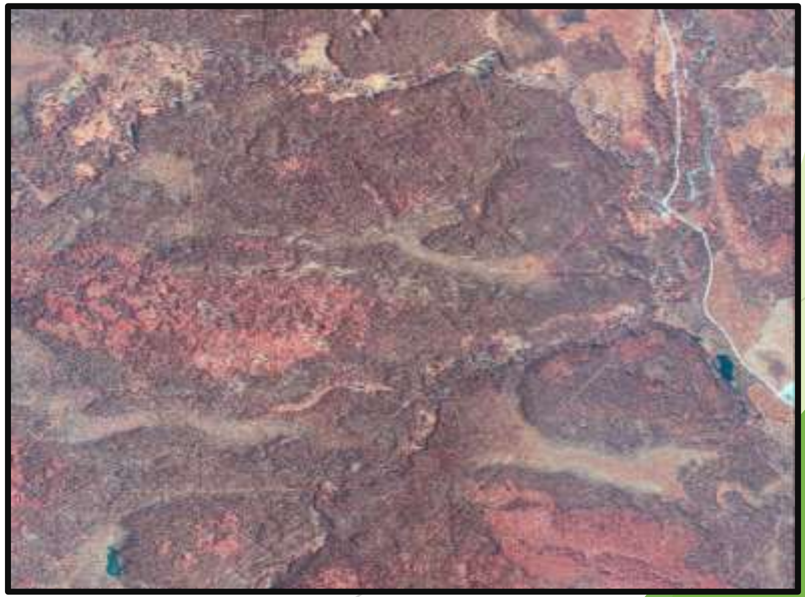
Census Concept

“A census is often construed as the opposite of a sample as its intent is to count [everything] in a population, rather than a fraction.”

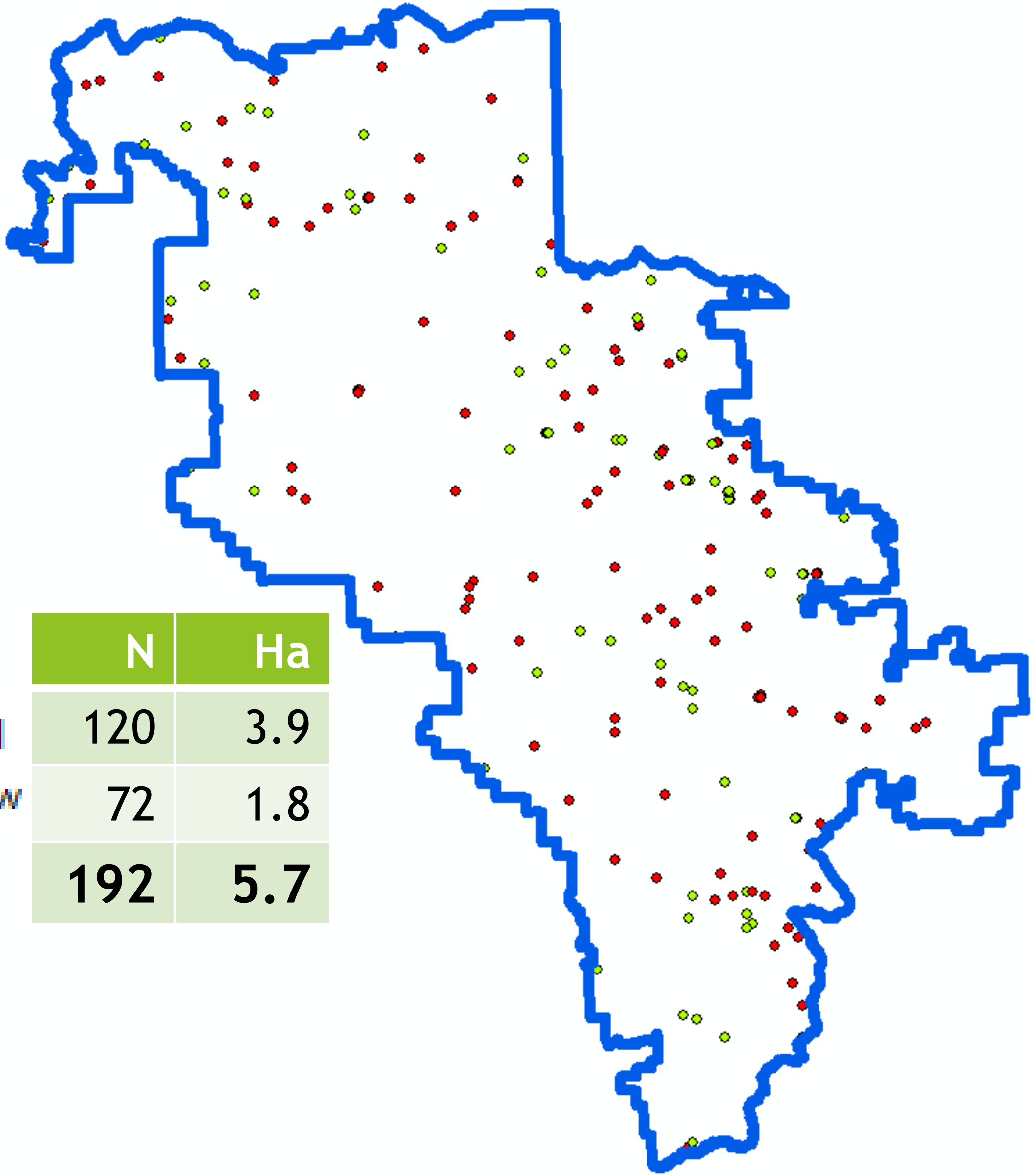
Census Concept

- …In this case trees: the whole ‘active’ landbase is sampled

- Increasing growth and yield sample size from the field (plot) level to the landscape (polygon) level

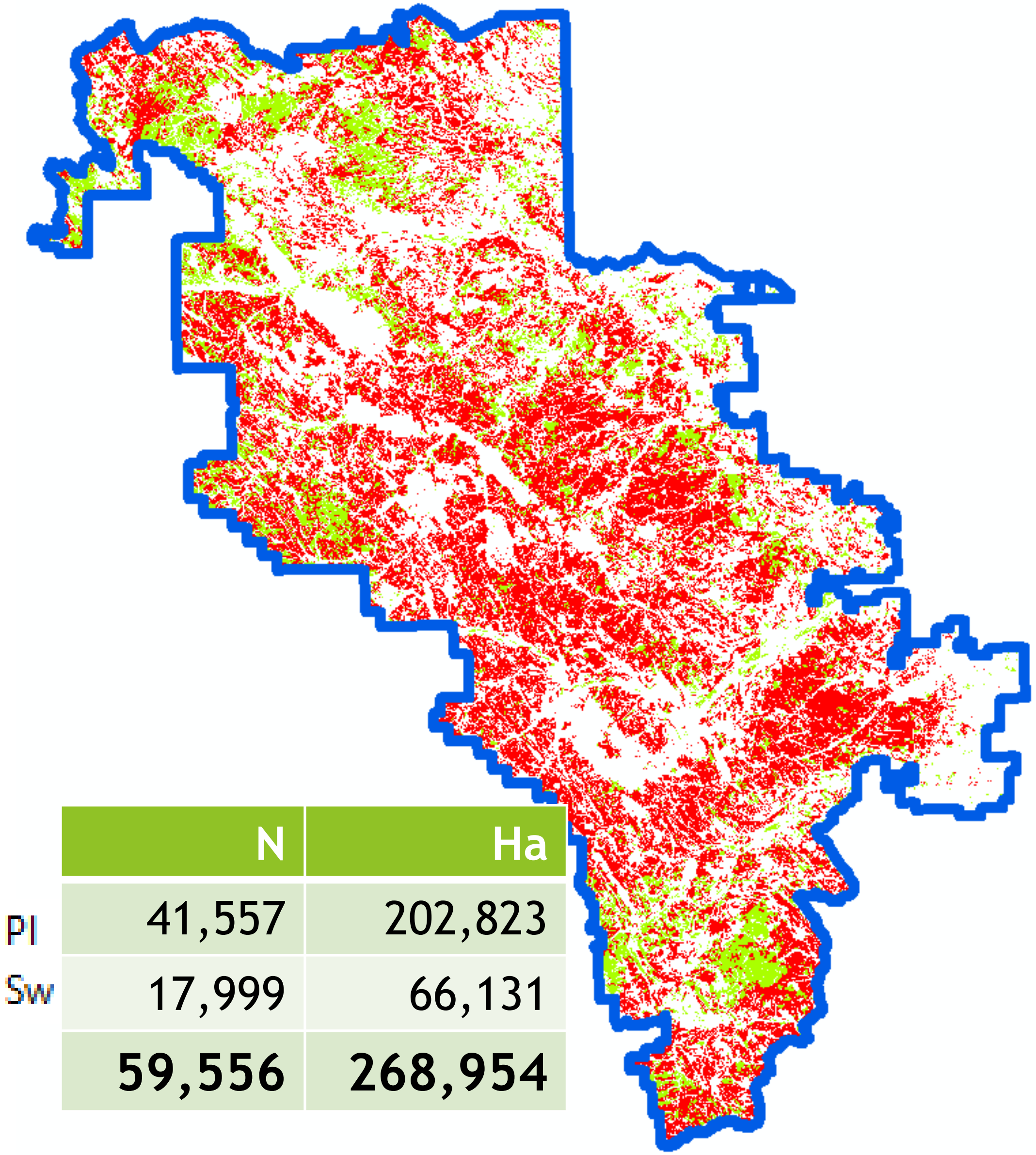


TSP



	N	Ha
Pl	120	3.9
Sw	72	1.8
	192	**5.7**

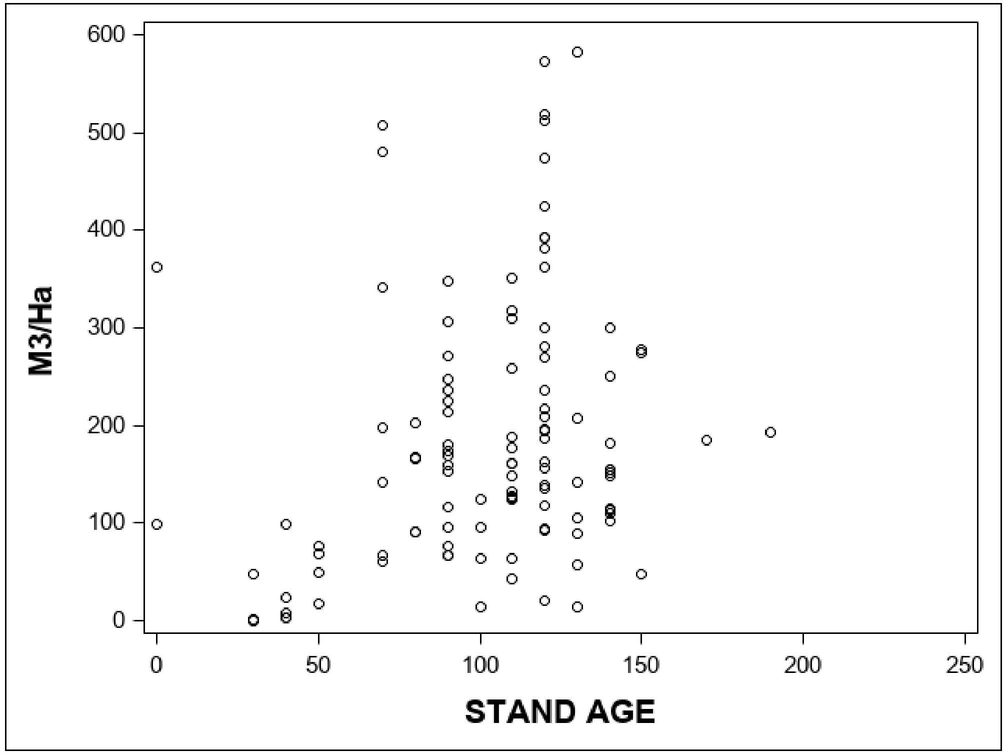
Census



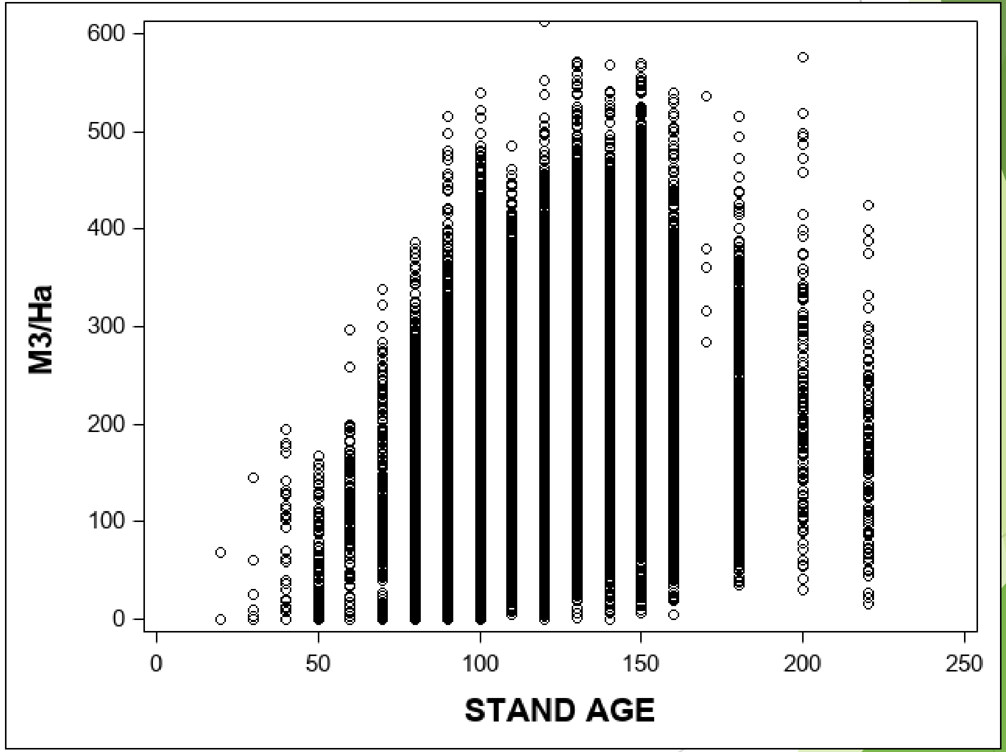
	N	Ha
Pl	41,557	202,823
Sw	17,999	66,131
	59,556	**268,954**

Census Concept –Base Stratum 7, Sw

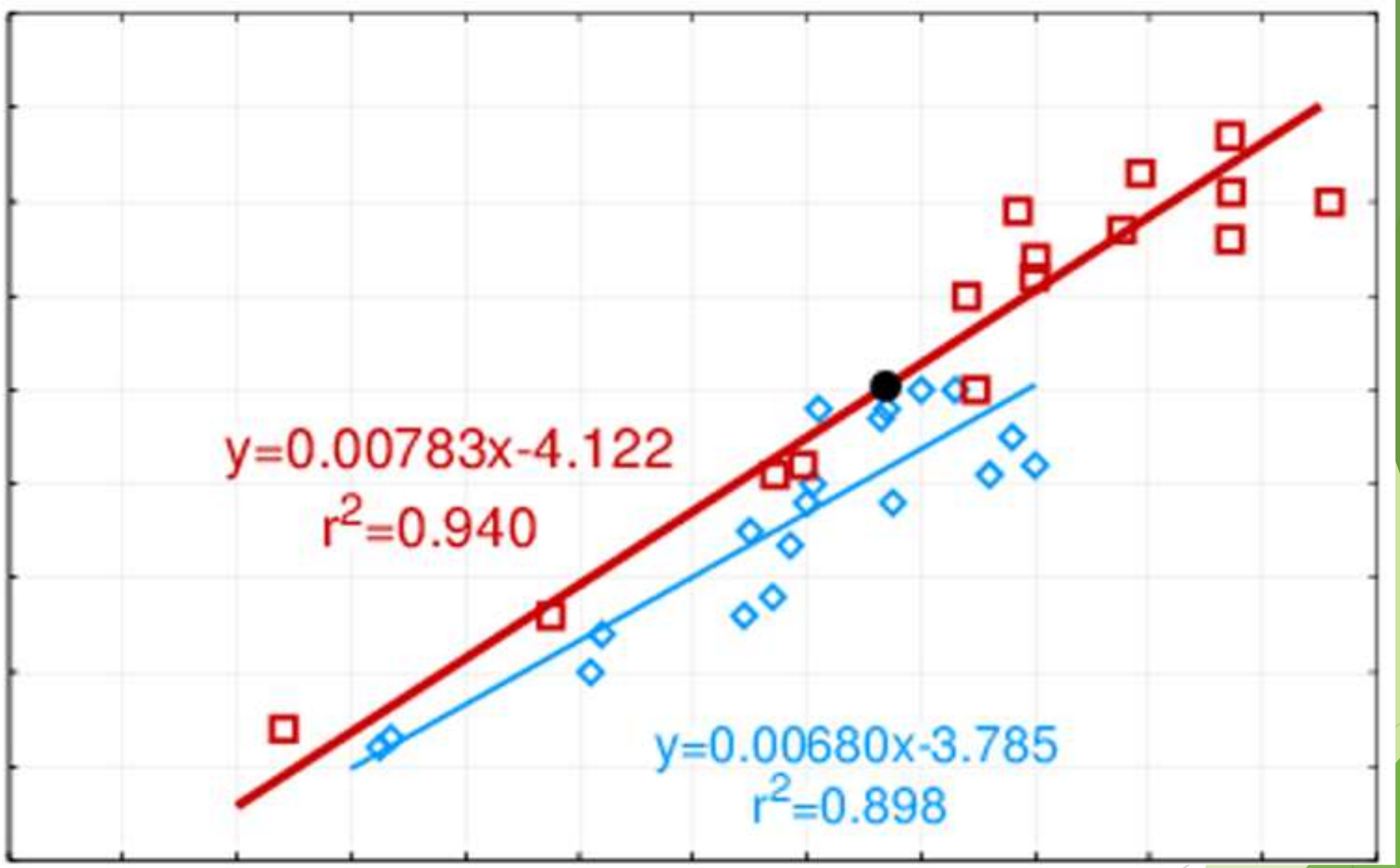
TSP



Census

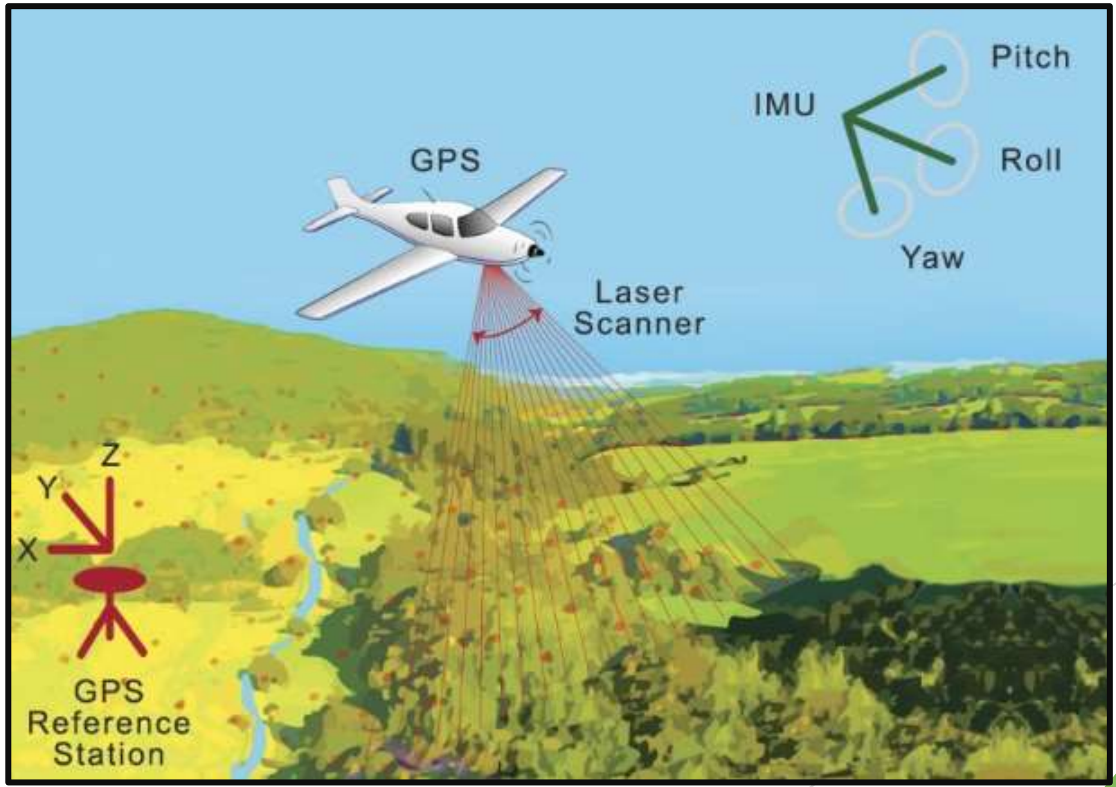


Context

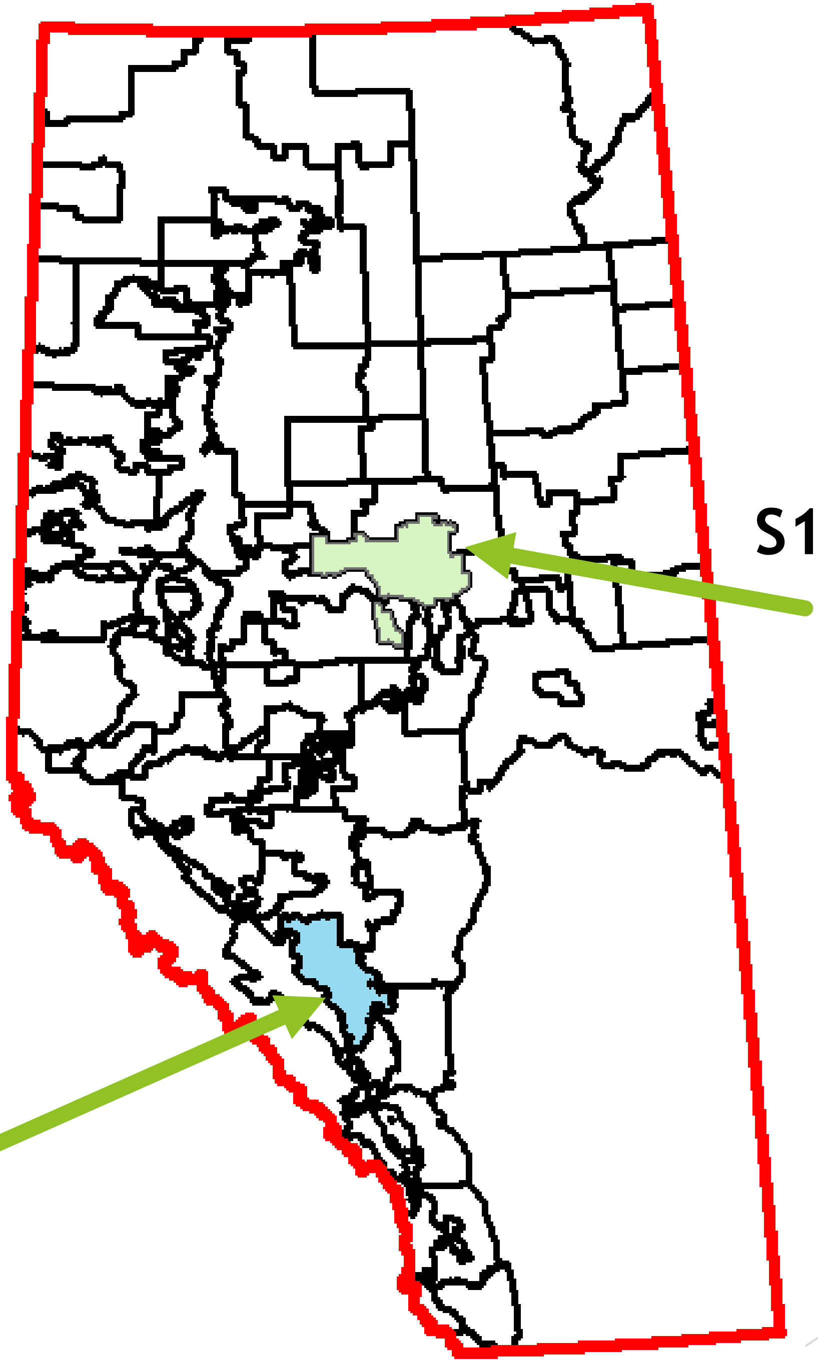


LiDAR

- **LiDAR** data is the "Foundation" or "Chief Ingredient" driving this method. More specifically, LiDAR derived Canopy Height Models.
- Although, tree species and stand age derived from **AVI data** plays an important role as well.



2 FMUs



S17 – 728,164 ha
LiDAR 2007-2008
100 cm CHM

R10 – 582,540 ha
LiDAR 2020
50 cm CHM

Coniferous Tree Species ***NOTE: Check with TOM for Sw Picts***

Lodgepole Pine *(Pinus contorta)*

White spruce (*Picea glauca)*

Government of Alberta Base Strata

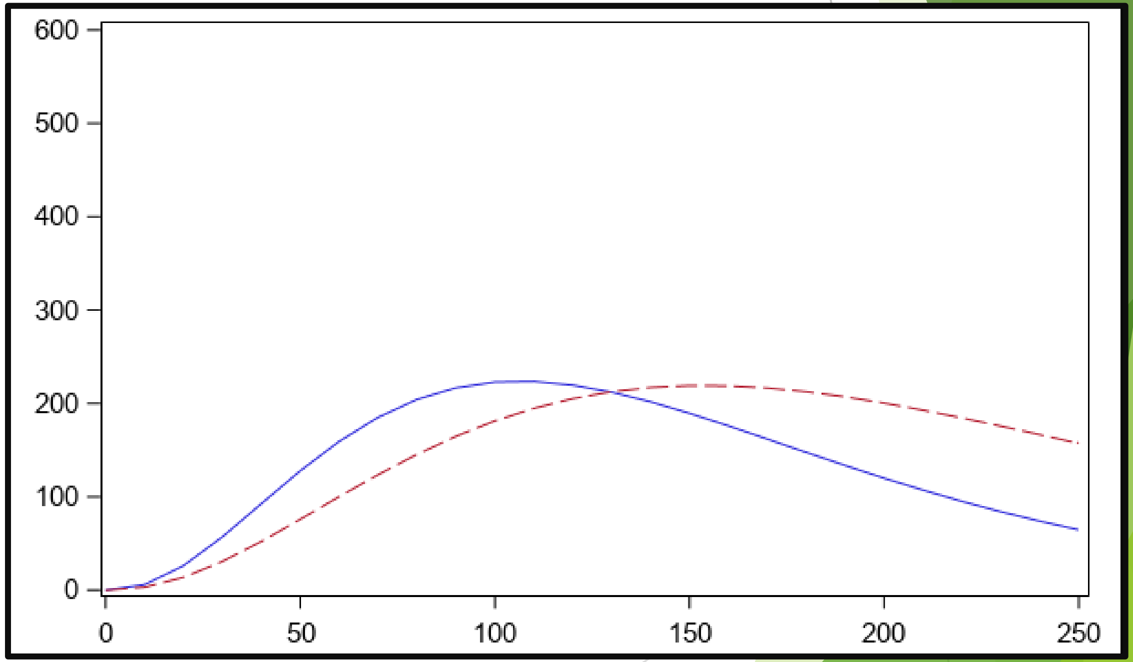
- **Stratum 7.** White spruce
- **Stratum 8.** Pine (lodgepole with some Jack in S17)

STRATUM			
No.	LABEL	DESCRIPTION	CONIFER TREE PERCENT %
1	Hw	Hardwood	00-20
2	HwPl	Hardwood-Pine	30-50
3	HwSx	Hardwood-Spruce	
4	SwHw	White spruce-Hardwood	50-70
5	PlHw	Pine-Hardwood	
6	SbHw	Black spruce-Hardwood	
7	Sw	White spruce	80-100
8	Pl	Pine	
9	Sb	Black spruce	
10	Fd	Douglas Fir	

Methods

TWO PARTS:

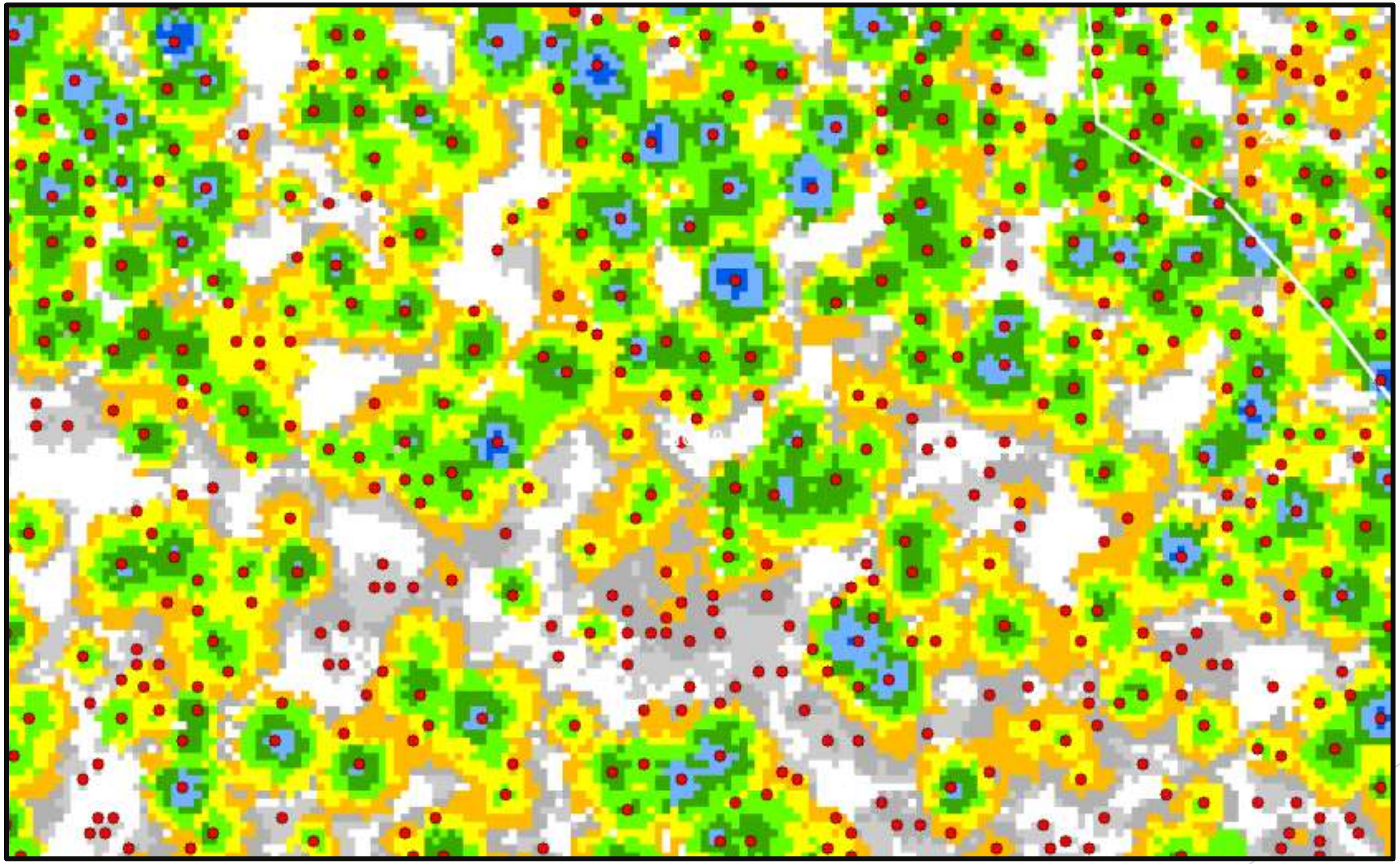
1. **Landscape Forest Metrics Model** (Assign M^3 and M^3/Ha to Alberta Vegetation Inventory (AVI) Polygons
2. Generate **Growth and Yield Curves** from AVI Polygons



PART-1 Landscape Forest Metrics Model

1. Stem Map
2. Alberta Vegetation Inventory (AVI). S17(AVI 2.1) R10(AVI 2.5)
3. GOA Models (Height-to-DBH), (Individual Tree Volume)
4. Assign Volume Metrics to AVI polygons
5. Validation

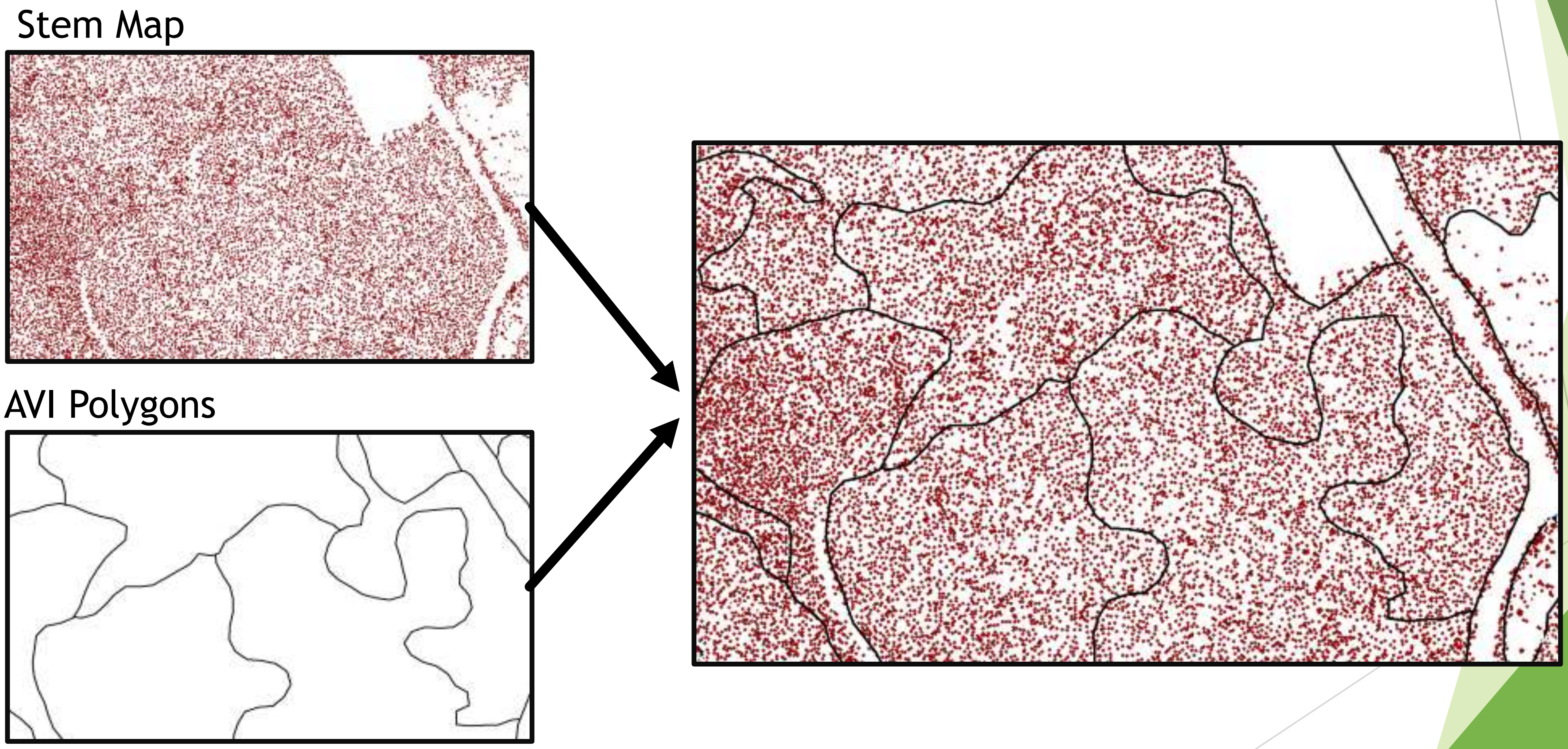
Step 1. Stem Map



All in meters.

X	Y	HEIGHT
556366.8	5823924	12.59
556405.8	5823880	22.99
556272.3	5823906	21.98
556177.8	5823814	16.07
556047.3	5823715	20.19

Step 2. Intercept stem-map (point data) with AVI (Vector data)



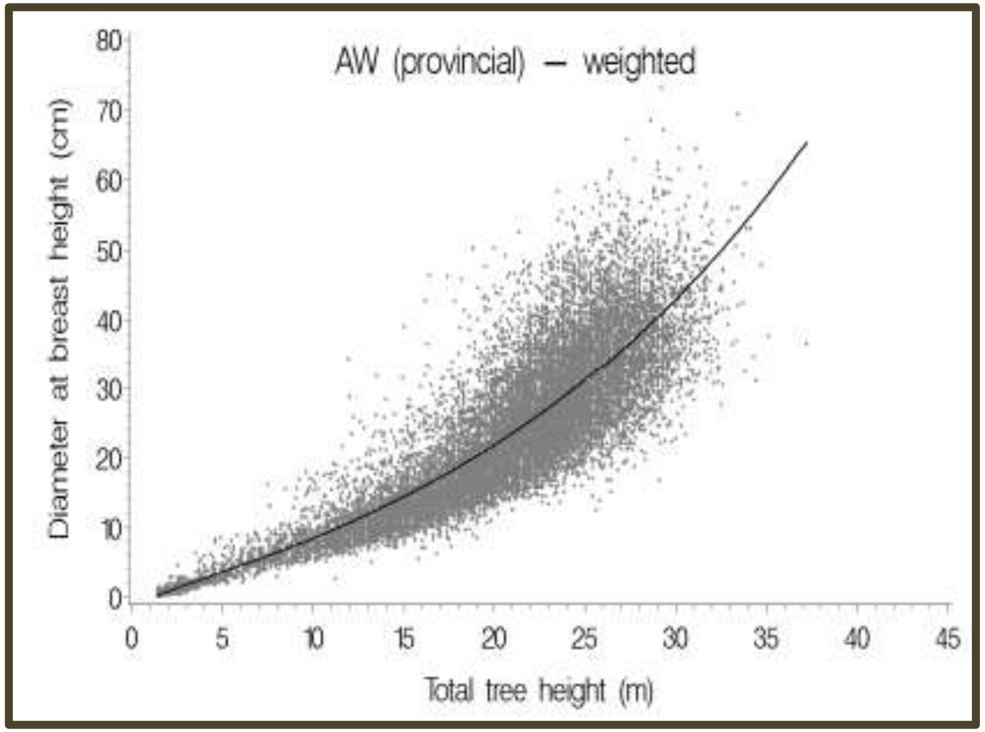
Tree species assigned based on proportion data in AVI.

Ex. If AVI=70% Pl and 30% Sw then 70% of the LiDAR returns are assigned Pl and 30% of the LiDAR returns are assigned Sw.

X	Y	HEIGHT	POLYGON ID	TREE SPECIES	NSR
556366.8	5823924	12.59	104182	FB	LF
556405.8	5823880	22.99	104182	PL	LF
556272.3	5823906	21.98	104182	PL	LF
556177.8	5823814	16.07	104182	SW	LF
556047.3	5823715	20.19	104182	SW	LF

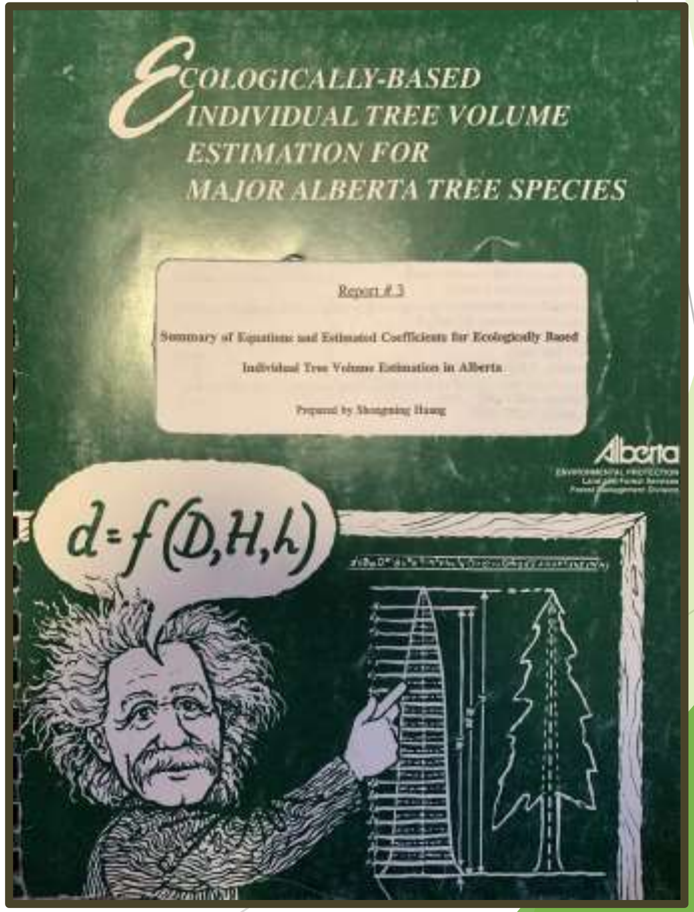
Step 3. Calculate DBH and Merchantable Volume

DBH (cm)



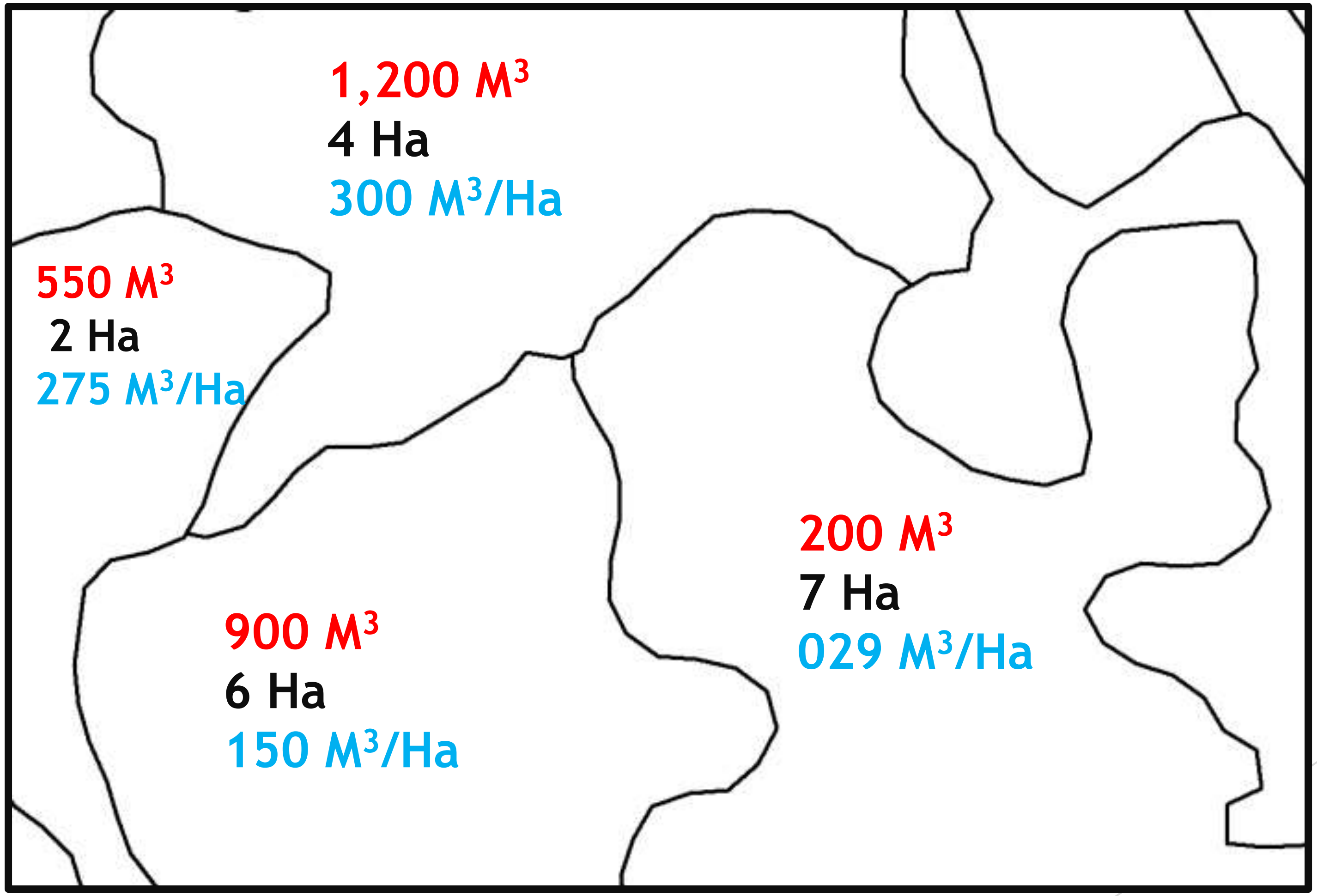
Huang, 2016. Population and Plot-Specific Tree Diameter and Height Prediction Models for Major Alberta Tree Species. Report #1. Individual Tree Diameter Prediction Models from Tree Height.

TREE VOLUME (M^3)



X	Y	HEIGHT	POLYGON ID	TREE SPECIES	NSR	DBH	MERCH VOLUME
556366.8	5823924	12.59	104182	FB	LF	16.05	0.081315
556405.8	5823880	22.99	104182	PL	LF	27.83	0.602008
556272.3	5823906	21.98	104182	PL	LF	26.43	0.51781
556177.8	5823814	16.07	104182	SW	LF	22.44	0.223439
556047.3	5823715	20.19	104182	SW	LF	28.94	0.490217

Step 4. Roll Point data to AVI Polygon Level



STEP 5. VALIDATION
Scale Data

VALIDATION

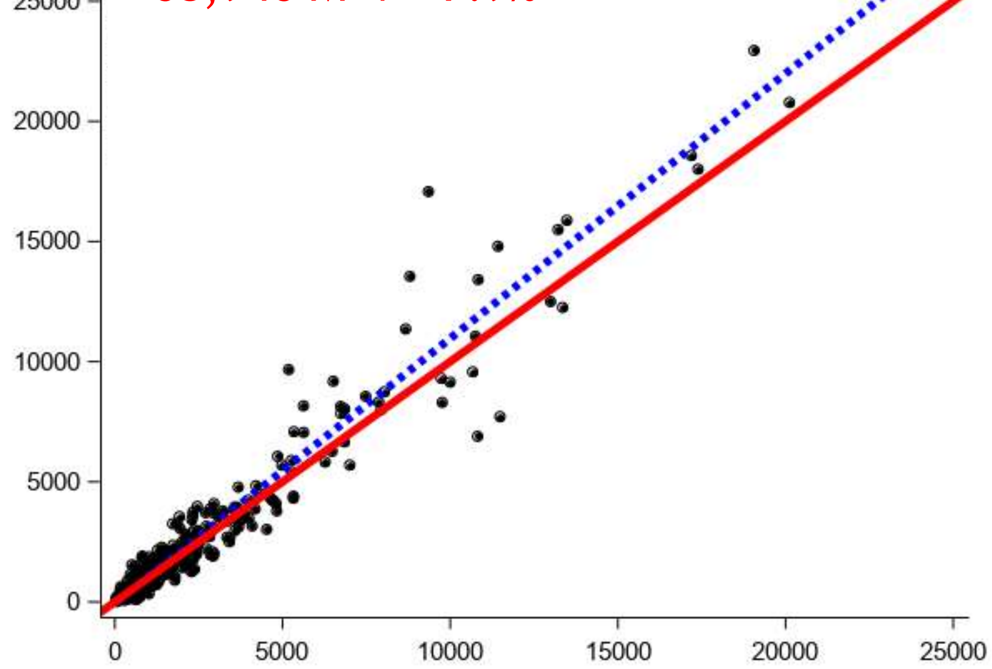
LiDAR Acquired 1.1-PPM^2, 2007-2008

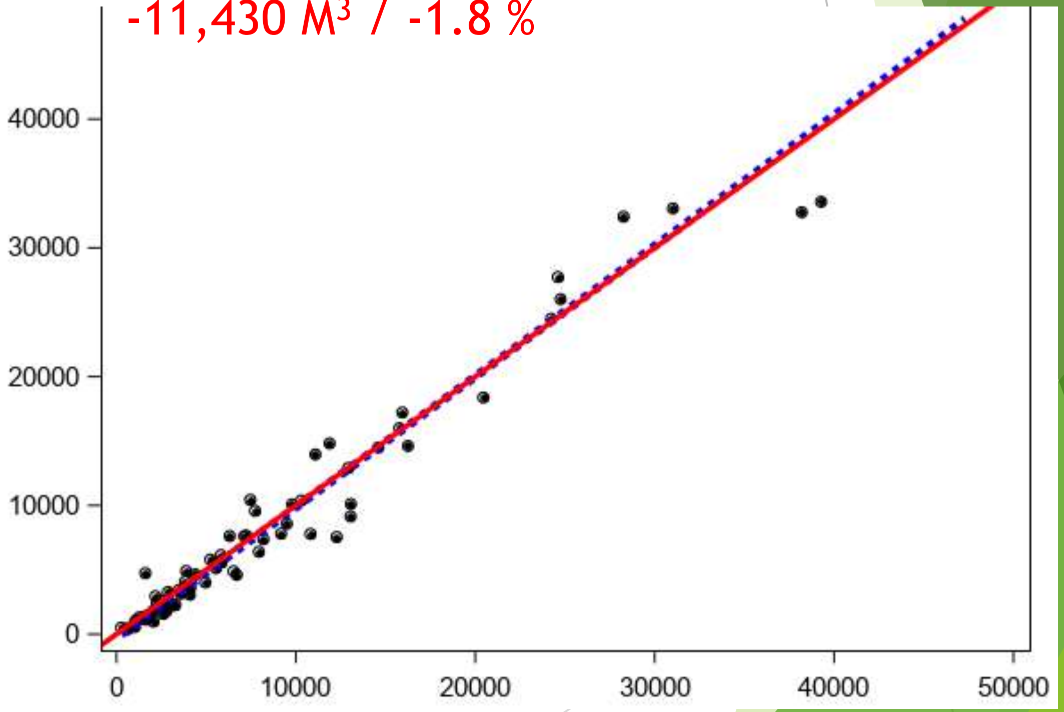
S17 (n=341 cutblocks)
R^2: 0.945
LiDAR: 935,587 M^3
Scale: 866,641 M^3
+68,946 M^3 / +7.9%

LiDAR Acquired 12-PPM^2, 2020

R10 (n = 73 cutblocks)
R^2: 0.963
LiDAR: 636,566 M^3
Scale: 647,996 M^3
-11,430 M^3 / -1.8 %

LiDAR DATA (M^3)





SCALE DATA (M^3)

PART-2
Census Growth and Yield Curves

Part-2 Census Growth and Yield

- Growth and Yield Models Developed from both TSP and Polygon Data

- Two parameter Growth and Yield Model:

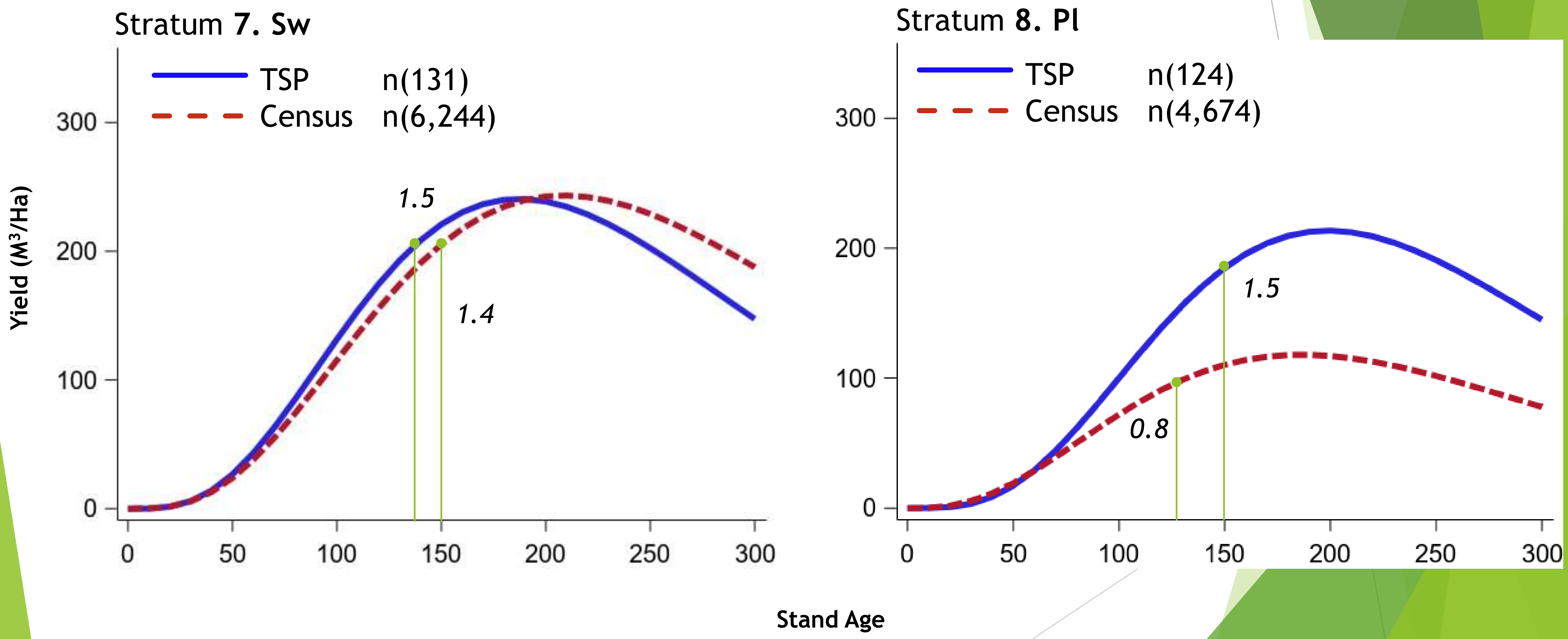
$$\boldsymbol{V = a(SA)^{b} * e^{-a*SA}}$$

V = Volume (M^3)
SA = Stand Age (Years)

- Census Growth and Yield models were Area (Ha) weighted
- Plots in FMU R10 were also Area weighted (TSPs 160 m2, PSPs 1,000 m2)

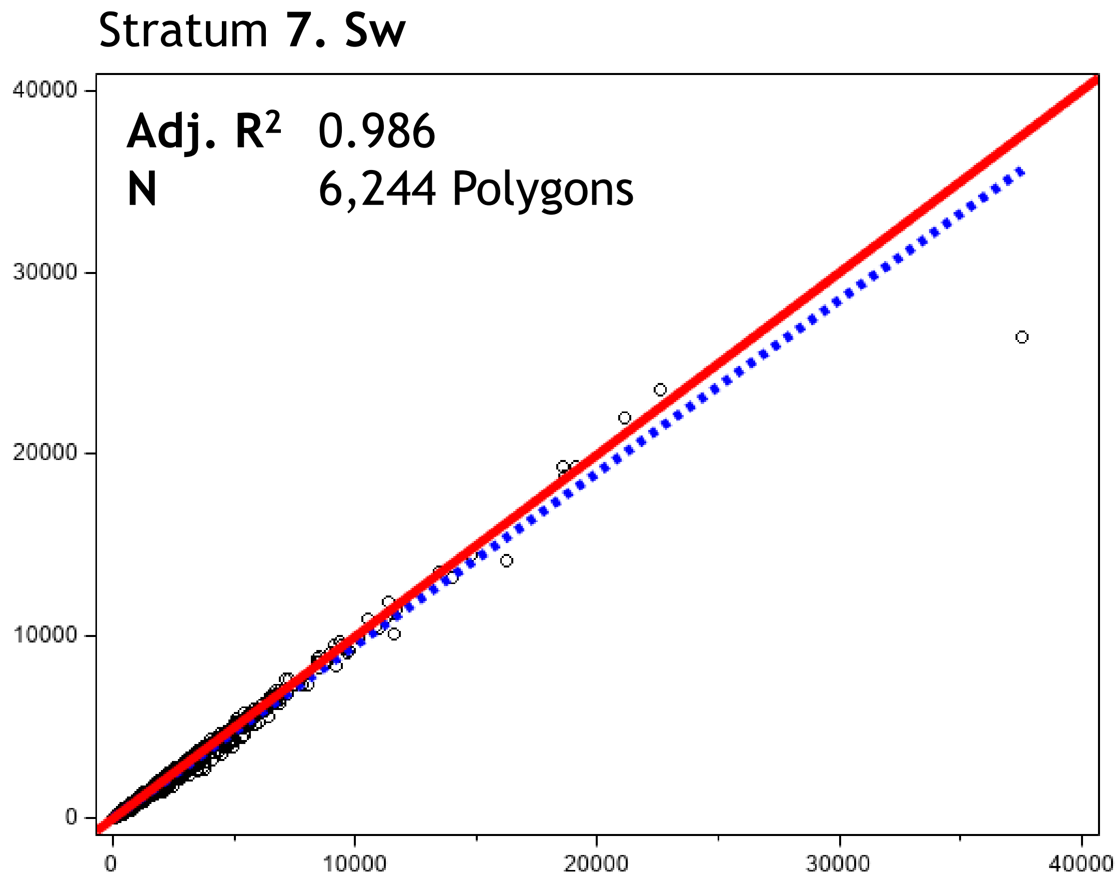
FMU S17 – Growth and Yield Curves

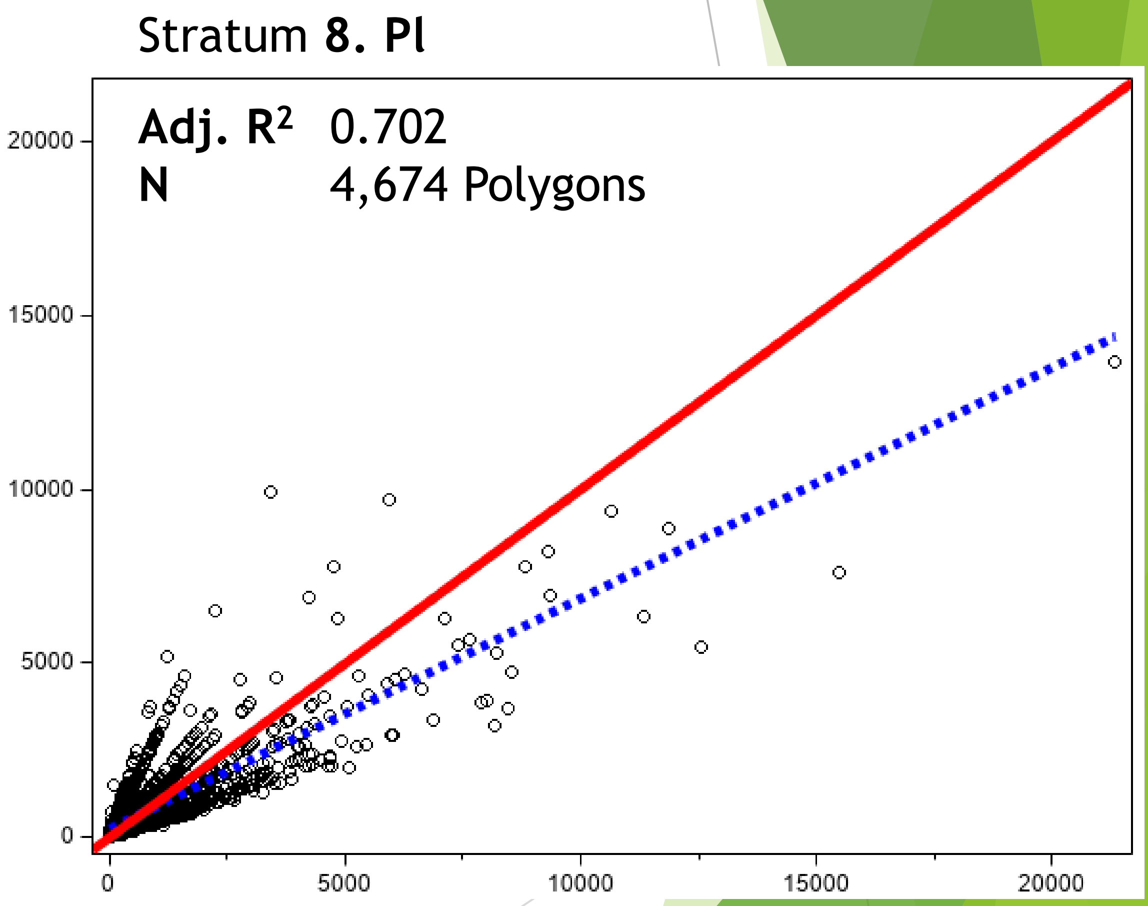
LiDAR Acquired 1.1-PPM², 2007-2008



FMU S17 – Agreement Plots

LiDAR Acquired 1.1-PPM², 2007-2008



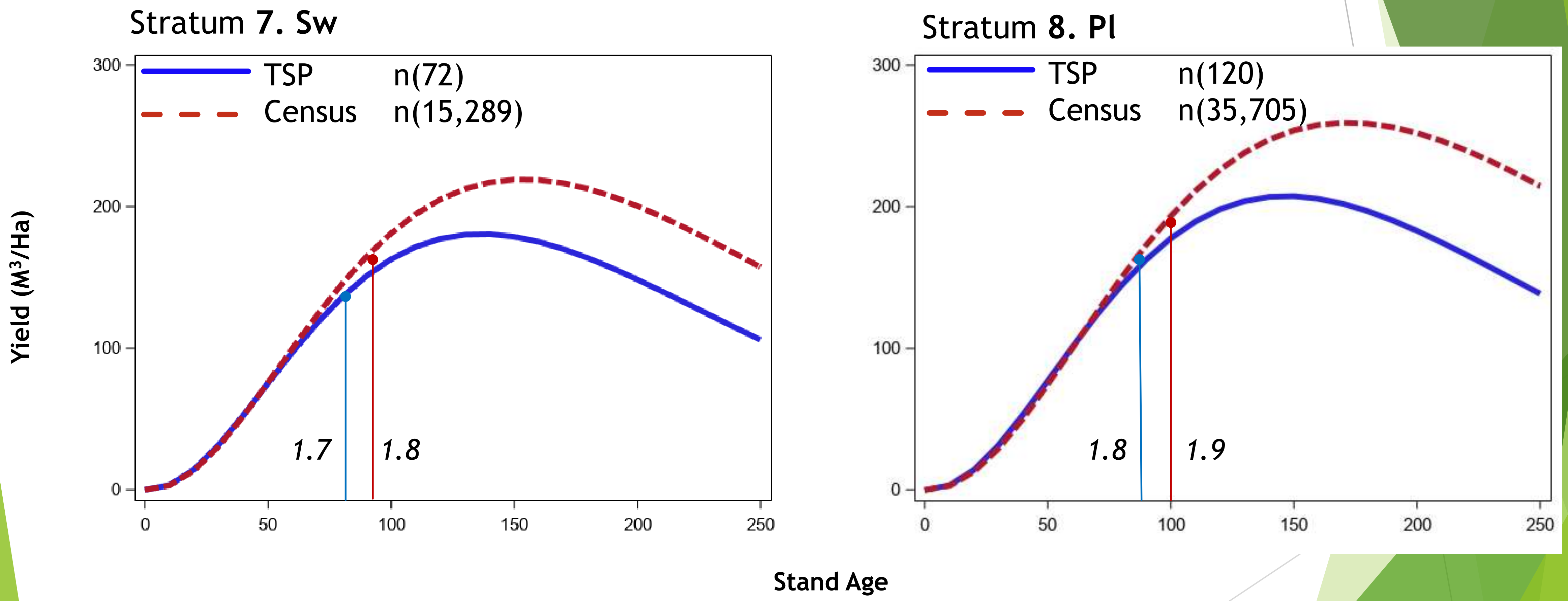


CENSUS Volume (M^3)

TSP Volume (M^3)

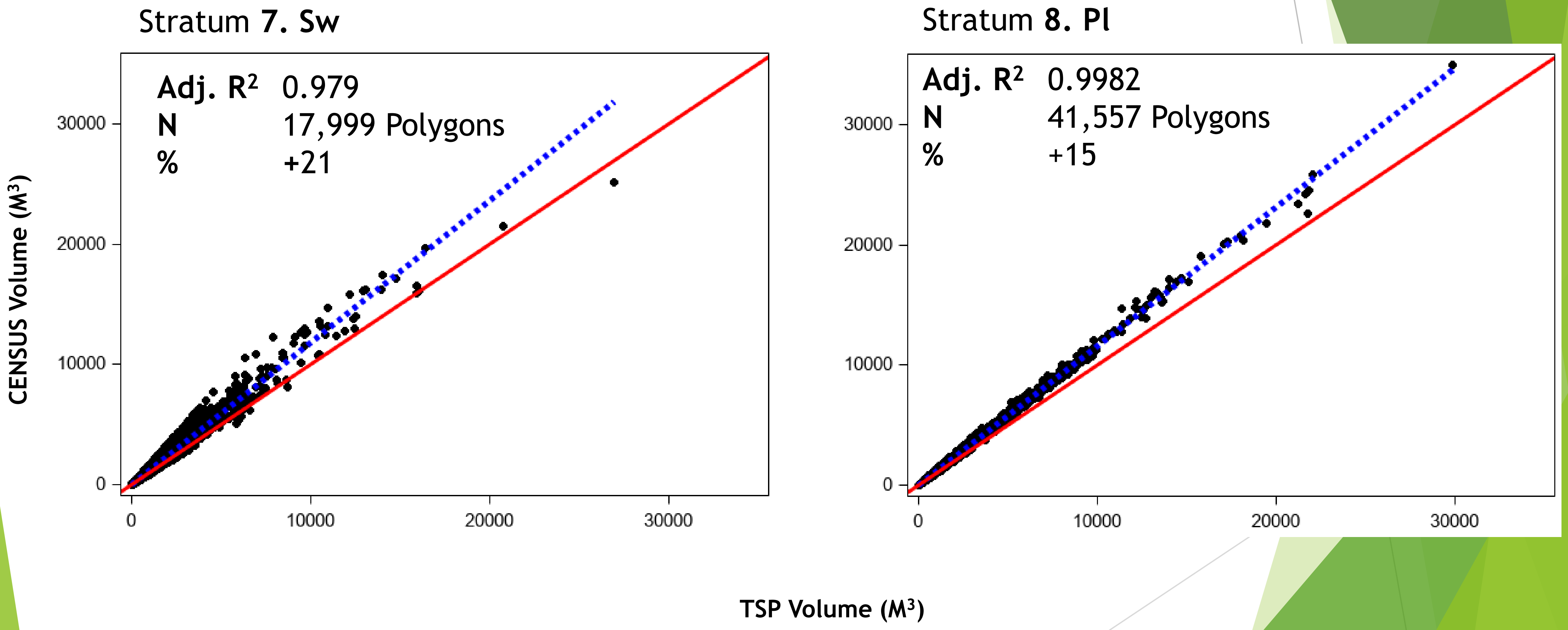
FMU R10 – Growth and Yield Curves

LiDAR Acquired 12-PPM^2, 2020



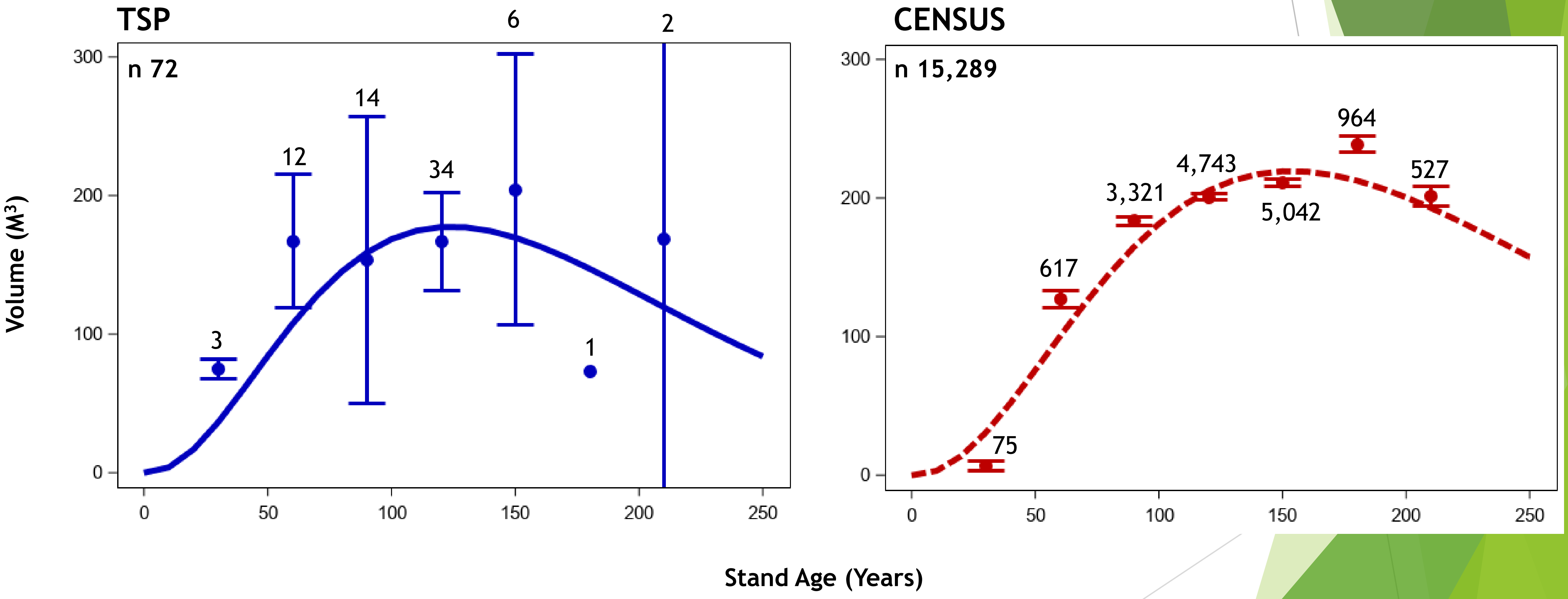
FMU R10 – Agreement Plots

LiDAR Acquired 12-PPM^2, 2020



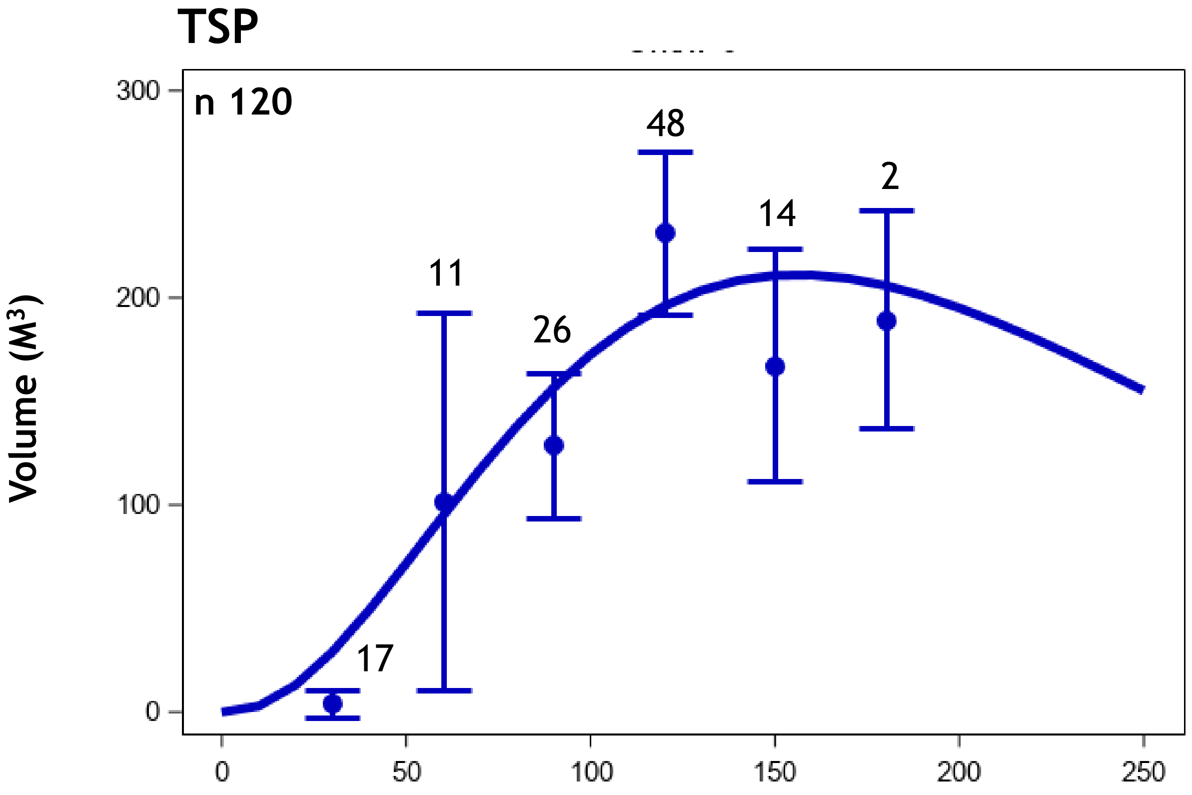
FMU R10 – Growth and Yield Curves with 30-Year Average

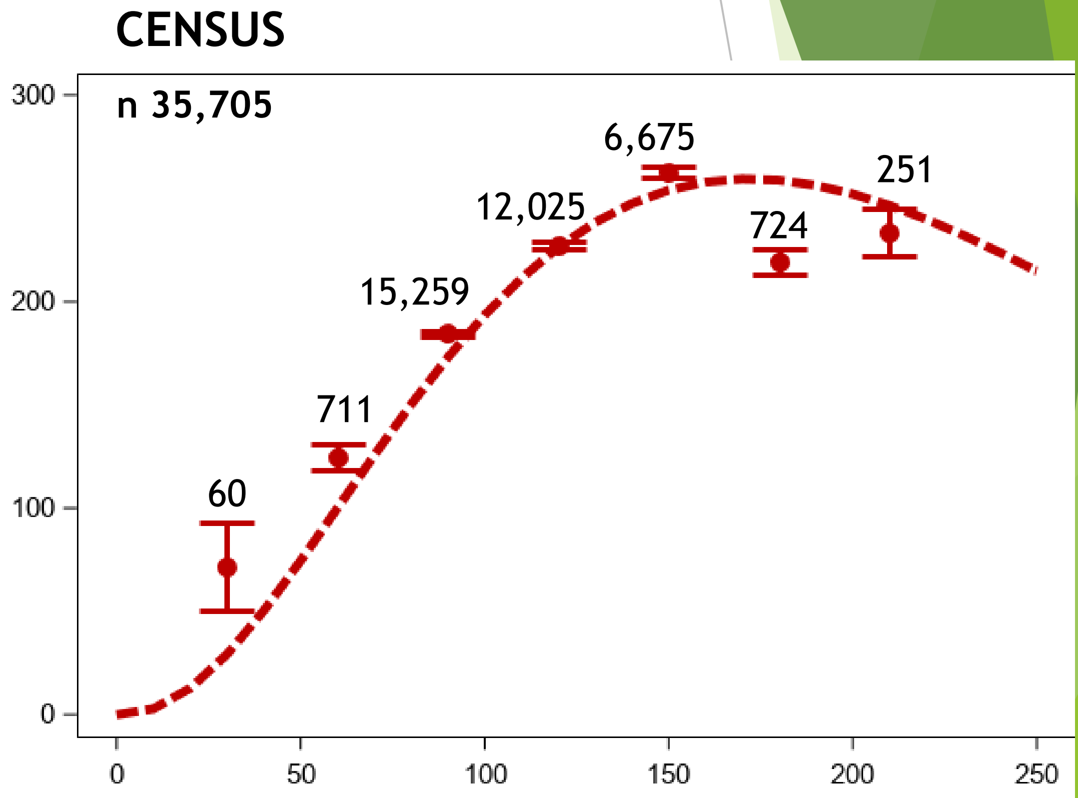
Stratum **7. Sw**



FMU R10 – Growth and Yield Curves with 30-Year Average

Stratum **8. Pl**



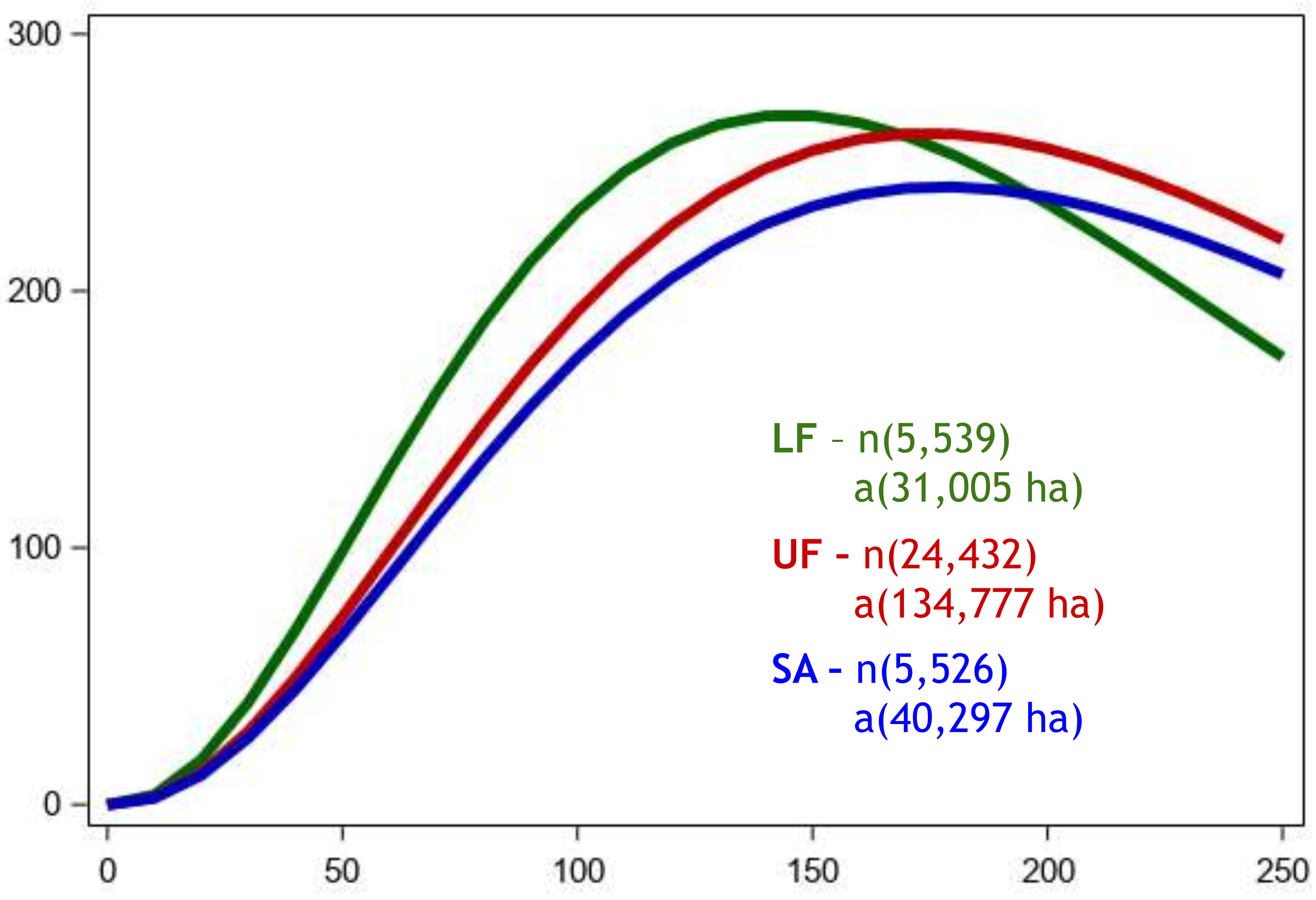


Volume (M³)

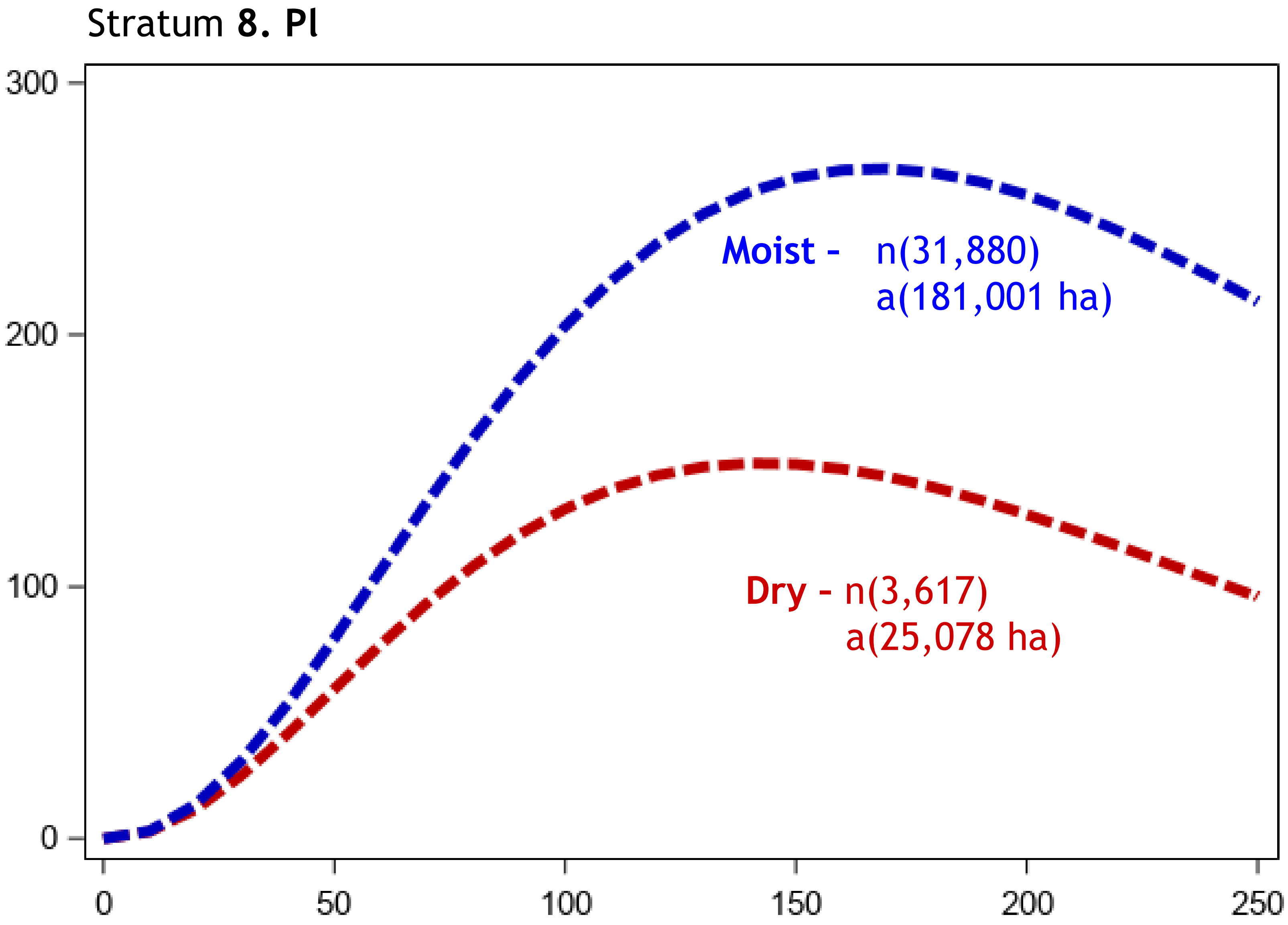
Stand Age (Years)

FMU R10 – Stratum 8, Split by Natural Subregion

Stratum 8. Pl



FMU R10 – Stratum 8, Split by AVI Moisture Regime



Is the Census method as good or better then the TSP method?

- Census Growth and Yield is still at a preliminary stage
- Need to understand various weights of both approaches to ensure we are comparing apples to apples.
- Heavily dependent on the stem map. We need to understand better the trade-offs with stem-map error and harvesting methods
- Will we get similar (consistent) results with scale data?

Current Knowns

Strength over TSP	Limitations
• Significant Increase Sample Size • Further stratify by important growth parameters • Truer age class distribution • No Additional Field Sampling • No sample bias (Ex. Access Constraints) • Can be More efficient	• Stem Map Error • Does not account for Tree Condition • Limited non-timber values

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