

EFI to AVI

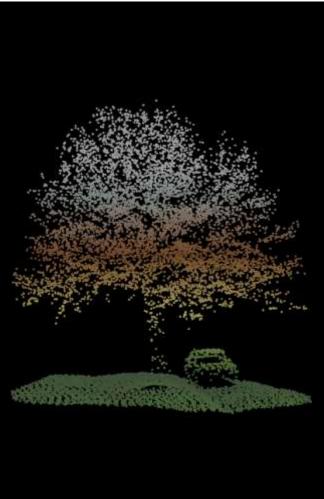
PUTTING STEREO GLASSES ON DATA SCIENTISTS

Kat Gunion RPF (BC, AB)

kgunion@forsite.ca



Overview



- Start at the end. What is AVI?
- Broad Approach
- Review Three Challenges
 - Multi Layer Stands
 - Age/Site Index
 - Polygon Delineation
- Validation
- Advantages/Disadvantages
- Next Steps

FORSITE

What is AVI?

What it is:

- Alberta Vegetation Inventory
- Strategic Level & Timber Supply
- Uniform Province Wide
- Height, Stand Origin, Timber Productivity, Species Label, Moisture Regime, Crown Closure

What it's not:

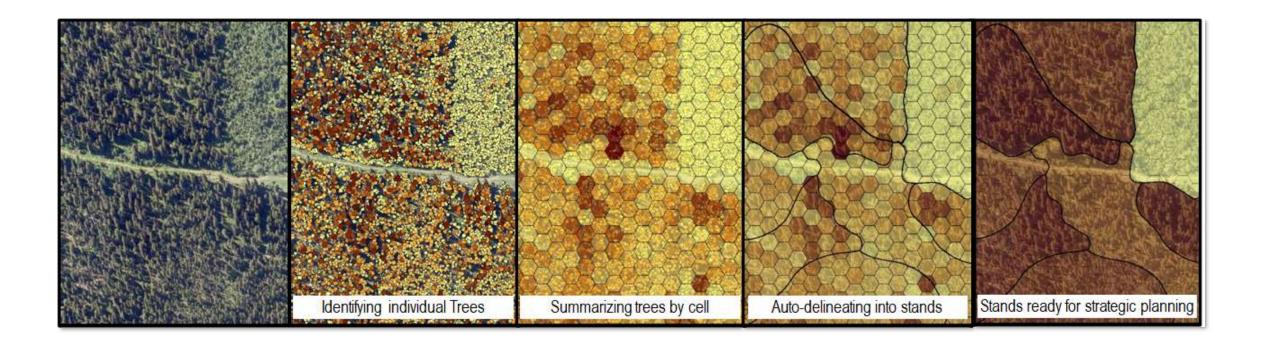
- Doesn't include basal area, diameters, stem density, or volumes.
- Yield curves are developed separately and assigned to Yield Strata from AVI.



Broad Approach

- Individual Tree Inventory
- 400m² hexagons

- Auto-Delineated Polygons
- Assign Attributes

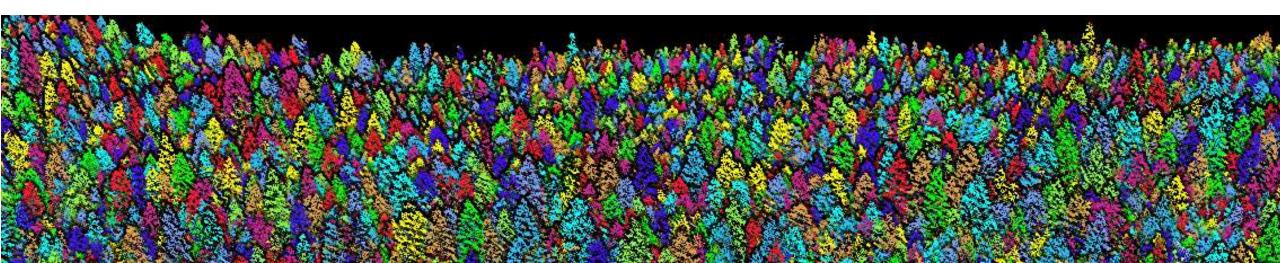




Challenges - AVI Attributes using Data Science

- Multi Layer stands
- Site Index Height Age
- Polygon Delineation

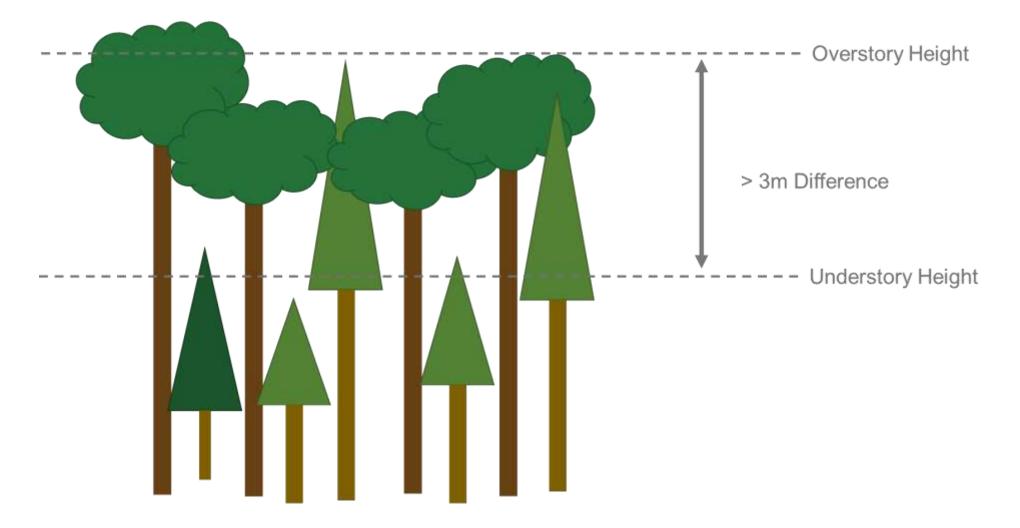
- Categorical Attributes
- Human Judgement



Determining Multi-Layer Stands



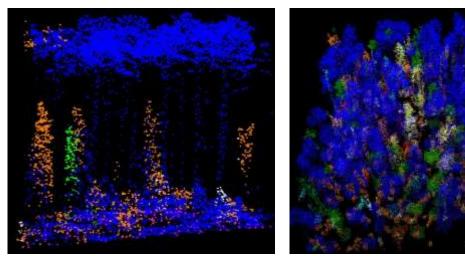
Conceptually Simple but Difficult to Achieve Systematically

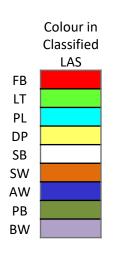


Segmentation in Understory



New segmentation algorithm detects presence of sub-canopy trees (but not all).

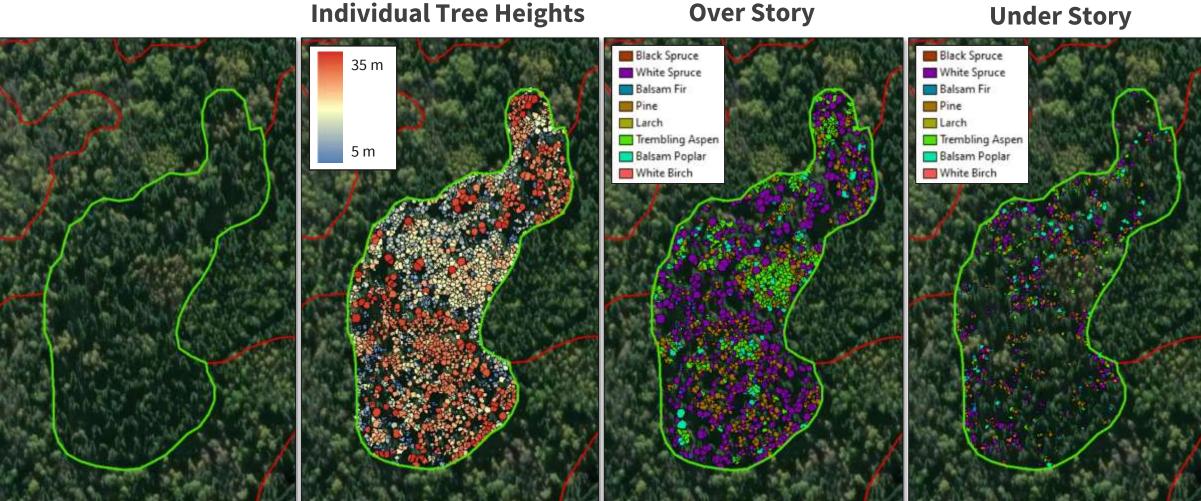




Separating the Over and Under Story Trees Forest Management Specia Systematic Approach Developed with the GOA Top Height – P95 **Over Story Trees** Split Height – 65% of TH **Under Story Trees**

Attributing Polygons

Based on Over/Under Story Trees

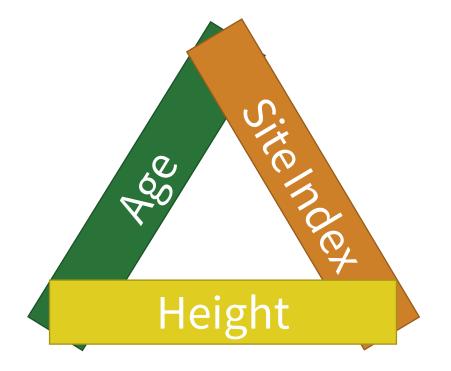


Individual Tree Heights





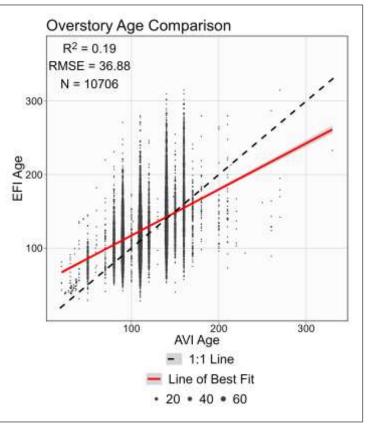
Age-Site Index-Height

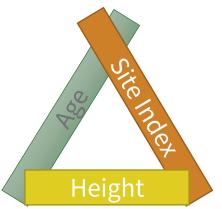




Attempt 1: Predict Site Index

Timber Productivity Rating Category		Prediction	n (Through S	Total	% Correct			
		G	М	F	(Row)	(Row)		
ice (G G		720	441	1,166	0%		
Reference (Interp)	М	132	10,554	10,242	20,928	50%		
Re (I	F	117 16,688 18,90		18,900	35,705	53%		
Total (0	Column)	254	27,962	29,583	57,799			
% Correct (Column)		2%	38%	64%	Overall N	latah - 510/		
% Avera	ge Correct	1%	44%	58%	Overall Match = 51%			



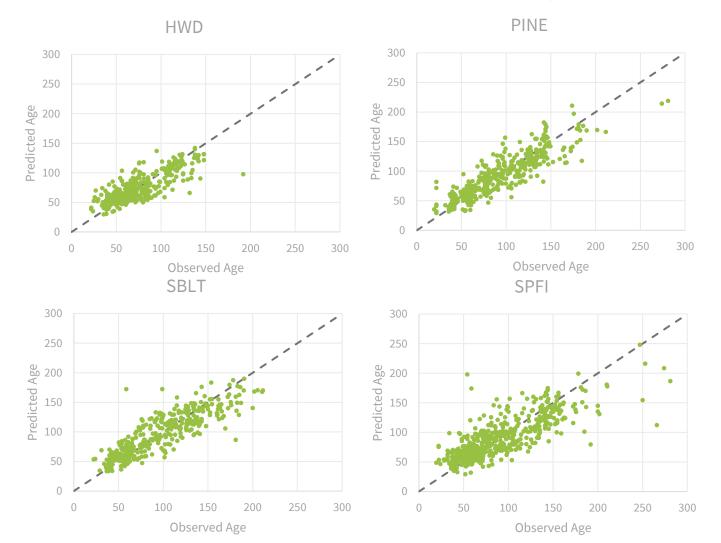




• In progress...seems promising

• Use Lidar metrics and an Elastic Net regression method

Attempt 2: Predict Age





Auto Delineation

Photo Interpreter

Computer Generated





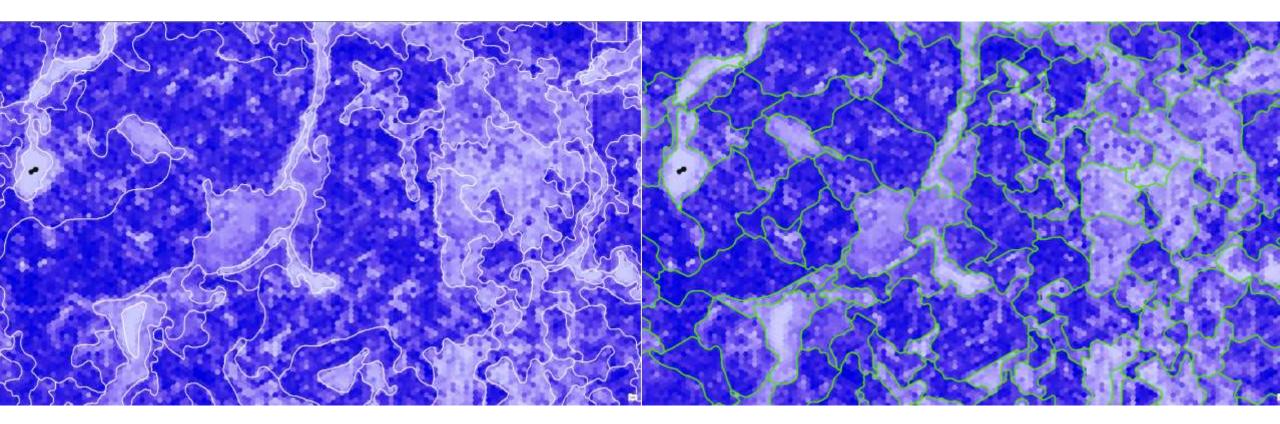




Auto Delineation

Photo Interpreter

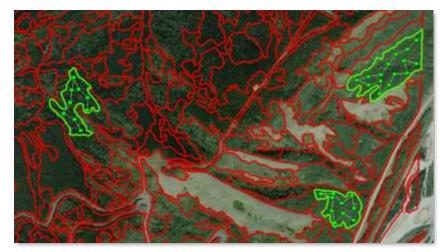
Computer Generated



Validation

- Macro-Level: Compare results on a stand-by-stand level across one of the sample areas
- Micro-Level: Stand-based validation
 - Selected 32 stands from the latest AVI layer (2019)
 - Completed a field check with pre-determined survey points to capture an average of the stand
 - Thorough secondary photo-interpretation

ALC INCOME IN COMMENTAL								
AN ADDRESS IN	All strategies	1	K LS		a ti barra a	Cont Of Sale of Street of	a of balance at	- 60
A DESCRIPTION OF THE OWNER OF THE	WI -COPPER	1011	1400.	TO DESCRIPTION OF THE OWNER OW	of the second			
NUMBER OF STREET	14	atte barrer Ale sal	16	All the second second			<u> </u>	-1
ALL HALLS BARRIES		ti setti sederili -	444	Athene D				
AVE PEOPlePT	Ber solder Barbita		100	out the set of the set of the set	COLUMN TAX	Contra Control		
an antimation		I SCHOOLSE	a sanaha	444	Contraction of the			
CONTRACTOR OF A DESCRIPTION OF A DESCRIP		A PARTY AT LC.		191	Continu	100		100
Bet auf 2019 auf			and a sub-	in market and	A 444			
and History and		and so its	The second in	AND DEPEND	1	and constrained		
iven and set we start the			And succession	ALC CONTRACTOR	and the second			
OTHER DESIGNATION.				The section of a Average of the test of a Average of the test of the test of the test of the test of the test of the test of the test of the test of the test of the test of the test of the test of test of the test of t	solution in the			
THE MERIDIAN PROVIDENCE IN THE PROPERTY OF THE		STATISTICS.			In setting the last	III easternet		
THE OT ACCOUNTS AT	A	STREET STREET	and with the first		In setting that in setting the setting that setting that	and the second	and the second	inter fo
ITTI AVI INCOMPTION	In succession in the second seco		CAR HOUSE HAL	and the second second	a selestines	ALC: NOT THE	Piller P	~ ~
A COLUMN TO A COLUMN	t milit tuerti tuet di tuetti tuetti tuetti tuetti			No other than			TA REAL	tiet.
And and address of the second se			All out they had			an and the sure	Avancian	
	100	and the second distances			ALL A LOSS SHOPS	AND DESCRIPTION		
to entry hereits are well bourtes		angelian and All a Col	ALC: NO		-			
The second se					HI with the	111		
ALS ATTACTOR Date AVE NO. 19793					and the second	1 120-1	-	
THE REPORT OF			President Sal	And setting hadness	the second		- 10 Y	
AND A STREET AND A	The second secon		the second by				B spinner	1.1
they dive entry hadded	ALC: NOT		ar Hanna	10 - A C (A			ANT INCOMES	
tellu III elitratet	All society and	PLANE OF STREET		N 19 10			PT SHITTPE IS	
Aw entering	and the second second			in the second				
		And the fact that the	It what bearing	100	NEED BALLER			
		Contract on the second		and the second se	Contraction of		A COL	
AND DESCRIPTION OF THE OWNER.	And Designation of the local division of the	and the second	an instantion of	ALL DR. D. P. B. B. B.	and the subscript of the	out IN CONTENT AND AND	and the second	
anne ber fir entrete bei er bester in	INAL AND MEANING		The particular of the	an summer all	edelianity for	- Internet and	ALC: NOT	
						調査の登録	NUMBER OF STREET	
the second of the	statistic business	en printfad		A COLORING		The second second	11-3465	194
AND THE REAL PROPERTY IN COMPANY OF THE REAL PROPERTY IN COMPANY.	CONTRACTOR (ALIS)		I CONTRACTOR OF	and the second		Contractores		
LAUTER OF THE PARTY OF		1 Mar 4	FIGURE	10.1				****
and called a find a set	All with the series		manipul and the lit	a la		and the second second	All Long Desig	
And a state of the	1 11	1. A.	CHOIR MENT	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		ALL OF THE	and the state	1000
Contraction of the second second	Same and		See Lines	100 C 100				
ALC: NOT THE OWNER.	All subble to have	Same I	A DECEMBER		The set of		antist bertragt	
And Sector And Sector and	O OT I DELTRIBUTED	T and ST Saddell	III SALLARD		with the set	TT ARTS IN	P.B.	
	and by home and	Contraction of the local division of the loc		C North	Statistics and the	string of the strengthe	A	
A STATE OF A		Printers Sales	At setting		AVA HIGHL	And a set of the set o	A DESCRIPTION OF	
an and an and an and an and an and an	the sector designed to be the	A DESCRIPTION OF	And the United	ALL DOCTOR	Contraction of the local division of the loc	of an electronic states	ALC: NO.	100
	And in case of the local division of	THE SHITT WAS NOT	And South Provides		and the state of	il senter .	OTO SALE IS	140
COLUMN TO ADDRESS OF TAXABLE		THE AVE PERSON AT LCC	And The owned in the	All other Desired	A DESCRIPTION			-
				COLUMN TARGET AND IN				



Individual Stand Comparison



Generally Excellent Match

Sample Stand No	Source	Age	Moisture	TPR	HEIGHT	DENSITY	SP1	SP1_PER	SP2	SP2_PER	SP3	SP3_PER	SP4	SP4_PER	SP5	SP5_PER
	Field Plot	140	w	M	26	с	Sw	10								
107	AVI	140	m	М	25	С	Sw	8	Pl	2						
107	Forsite	140	m	М	25	В	Sw	9	Pl	1						
107	Sr. Interp	140	m	М	26	В	Sw	9	Pl	1						

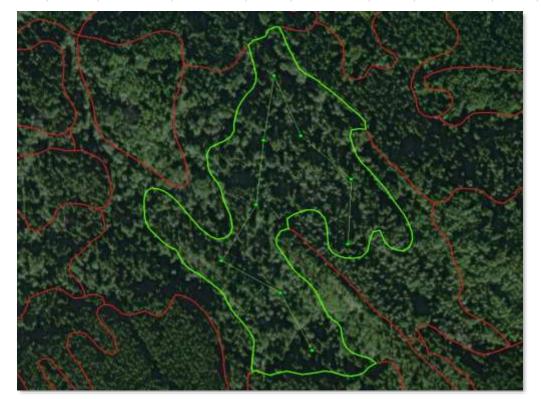


Individual Stand Comparison



Difference in Over/Under-Story Height Split

Sample Stand No	Source	Age	Moisture	TPR	HEIGHT	DENSITY	SP1	SP1_PER	SP2	SP2_PER	SP3	SP3_PER	SP4	SP4_PER	SP5	SP5_PER
109	Field Plot	0	m	G	15	С	Sw	8	Pb	2						
109	AVI	90	m	М	21	A	Sw	7	Pb	3						
109	Forsite	80	m	М	17	D	Sw	4	Ρl	3	Pb	2	Aw	1		
109	Sr. Interpreter	90	m	М	21	А	Sw	7	Pb	3						

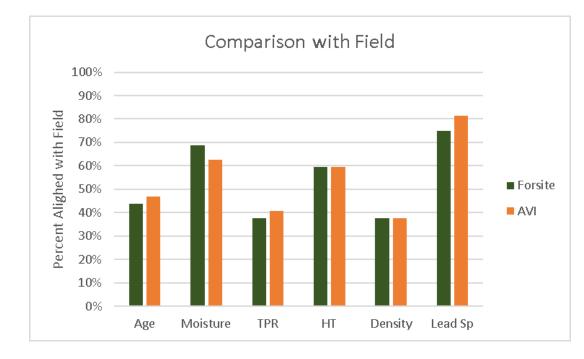


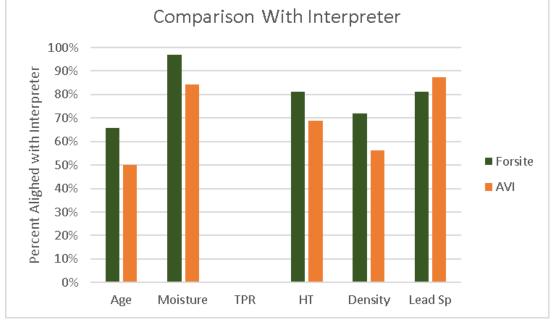


Results - Overstory

Compare to Field Plots

Compared to Sr. Interpreter



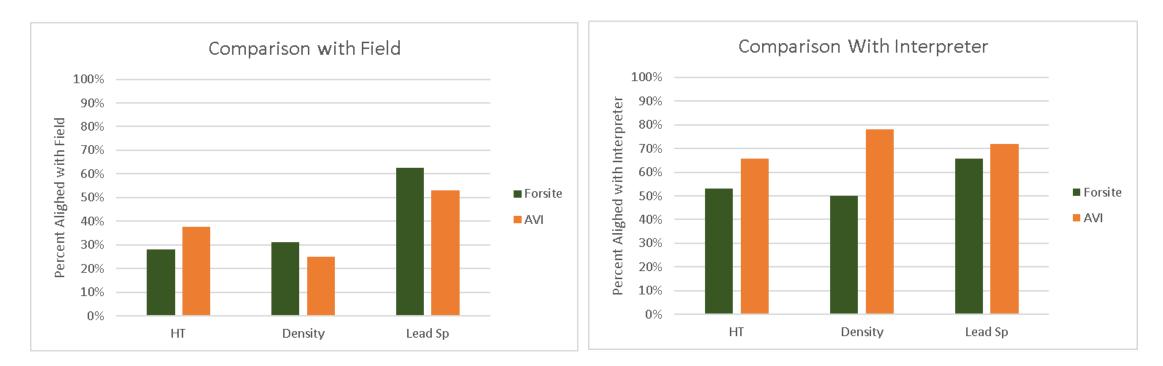




Results - Understory

Compare to Field Plots

Compared to Sr. Interpreter





Summarize Results and Challenges

- Matching AVI layers is difficult in a data driven environment
- Best to predict age directly, and calculate site index
- Polygons are smaller, do not look like human drawn polygons, but are more homogenous
- Core attributes align well in the overstory, and conifer presence/absence in understory is successful



Were We Successful?

- Short Answer: No
 - Wont pass current GoA AVI Standards audit
 - We could pass a standard if it were designed for a data approach
 - Really sensitive to the layer call & full details on the understory
 - We can create polygons, but they don't look like human drawn polygons
- But There are Advantages and Disadvantages to Data Driven AVI.



Time Frames & Budget

Advantage

- Produced in a much shorter timeframe
- Most time restrictive element is the plots
- Millions of hectares can be done in 6-10 months

Disadvantage

• Less efficiencies on small landbases



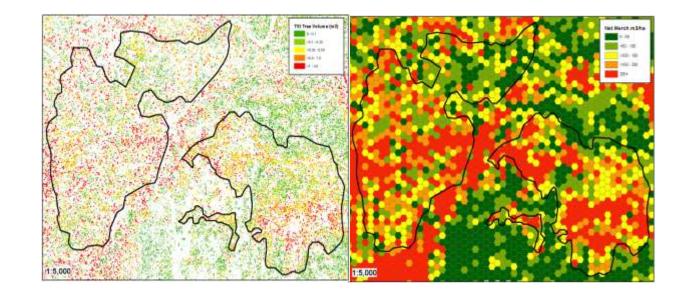
Products/Attributes

Advantage

- ITI and EFI also delivered
- Less subjective attribution
- Plot driven corrections in the hexagon EFI
- Volume/BA/Stems information created

Disadvantage

• Reduced accuracy on understory layer relative to AVI



FORSITE

Consistency

Advantage

- More consistent attribution
- Eliminates potential Data Entry Errors
- Will allow users to compensate for any bias over time

Disadvantage

• Less able to address unique or special conditions where human judgement is necessary



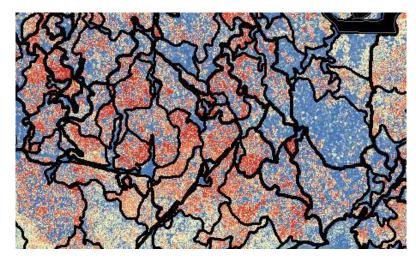
Polygon Homogeneity

Advantage

- Smaller polygons can be created for no additional cost
- These smaller polygons are more homogeneous
- Better growth and yield estimates due to less within polygon variability
- Population level growing stock check with volume estimates

Disadvantage

- Do not always capture landforms as well as human delineated polygons
- Does not look like traditional AVI polygons





Future Research

- 1. Improve understory identification
- Define Stand Types across the landbase prior—single story, two story or complex. (Woods and Penner Petawawa research forest – CWFC 20023 presentation)
- 3. Continue adapting the age and Site Index methodology
- 4. Continue refining polygons





Kat Gunion RPF

Sr. Forest Analyst & Biometrics Team Lead

kgunion@forsite.ca

Cam Brown RPF

Manager – Resource Management & Technology Group

cbrown@forsite.ca

Julianno Sambatti

Sr. Data Scientist

jsambatti@forsite.ca