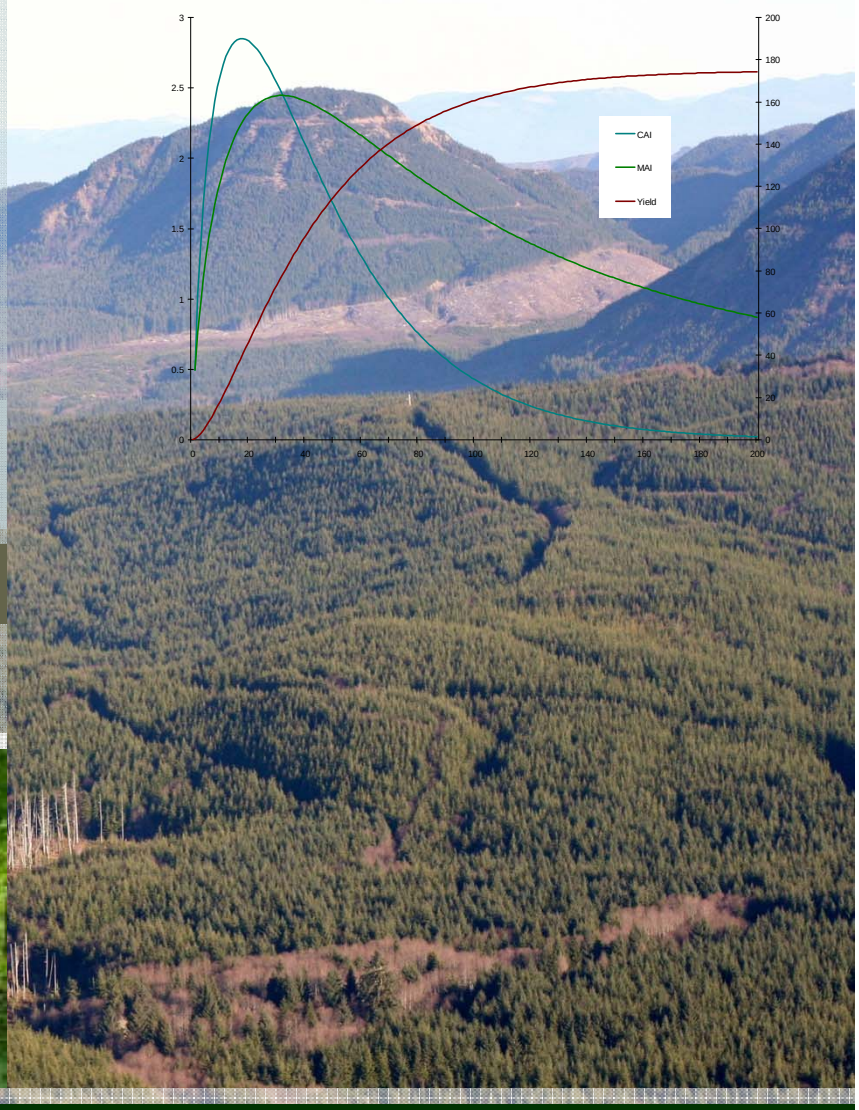
Forest Growth and Yield Models

What makes them Work and What Makes Them Fail?



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Session 1 – Background and Model Description

The Models:

Overviews

FPS

FVS

ORGANON

Summary

Forest Projection and Planning System (FPS)
Forest Biometrics Research Institute
https://forestbiometrics.org/

Forest Vegetation Simulator (FVS)
United States Forest Service
http://www.fs.fed.us/fmsc/fvs/

ORGANON
Oregon State University College of Forestry
http://www.cof.orst.edu/cof/fr/research/organon/

Session 1 – Background and Model Description

Workshop Agenda:

- Overviews
- FPS
- FVS
- ORGANON
- Summary

Overview of FPS, FVS & ORGANON

components, strengths, weaknesses & data requirements

Model Evaluation

with data

without data

techniques

Model Localization

is it necessary?

basic adjustments

Scenarios

		Models		
		FPS	FVS	ORGANON
Model Attributes	Individual Tree-Based	Y	Y	Y
	Spatial Category	DD	~DI[1]	DI
	Equations	N	Y	Y
	Dbh-Driven	N	Y	Y
	Height-Driven	Y	N	N
	Support/Updates	Y	Y	N
	Relational DB	Y	Y	N (DLLs)[2]
	Extensions	N	Y	N
	Age Invariant	Y	Y	Y
	Time Steps	Variable[3]	Variable[4]	5 years (RAP is 1 year)
	Applicable Area	Western States +	US	NWO, SWO, SMC, RAP
	Young Stand Growth	Y	Y	N[5]
	Ingrowth Model	Y	Y	N
	Cost	Variable[6]	Free	Free
	Source Code Available	N	Y	Y
	Calibration Possible	Y[7]	Y	Y

1: semi-DI since some FVS variants use plot level densities (plotBAL or plotBA) in the growth equations

2: Dynamic Link Library files allow users to call ORGANON routines from spreadsheets and databases

3: a growth step is years to 20' height growth with linear interpolation to specified time steps

4: recommended 5 or 10 year growth step depends on variant, but can specify number of years in steps

5: heights must be > 4.5', an even age stand must be a minimum age of fifteen years

6: FBRI membership fee is currently $0.03/acre with a $1,500 minimum and $35,000 maximum

7: Survival and height growth to 20' can be "calibrated" in a silvics regime via PctSur and PctHt

How trees grow

- Diameter growth
- Height growth
- Survival
- BA: combines D & S
- Volume: integrates D, H & S (with taper)

How tree growth is modeled

- potential growth with modifiers
- competition, health, resources, etc.
- diameter growth drives height and survival
- height growth drives diameter and survival

Session 1 – Background and Model Description

Attribute Overview

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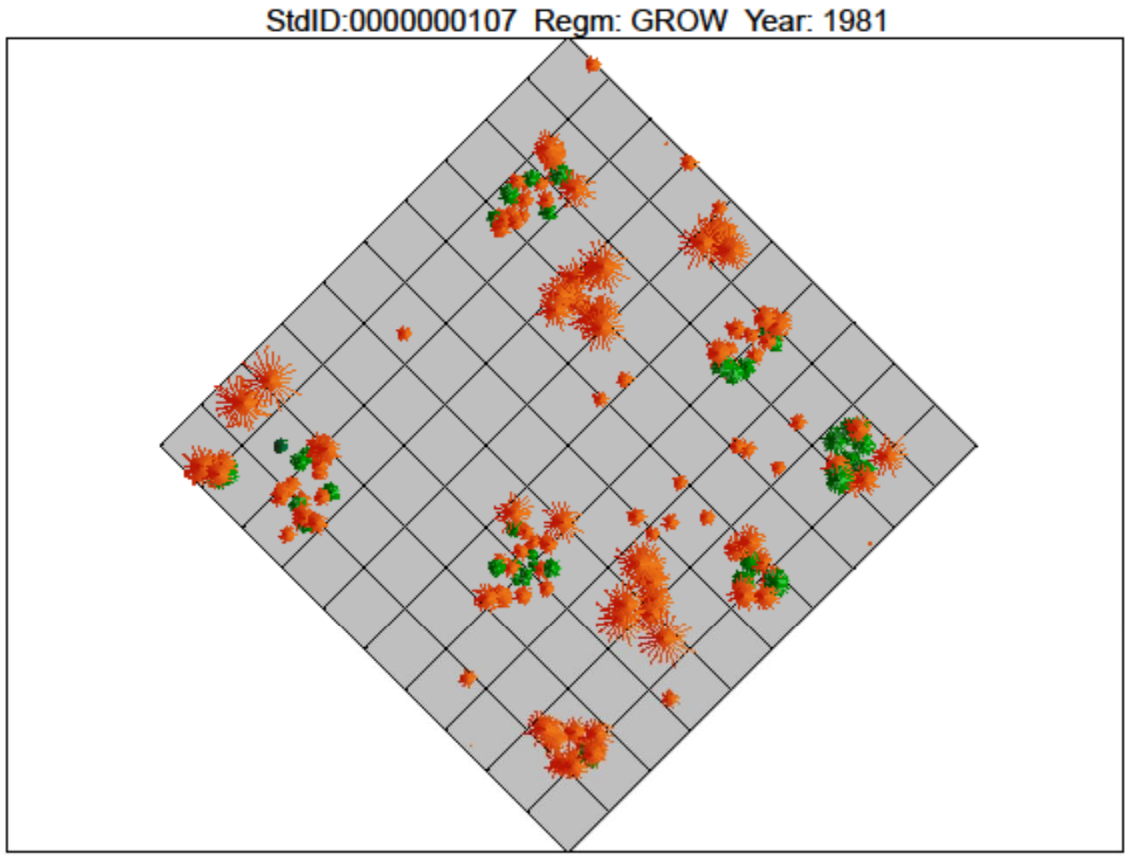
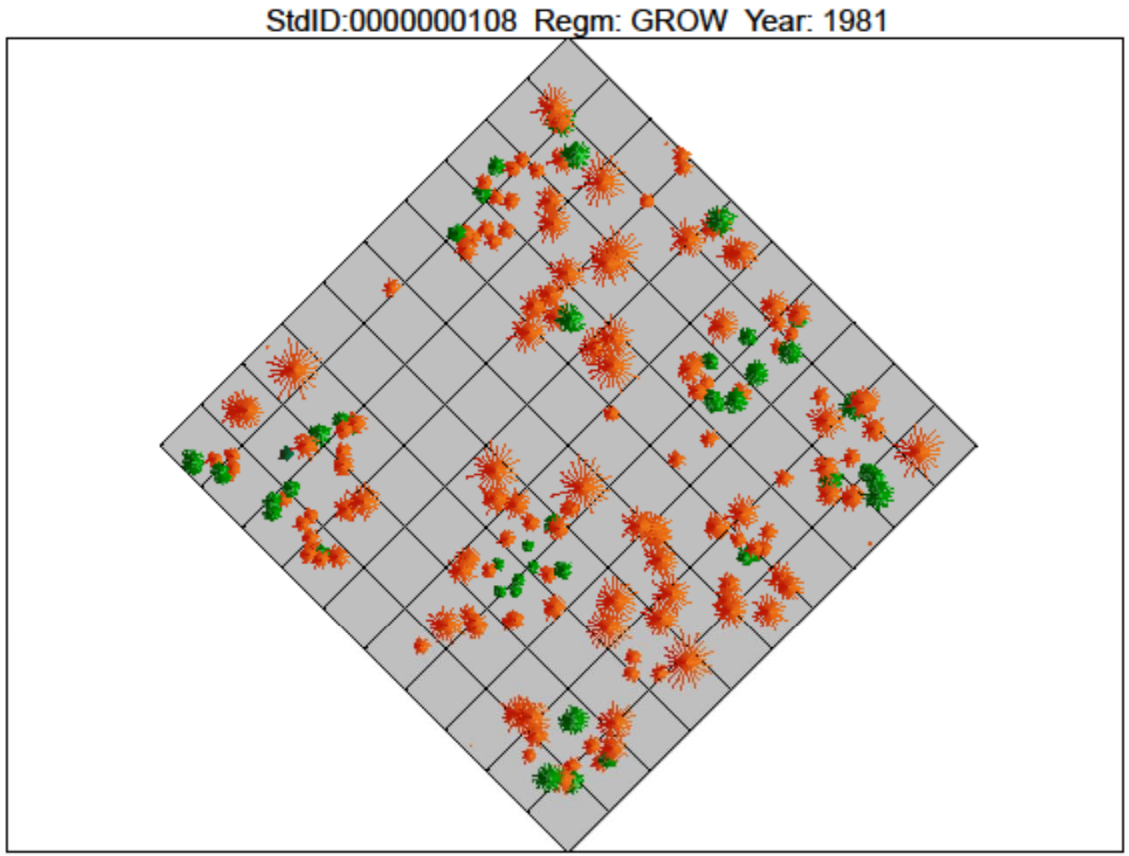
Summary

- **Distance dependent**
  - **spatially explicit via stem map or clump index**
    - **Stand.Clump defaults to 0.75**
  - **competitive stress index (crown overlap)**
- **Grows in 20’ height steps with linear interpolation**
- **10 meter site index**
- **Nonparametric (estimates in FBRI_lib.mdb tables)**
  - **“certified status”**
- **Reads and writes to MS Access (perhaps others?)**
  - **tables, queries, forms, reports, macros, modules**
- **Compiler, Expander, Re-merchandiser, Harvest Scheduler**
- **Components and data requirements to evaluate/calibrate**

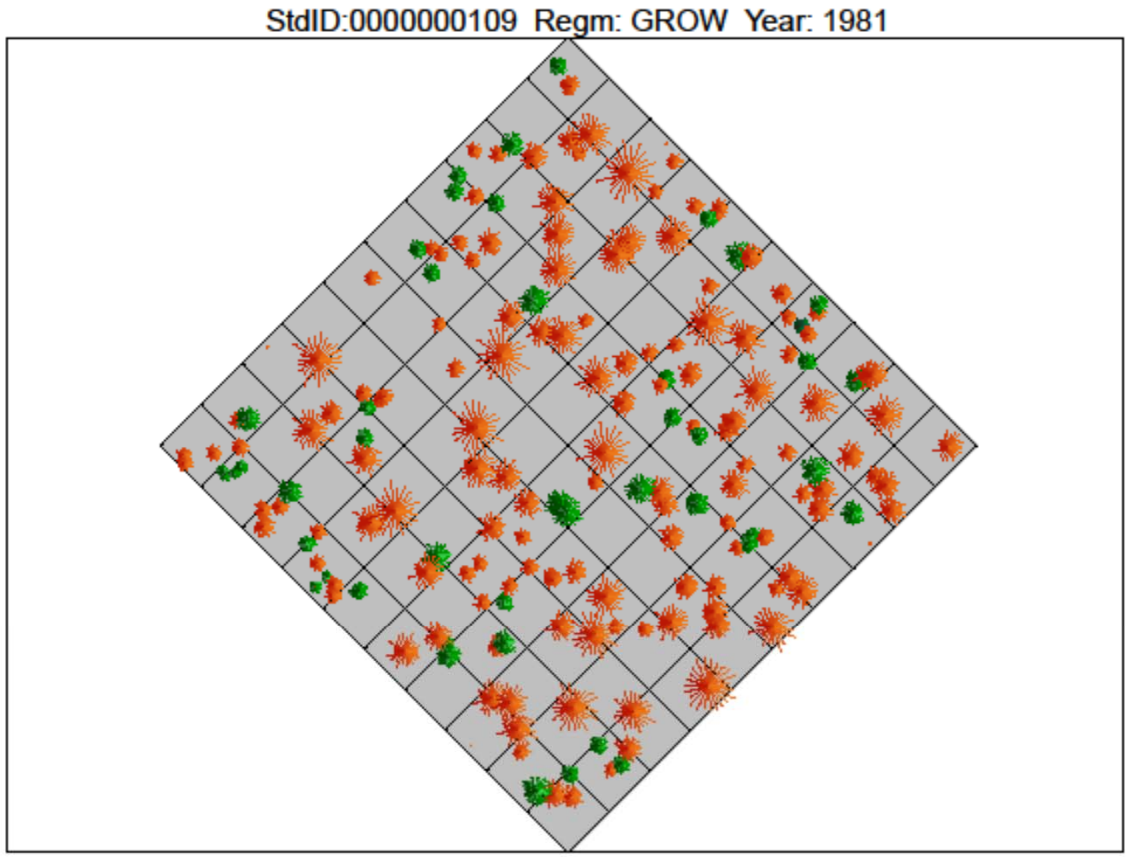
Clump 30% on full acre



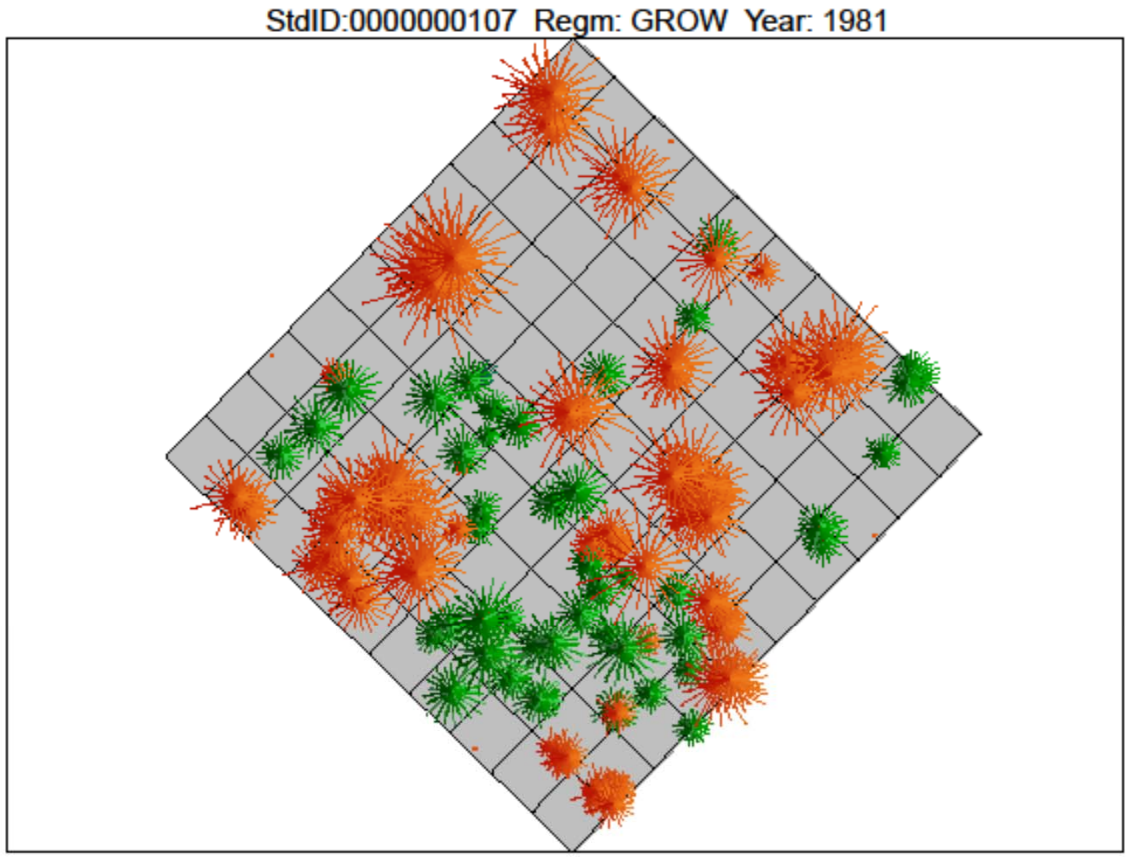
Clump 60% on full acre



Compiler clump estimate 87% on full acre



Actual stem map on 0.2-acre plot



10 m site and site shape

Attribute Overview

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Site Index has three components:

% early ht growth relative to 10m macro site (Silvics.PctHt)

10-meter macro site (meters per decade) (Admin.Site_Phy)

% late ht growth relative to 10m macro site (Admin.Site_Shp)

10 m site and site shape

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10m macro site: (100/#yrs from 34' to 67')

10-meter macro site conversion:

10m = (BHSI-30)/10

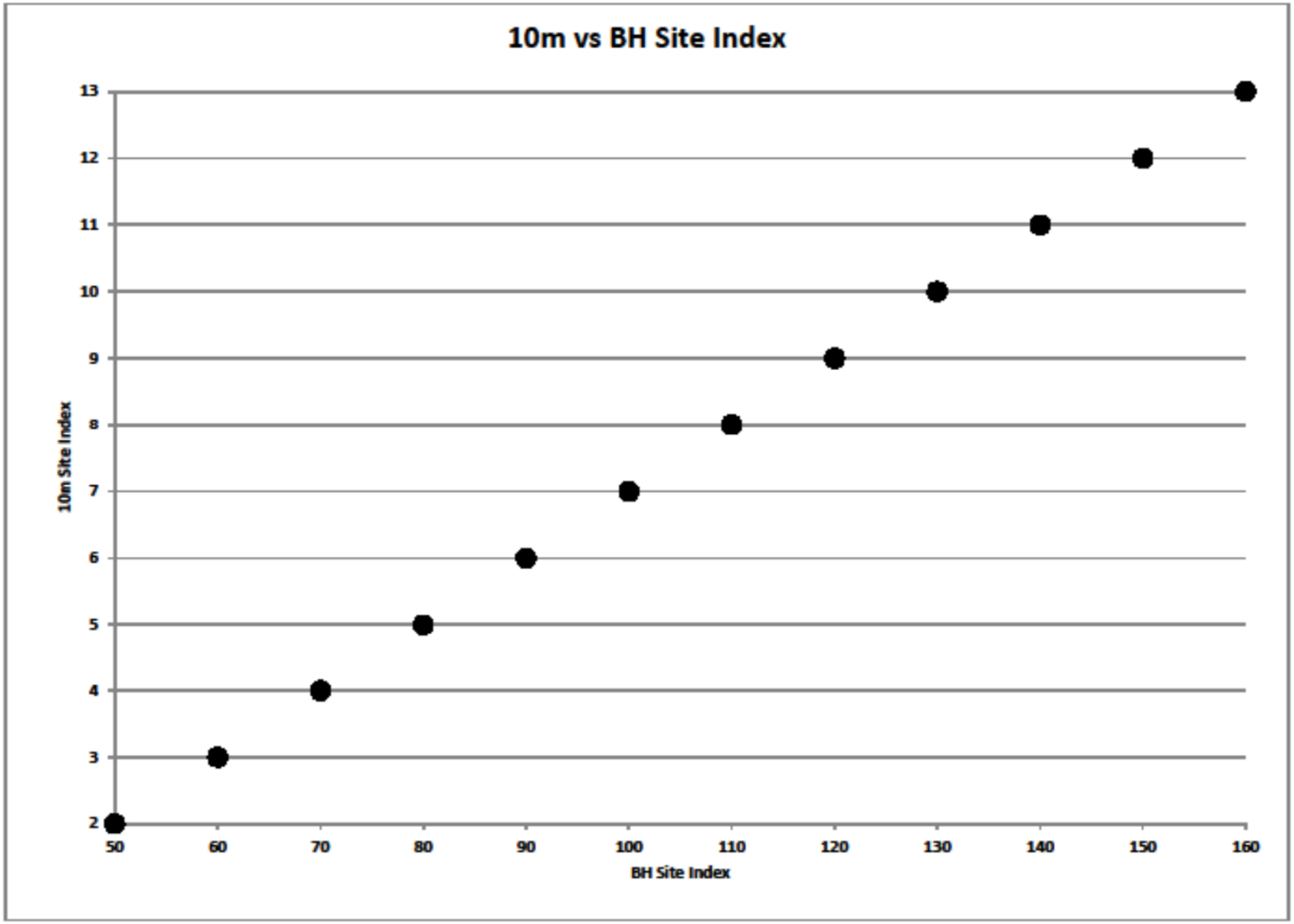
BHSI = (10m*10)+30

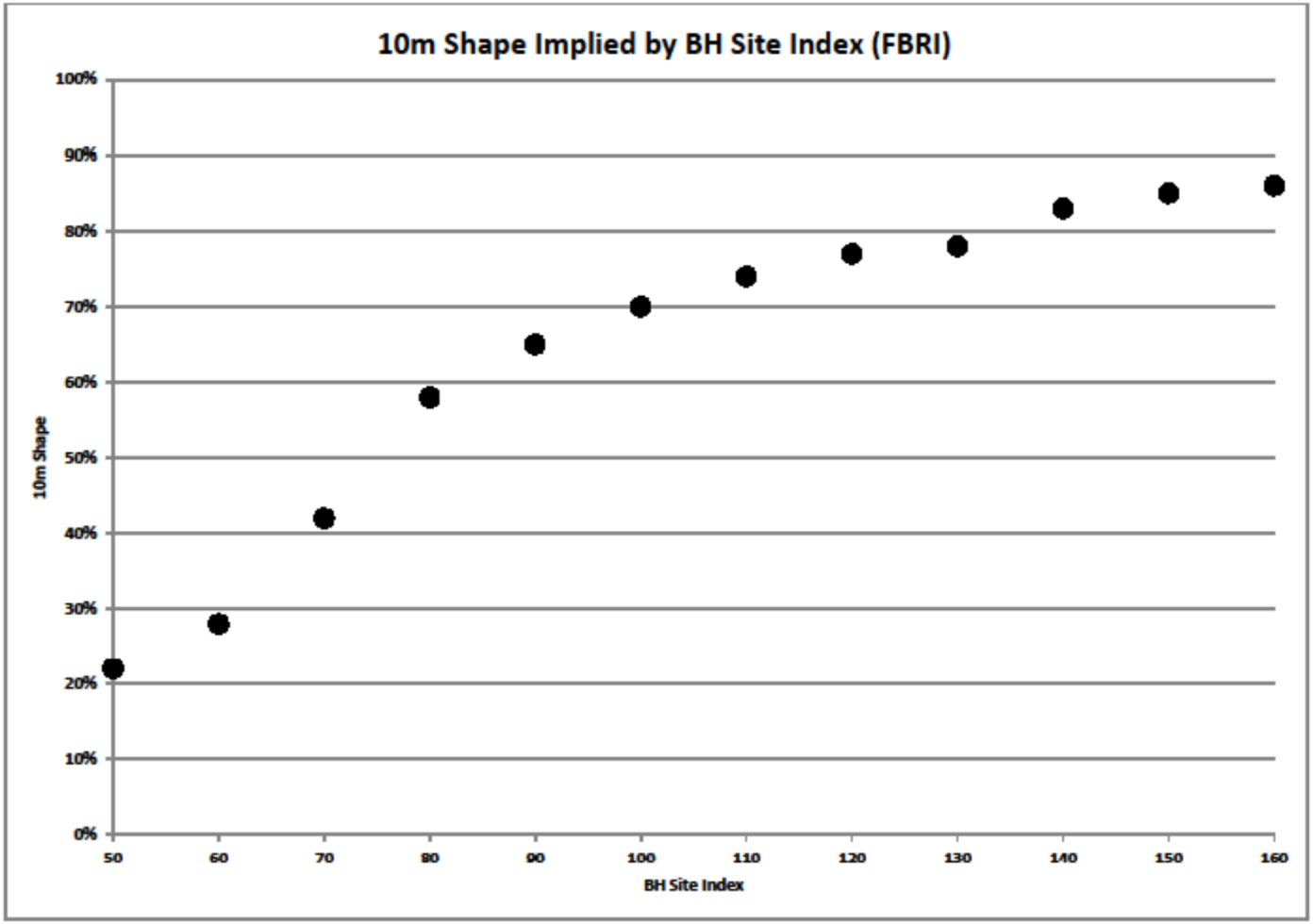
linear relationship

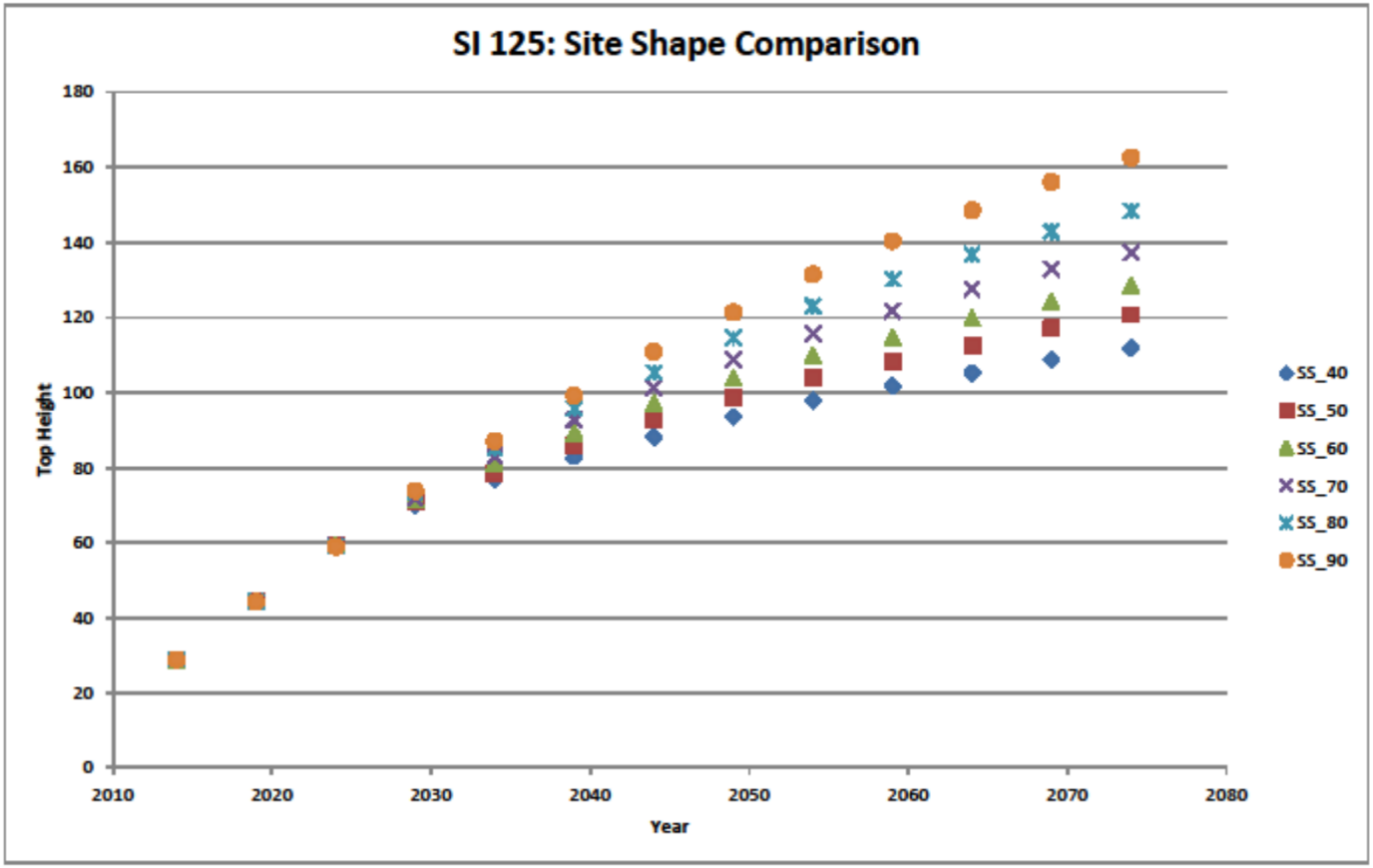
10m shape: (#yrs from 34' to 67')/(#yrs from 67' to 100')

default in FPS 67%

shape is nonlinear if wanting traditional BH site behavior


10m vs BH Site Index
10m Site Index
13
12
11
10
9
8
7
6
5
4
3
2
50
60
70
80
90
100
110
120
130
140
150
160
BH Site Index


10m Shape Implied by BH Site Index (FBRI)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10m Shape
50
60
70
80
90
100
110
120
130
140
150
160
BH Site Index


SI 125: Site Shape Comparison
Top Height
Year
0
20
40
60
80
100
120
140
160
180
2010
2020
2030
2040
2050
2060
2070
2080
SS_40
SS_50
SS_60
SS_70
SS_80
SS_90