Projecting Growth and Yield

Scales that we consider.

Growth over time at the

Individual tree level.

Stand growth

Factors that influence growth

Abiotic factors

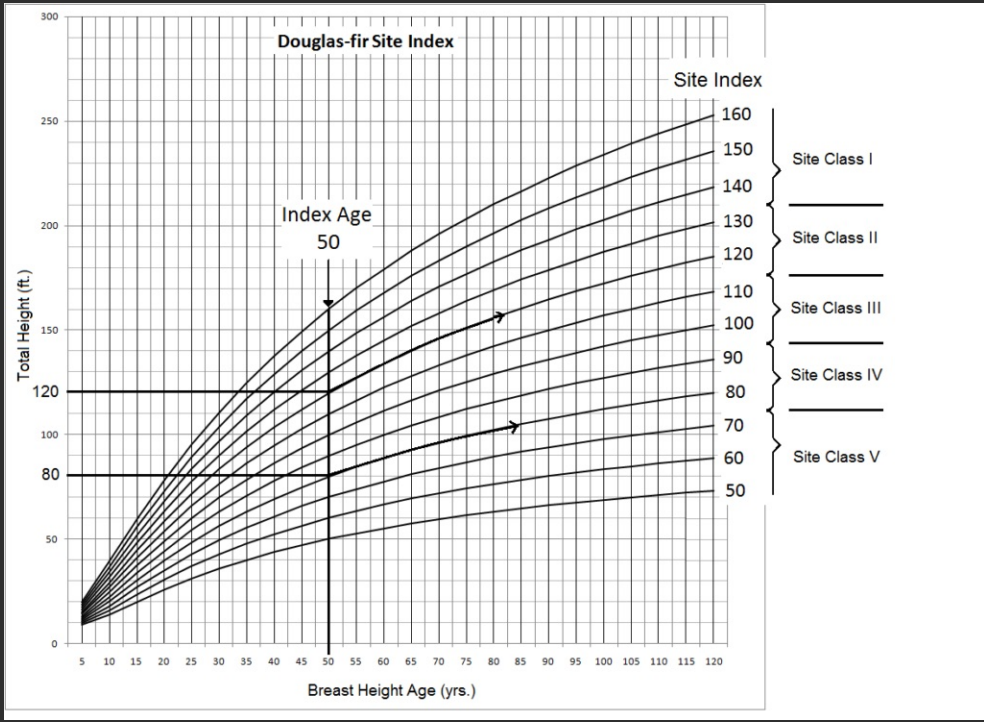
- Climate
- Soil
- Light

Stand factors

- Density
  - → Competition

Site Index

→ Average height of trees that dominate/codominate for a given age.



Stand Density Index (SDI)

SDI_{MAX} = The maximum density for tree size before stem exclusion occurs. Assuming commercial forestry!

$$\log_{10}(N) = -1.605(\log_{10}(D)) + k$$

$N = TPA$ (density)

$D = QMD$

when $QMD = 10$

$$\log_{10} SDI = -1.605(1) + k$$

Constant for each species.

$$k = \log_{10} SDI + 1.605$$

$$\log_{10} SDI = \log_{10} N + 1.605 - 1.605(\log_{10} 1)$$

$\log_{10} SDI = \log_{10} N + 1.605(\log_{10} D) - 1.605$

2.17 $D = 11.05$ 1.04

$\frac{ft^2}{ac}$ in = dia

$QMD = \sqrt{\frac{ba}{tpa}}$ $\frac{100}{150} = 12$

$\sqrt{0.005454154}$

Avg tree diameter for a basal area

What is SDI of a stand where BA = 100 ft^2 and density = 150 TPA

$\log_{10} SDI = 2.25$

$\log_{10} x = 10^x$

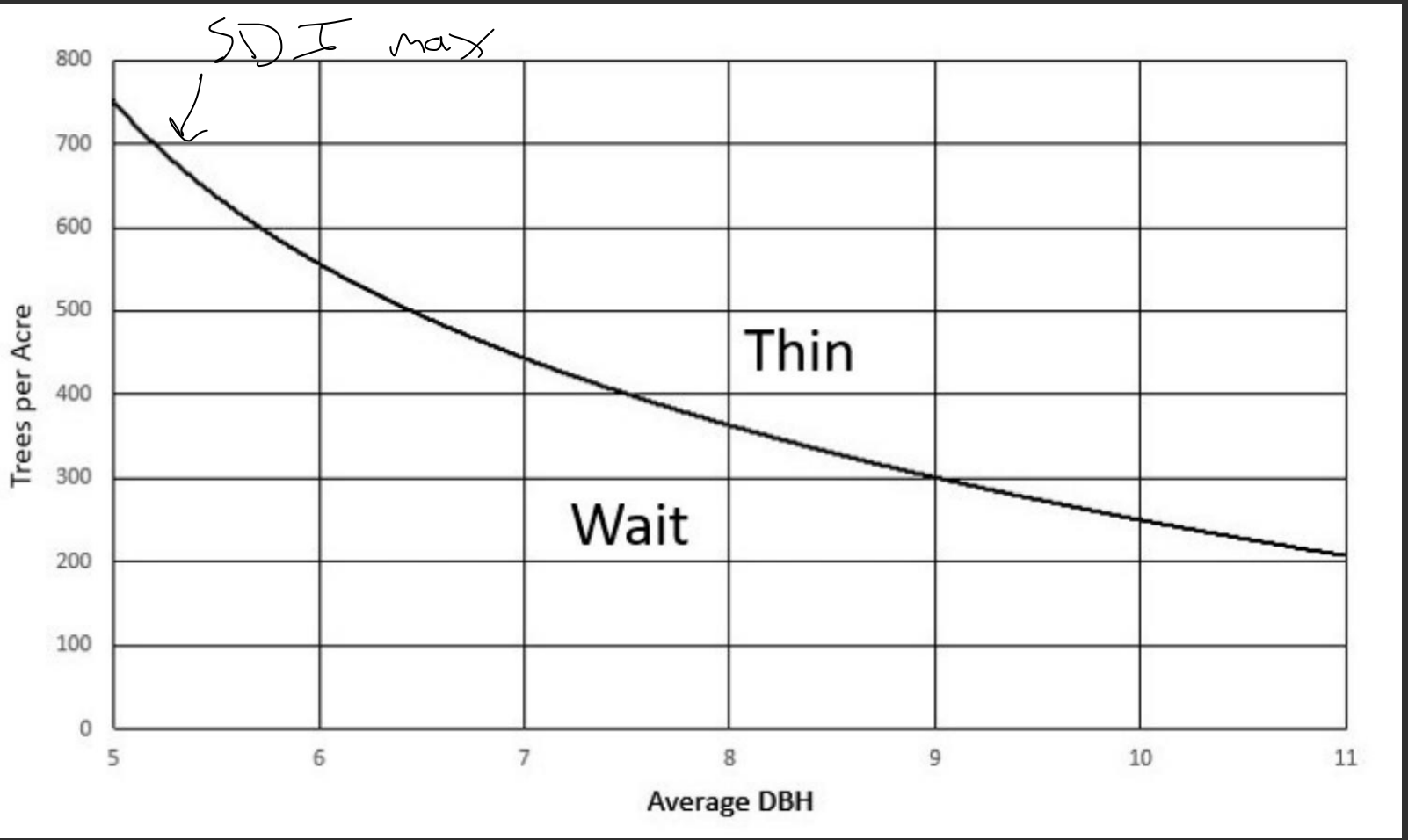
$SDI = 10^{2.25} = 177.83$

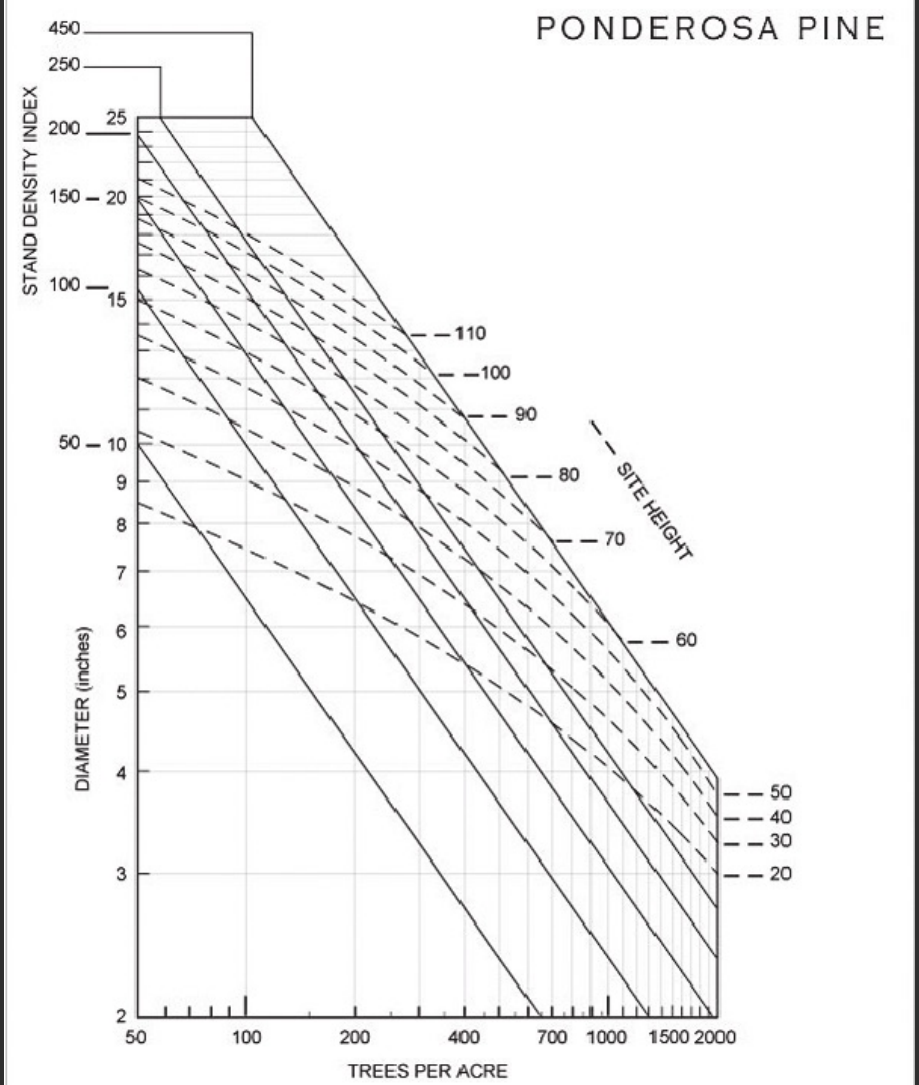
If $SDI > SDI_{max}$

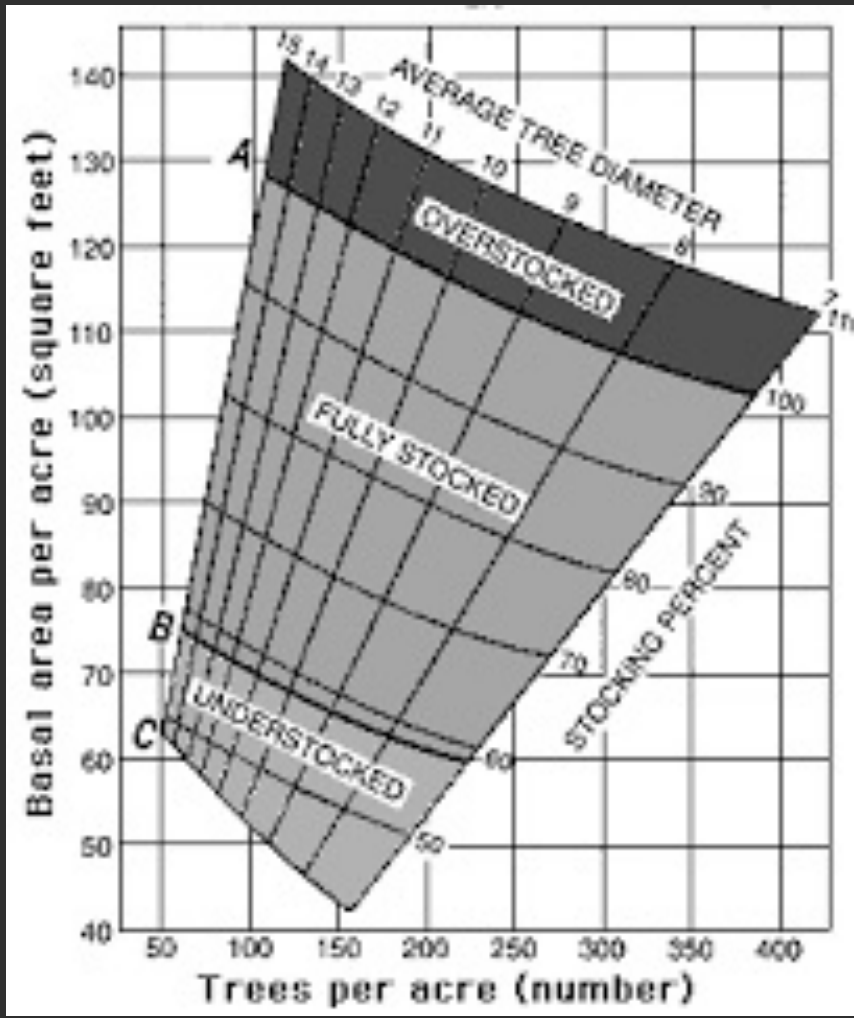
then overstocked.

If $SDI < SDI_{max}$ then

room for growth


SDI max
800
700
600
500
400
300
200
100
0
Trees per Acre
Thin
Wait
5
6
7
8
9
10
11
Average DBH


PONDEROSA PINE
STAND DENSITY INDEX
450
250
200
150
100
50
25
20
15
10
9
8
7
6
5
4
3
2
DIAMETER (inches)
110
100
90
80
70
60
50
40
30
20
SITE HEIGHT
50
100
200
400
700
1000
1500
2000
TREES PER ACRE


AVERAGE TREE DIAMETER
18 14 13 12 11 10 9 8 7
OVERSTOCKED
FULLY STOCKED
UNDERSTOCKED
STOCKING PERCENT
100
90
80
70
60
50
A
B
C
Basal area per acre (square feet)
140
130
120
110
100
90
80
70
60
50
40
50 100 150 200 250 300 350 400
Trees per acre (number)

Growth . . . into the future

$$Y = 1.6689 + 0.041066\,BA - 0.00016303\,BA^2 - 0.076958\,A + 0.00022741\,A^2 + 0.06441\,S$$

Potential Growth

$$PG = b_1 \cdot SI \cdot [1.0 - e^{(-b_2 \cdot D)}] \cdots e^{-b_3 \cdot BA}$$

competing modifier

Survival ....

$$S = 1 - [1/(1 + en)]$$

$$n = c_1 + c_2 \cdot (D + 1)^{c_3} + e^{c_4 \cdot P - c_5 BA}$$

FVS

Forest vegetation Simulator