

Problem Set 2
Forest Measurements FO-2122

Required Data Sets:

growth_data.xls
felled_tree_data.xls
stand_table.xls

Growth_data.xls Data File:

1. Using the dbh-height data, derive a height-dbh regression equation for the model
$$\ln(H) = b_0 + b_1(\text{dbh})^{-1}$$
and compute the I^2 and $s_{y,x}$ fit statistics.
2. Using the dbh_{ob} , 1x-bark, and 1x-10 yr radial growth data, derive:
 - a. a dbh outside- to inside-bark regression equation for the model
$$\text{dbh}_{\text{ob}} = b_0 + b_1(\text{dbh}_{\text{ib}})$$
 - b. a dbh growth regression equation for the model
$$\text{dbh growth} = b_0 + b_1(\text{dbh}_{\text{past}})$$

Felled tree data.xls Data File:

3. For each of the 24 sample trees, compute:
 - a. the diameter inside bark at each height location on the felled stem.
 - b. the merchantable height/length to a 3" and 6" top diameter.
 - c. the cubic volume to a 3" and 6" top diameter (ob) using Smalian's equation
 - d. the Doyle board foot volume to a 6" top diameter (ob) using the Dole equation
4. Using the per-tree volumes in Question 3 above, compute standing-tree volume equations for the regression models:
 - a. $\text{Volume}_{\text{unit, hi}} = b_0 + b_1(D^2H_0)$
where unit, h_i = cubic feet to a 3" & 6" top diameters, ob, and
= Doyle board feet to a 6" top diameter, ob
 H_0 = total tree height in feet.
 - b. $\text{Volume}_{\text{unit, hi}} = b_0 + b_1(D^2H_6)$
where unit, h_i = Doyle board feet to 6" top diameter, ob.
 H_6 = merchantable height to a 6" top in feet.

Stand_table.xls Data File:

5. Using the height equation from Question 1, compute the height of each dbh class.
6. Using the volume equation for ft^3 to 3" top (ob) and Doyle board feet to 6" top (ob) from Question 4a, compute the current volume(s) per acre for the current stand table.
7. Using the dbh growth equation from Ques 2b, compute dbh growth for each dbh class.
8. Using the growth ratio index (g.r.i.) method, compute a future stand table.
9. Apply the ft^3 and Doyle volumes from Question 6 to the future stand table and compute a future stock table.

Items to Turn In for Assignment:

1. $\ln H = b_0 + b_1 (\text{dbh}^{-1})$ equation with fit statistics
2. $\text{Dbh}_{\text{ob}} = b_0 + b_1 (\text{dbh}_{\text{ib}})$ equation with fit statistics
3. $\text{Dbh}_{\text{growth}} = b_0 + b_1 (\text{dbh}_{\text{past}})$ equation with fit statistics
4. Table of sample trees showing dbh, height to 3", height to 6", CV3", CV6", Doyle6"
5. $\text{CV}_3 = b_0 + b_1 (\text{dbh}^2 H_0)$ equation with fit statistics
6. $\text{CV}_6 = b_0 + b_1 (\text{dbh}^2 H_0)$ equation with fit statistics
7. $\text{DoyleV}_6 = b_0 + b_1 (\text{dbh}^2 H_0)$ equation with fit statistics
8. $\text{DoyleV}_6 = b_0 + b_1 (\text{dbh}^2 H_6)$ equation with fit statistics
9. Current and Future Stand and Stock Table: showing number of trees and volume(cubic and Doyle) on per-acre basis for current and future stand in the format shown below>

		Current	Current	Current	10 yr.		Future	Future	Future
DBH	Hgt ₀	Trees	CV ₃	DBF ₆	Growth		Trees	CV ₃	DBF ₆
6									
7									
8									
Totals		Trees	CV ₃	DBF ₆			Trees	CV ₃	DBF ₆

Growth_data.xls

Tree#	dbh(ob)	Height	1x-Bark	1x-RG10
1	3.5	37.0	0.5	0.10
2	3.9	40.0	0.6	0.11
3	5.0	45.0	0.7	0.15
4	5.5	47.0	0.7	0.16
5	5.9	49.0	0.8	0.20
6	6.9	59.0	0.9	0.23
7	7.5	58.0	1.0	0.25
8	8.0	58.0	1.1	0.23
9	8.8	65.0	1.0	0.30
10	9.4	67.0	1.1	0.32
11	10.0	69.0	1.1	0.33
12	10.9	64.0	1.3	0.33
13	11.9	73.0	1.4	0.40
14	12.3	75.0	1.4	0.44
15	13.1	70.0	1.5	0.46
16	14.0	77.0	1.4	0.45
17	15.0	78.0	1.3	0.42
18	15.8	73.0	1.7	0.47
19	16.7	80.0	1.5	0.54
20	17.9	80.0	1.8	0.43
21	18.5	82.0	1.7	0.53
22	19.0	83.0	1.7	0.60
23	20.1	72.0	2.1	0.67
24	21.8	90.0	2.0	0.66
25	22.4	85.0	2.0	0.56

Felled_tree_data.xls

Tree 1
dbh 8.0
height 62.1

hi	dobi1x Bark	
0.5	10.0	0.9
4.5	8.0	0.6
8.5	7.5	0.6
16.5	6.8	0.5
24.5	6.1	0.5
32.5	5.4	0.4
40.5	4.6	0.3
48.5	3.4	0.2
56.5	1.6	0.1

Tree2
dbh 8.5
height 63.7

hi	dobi1x Bark	
0.5	10.5	0.9
4.5	8.5	0.7
8.5	8.0	0.6
16.5	7.2	0.6
24.5	6.5	0.5
32.5	5.9	0.4
40.5	5.0	0.4
48.5	3.8	0.3
56.5	2.1	0.1

Tree3
dbh 9.0
height 65.1

hi	dobi1x Bark	
0.5	11.1	0.9
4.5	9.0	0.7
8.5	8.5	0.2
16.5	7.6	0.2
24.5	7.0	0.1
32.5	6.3	0.1
40.5	5.4	0.1
48.5	4.2	0.1
56.5	2.5	0.0

Tree 4
dbh 9.5
height 66.3

hi	dobi1x Bark	
0.5	11.7	0.9
4.5	9.5	0.7
8.5	9.0	0.7
16.5	8.1	0.6
24.5	7.4	0.5
32.5	6.7	0.5
40.5	5.8	0.4
48.5	4.6	0.3
56.5	2.9	0.2

Tree5
dbh 10.0
height 65.1

hi	dobi1x Bark	
0.5	12.2	1.0
4.5	10.0	0.7
8.5	9.4	0.7
16.5	7.6	0.6
24.5	7.0	0.5
32.5	6.3	0.5
40.5	5.4	0.4
48.5	4.2	0.3
56.5	2.5	0.2

Tree6
dbh 10.5
height 66.3

hi	dobi1x Bark	
0.5	12.8	1.0
4.5	10.5	0.8
8.5	9.9	0.7
16.5	8.9	0.6
24.5	8.2	0.6
32.5	7.4	0.5
40.5	6.4	0.4
48.5	5.1	0.3
56.5	3.2	0.2
60.5	2.1	0.1

Tree 7
dbh 11.0
height 69.5

hi	dobi1x Bark	
0.5	13.4	1.0
4.5	11.0	0.8
8.5	10.4	0.7
16.5	9.4	0.7
24.5	8.6	0.6
32.5	7.9	0.5
40.5	7.0	0.5
48.5	5.8	0.4
56.5	4.1	0.2
64.5	1.8	0.1

Tree8
dbh 11.5
height 70.5

hi	dobi1x Bark	
0.5	13.9	1.0
4.5	11.5	0.8
8.5	10.9	0.8
16.5	9.9	0.7
24.5	9.0	0.6
32.5	8.3	0.6
40.5	7.3	0.5
48.5	6.1	0.4
56.5	4.5	0.3
64.5	2.2	0.1

Tree9
dbh 12.0
height 71.3

hi	dobi1x Bark	
0.5	14.5	1.0
4.5	12.0	0.9
8.5	11.4	0.4
16.5	10.3	0.3
24.5	9.5	0.3
32.5	8.7	0.3
40.5	7.7	0.2
48.5	6.5	0.2
56.5	4.8	0.1
64.5	2.5	0.0

Felled_tree_data.xls

Tree 10
dbh 12.5
height 72.1

hi	dobi1x Bark	
0.5	15.1	1.1
4.5	12.5	0.9
8.5	11.8	0.8
16.5	10.8	0.7
24.5	9.9	0.7
32.5	9.0	0.6
40.5	8.1	0.5
48.5	6.9	0.4
56.5	5.2	0.3
64.5	2.9	0.1

Tree11
dbh 13.0
height 71.3

hi	dobi1x Bark	
0.5	15.6	1.1
4.5	13.0	0.9
8.5	12.3	0.9
16.5	10.3	0.7
24.5	9.5	0.7
32.5	8.7	0.6
40.5	7.7	0.5
48.5	6.5	0.4
56.5	4.8	0.3
64.5	2.5	0.1

Tree12
dbh 13.5
height 72.1

hi	dobi1x Bark	
0.5	16.2	1.1
4.5	13.5	0.9
8.5	12.8	0.9
16.5	11.6	0.8
24.5	10.7	0.7
32.5	9.8	0.7
40.5	8.7	0.6
48.5	7.4	0.5
56.5	5.6	0.3
64.5	3.1	0.1
68.5	1.6	0.0

Tree 13
dbh 14.0
height 74.2

hi	dobi1x Bark	
0.5	16.7	1.1
4.5	14.0	1.0
8.5	13.3	0.9
16.5	12.1	0.8
24.5	11.1	0.7
32.5	10.2	0.7
40.5	9.2	0.6
48.5	7.9	0.5
56.5	6.2	0.4
64.5	3.9	0.2
68.5	2.4	0.1

Tree14
dbh 14.5
height 74.8

hi	dobi1x Bark	
0.5	17.3	1.2
4.5	14.5	1.0
8.5	13.7	0.9
16.5	12.5	0.8
24.5	11.5	0.8
32.5	10.6	0.7
40.5	9.6	0.6
48.5	8.3	0.5
56.5	6.5	0.4
64.5	4.2	0.2
68.5	2.7	0.1

Tree15
dbh 15.0
height 75.4

hi	dobi1x Bark	
0.5	17.9	1.2
4.5	15.0	1.0
8.5	14.2	1.0
16.5	13.0	0.9
24.5	12.0	0.8
32.5	11.0	0.7
40.5	10.0	0.6
48.5	8.6	0.5
56.5	6.9	0.4
64.5	4.5	0.2
72.5	1.4	0.0

Tree 16
dbh 15.5
height 75.9

hi	dobi1x Bark	
0.5	18.4	1.2
4.5	15.5	1.0
8.5	14.7	1.0
16.5	13.4	0.9
24.5	12.4	0.8
32.5	11.4	0.7
40.5	10.3	0.7
48.5	9.0	0.6
56.5	7.2	0.4
64.5	4.8	0.2
72.5	1.6	0.0

Tree17
dbh 16.0
height 75.4

hi	dobi1x Bark	
0.5	19.0	1.2
4.5	16.0	1.1
8.5	15.2	1.0
16.5	13.0	0.9
24.5	12.0	0.8
32.5	11.0	0.7
40.5	10.0	0.7
48.5	8.6	0.6
56.5	6.9	0.4
64.5	4.5	0.2
72.5	1.4	0.0

Tree18
dbh 16.5
height 75.9

hi	dobi1x Bark	
0.5	19.6	1.3
4.5	16.5	1.1
8.5	15.7	1.0
16.5	14.3	0.9
24.5	13.2	0.9
32.5	12.1	0.8
40.5	11.0	0.7
48.5	9.6	0.6
56.5	7.7	0.5
64.5	5.1	0.3
72.5	1.7	0.0

Felled_tree_data.xls

Tree 19
dbh 16.5
height 76.9

h_i	dob _i	1x Bark
0.5	19.6	1.3
4.5	16.5	1.1
8.5	15.7	1.0
16.5	14.3	0.9
24.5	13.2	0.9
32.5	12.2	0.8
40.5	11.1	0.7
48.5	9.7	0.6
56.5	7.9	0.5
64.5	5.4	0.3
72.5	2.2	0.0

Tree20
dbh 17.0
height 77.3

h_i	dob _i	1x Barkh
0.5	20.1	1.3
4.5	17.0	1.1
8.5	16.1	1.1
16.5	14.7	1.0
24.5	13.6	0.9
32.5	12.6	0.8
40.5	11.4	0.7
48.5	10.0	0.6
56.5	8.2	0.5
64.5	5.7	0.3
72.5	2.4	0.1

Tree21
dbh 17.5
height 77.8

h_i	dob _i	1x Bark
0.5	20.7	1.3
4.5	17.5	1.2
8.5	16.6	0.7
16.5	15.2	0.6
24.5	14.0	0.5
32.5	13.0	0.5
40.5	11.8	0.4
48.5	10.4	0.4
56.5	8.5	0.3
64.5	6.0	0.2
72.5	2.7	0.0

Tree 22
dbh 18.0
height 78.2

h_i	dob _i	1x Bark
0.5	21.3	1.3
4.5	18.0	1.2
8.5	17.1	1.1
16.5	15.6	1.0
24.5	14.4	0.9
32.5	13.4	0.8
40.5	12.2	0.8
48.5	10.7	0.7
56.5	8.8	0.5
64.5	6.3	0.3
72.5	3.0	0.1

Tree23
dbh 18.5
height 77.8

h_i	dob _i	1x Bark
0.5	21.8	1.4
4.5	18.5	1.2
8.5	17.6	1.1
16.5	15.2	1.0
24.5	14.0	0.9
32.5	13.0	0.8
40.5	11.8	0.8
48.5	10.4	0.7
56.5	8.5	0.5
64.5	6.0	0.3
72.5	2.7	0.1
76.5	0.7	-0.1

Tree24
dbh 19.0
height 78.2

h_i	dob _i	1x Bark
0.5	22.4	1.4
4.5	19.0	1.2
8.5	18.1	1.2
16.5	16.5	1.1
24.5	15.2	1.0
32.5	14.1	0.9
40.5	12.9	0.8
48.5	11.3	0.7
56.5	9.3	0.5
64.5	6.7	0.3
72.5	3.1	0.1
76.5	1.0	-0.1

Stand_table.xls

DBH	Trees/ac
6	10
7	15
8	20
9	25
10	30
11	30
12	15
13	16
14	10
15	7
16	4
17	5
18	6
19	3
20	4
Total	200