

**Protocols for Random Sampling Municipal Tree Inventories for Growth Curve Data  
December 1, 2004**

Refer to Madrone D:/Anchorage/Anchorageinventory.xls as an example for pulling data and Madrone D:/Anchorage/samplepulled.xls as example of final data, pulled, sorted and randomly selected for sampling in field.

1. Obtain database from city and place into Excel workbook.
  - 1a. You may need to add a 4-letter (ACSA) code or 4 letter and one numeric (ACSA1) code for each species in the database if not present. The alpha + numeric is used when more than one tree type shares the same genus and species code, e.g. sugar maple ACSA and silver maple ACSA1.
2. Sort entire database by dbh or dbh class depending upon how city has entered dbh data.
3. If sorted by dbh because dbh class column does not exist in database, you will need to add dbh class and associated numbers in a new column.

Insert new column, title it "dbhclass"

4. Assign classes as follows, according to actual dbh:

If DBH is:	assign DBHclass:
0-2.9	1
3-5.9	2
6-11.9	3
12-17.9	4
18-23.9	5
24-29.9	6
30-35.9	7
36-41.9	8
42 +	9

5. Sort database by 1) species and 2) dbh
6. Make a pivot table in Excel as shown:

Table 1

Count of DBHClass	DBHClass								Grand Total
Sp. Code	1.0	2.0	3.0	4.0	5.0	6.0	7.0		
ACGI	10								10
BE	545	260	68	7	4	4	1		889
BENI	5	1							6
BEPA	147	178	24	13	3	1			366
BEPECU	19	8							27
BEPO	16	12							28
FR	46	97	4						147
FRPE	4								4
LASI	4								4
MA	171	190	8	1					370
MAPU	4								4
OTHER	1								1
PI1	488	176	53	4	2				723
PI2	10	81	4					1	96
PIGL	432	1603	191	5	2	2	1		2236
PIGLDE	96	532	4	1	3	1			637
PIMU	2	1							3
PIPU	132	86	5						223
PIPUGL	5	58	18						81
PISY			2						2
PO	118	13	6	5	3	3	1		149
POGR		3							3
POTR1	10	29	1	1					41
POTR2		1							1
PR	209	599	49	2					859
PRMA	137	240	8	1					386
PRPACO	64	176	8						248
PRVI	225	138	8						371
PRVISH	34								34
RO		1							1
SA	22	10	4	1	1				38
SOAU	479	661	23	1		1			1165
STUMP	92								92
Grand Total	3527	5154	488	42	18	12	4		9245

7. Make a copy of the pivot table on same page, then sort this new table by Grand Totals in descending order and add botanic names and % of total sample as shown.

Table 2

	Count of DBHClass	DBHClass									% of
	Sp. Code	1.0	2.0	3.0	4.0	5.0	6.0	7.0	Grand Total	inventory	
Picea glauca	PIGL	432	1603	191	5	2		1	2236		24.19%
Sorbus aucuparia	SOAU	479	661	23	1		1		1165		12.60%
Betula sp.	BE	545	260	68	7	4	4	1	889		9.62%
Prunus sp.	PR	209	599	49	2				859		9.29%
Picea other	PI1	488	176	53	4	2			723		7.82%
Picea glauca 'Densata'	PIGLDE	96	532	4	1	3	1		637		6.89%
Prunus maackii	PRMA	137	240	8	1				386		4.18%
P. virginiana	PRVI	225	138	8					371		4.01%
Malus sp.	MA	171	190	8	1				370		4.00%
Betula papyrifera	BEPA	147	178	24	13	3	1		366		3.96%
P. padus v. commutata	PRPACO	64	176	8					248		2.68%
Picea pungens	PIPU	132	86	5					223		2.41%
Populus sp.	PO	118	13	6	5	3	3	1	149		1.61%
Fraxinus sp.	FR	46	97	4					147		1.59%
Pinus other	PI2	10	81	4				1	96		1.04%
Stumps	STUMP	92							92		1.00%
Picea pungens 'Glauc'	PIPUGL	5	58	18					81		0.88%
Populus tremuloides	POTR1	10	29	1	1				41		0.44%
Salix sp.	SA	22	10	4	1	1			38		0.41%
P. virginiana	PRVISH	34							34		0.37%
Betula populifolia	BEPO	16	12						28		0.30%
Betula pendula	BEPECU	19	8						27		0.29%
Acer ginnala	ACGI	10							10		0.11%
Betula nigra	BENI	5	1						6		0.06%
Fraxinus pennsylvanica	FRPE	4							4		0.04%
Larix sibirica	LASI	4							4		0.04%
Malus purpurea	MAPU	4							4		0.04%
Pinus mugo	PIMU	2	1						3		0.03%
Populus grandidentata	POGR		3						3		0.03%
Pinus sylvestris	PISY			2					2		0.02%
Other	OTHER	1							1		0.01%
Populus trichocarpa	POTR2		1						1		0.01%
Rosa sp.	RO		1						1		0.01%
	Grand Total	3527	5154	488	42	18	12	4	9245		100.00%

8. With Principal Investigator for study (Scott, Greg, Paula), use the above chart to select the species that will be used for their study.

9. Cut and paste all representatives of those species (usually 10 to 25 species) onto new worksheet pages in same workbook ( 1 species per page).

Label each page with the 4-6 letter species code (e.g., SOAU for Sorbus aucuparia).

10. Sort the species on each page by

1) DBHclass 2) Street 3)Address (numeric)

11. Make pivot table for each page as shown:

Table 3

DBH Class	Count of DBH Class		Sp. Code
	SOAU	Grand Total	
1.0	479	479	
2.0	661	661	
3.0	23	23	
4.0	1	1	
5.0	1	1	
Grand Total	1165	1165	

12. Check grand total for each individual species pivot table against the master pivot table on the first page of your inventory to make sure they match. If they don't, you did not copy all of the species from the master inventory onto the individual species pages correctly. Re-sort your master inventory and re-paste the species onto the page. Then repeat 10 and 11 above.

13. You must now determine how many trees in each size class to randomly select. Make the table as shown below (by hand, not pivot):

Table 4.

A Class	B #to select	C Totals
	1	
	2	
	3	
	4	
	5	

a. in the Class column, enter the number of classes that showed in the prior table (Table 3)

b. In each cell of the Totals column, write a macro so that B1 through B5 cells are cumulatively added.

Entry in C1 would be +B1

Entry in C2 would be =SUM(B1..B2)

Entry in C3 would be =SUM(B1..B3) etc.

Since you are selecting 70 trees total, you will want the last cell in C to total 70 after you have decided and entered how many trees you will sample in column B

c. Now look at Table 3 and note that Classes 5 and 6 have only one tree each.

Enter this number in Table 4 in B4 and B5 as follows:

Table 4a.

A	B	C
Class	# to select	Totals
1		
2		
3		
4	1	1
5	1	2

d. You will see C4 and C5 change accordingly, if you're macro is correct. C5 shows you have a total of 2 trees in your sample so far. That leaves 68 more to divide among the remaining 3 size classes. However, Class 3 only has 23 trees in it, so enter all of those in Table 4's cell B3 and you should see the following:

Table 4b.

A	B	C
Class	# to select	Totals
1		
2		
3	23	23
4	1	24
5	1	25

e. Now C5 totals 25 trees. Since  $70 - 25 = 45$ , you must divide the remaining 45 among Class 1 and 2. Place 22 in B1 and 23 in B2. **\* Always put the larger of the two numbers in the larger class size.** Now your chart should look like this:

Table 4c.

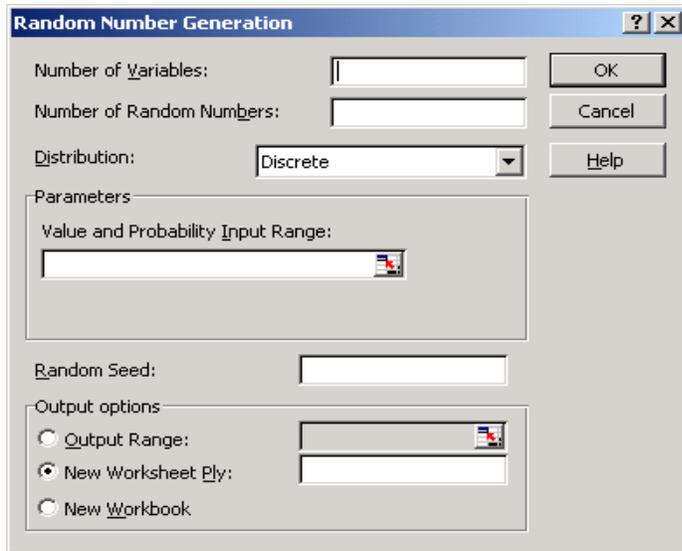
A	B	C
Class	# to select	Totals
1	22	22
2	23	45
3	23	68
4	1	69
5	1	70

14. Repeat #13 for every species page.

15. On each species page, add a last column and title it “RandomNo.”

16. Now go back to your first species page and start generating random numbers in the RandomNo. Column (1 number for each tree—each tree=1row) as follows:

Select Tools>Data analysis> Random Number Generation to obtain the following menu:



Enter the following:

Number of Variables: 1

Number of Random Numbers: this should equal the number of trees on your species page

Distribution: Uniform

Parameters: 0 and 1 ( this will automatically be entered when you select Uniform Distribution

Random Seed: leave blank

Output Range: Select this, then click the cell reference icon next to it and then select the cells in your random number column where you want numbers generated

Click OK.

17. Repeat #15 for every species page.

18. After generating random numbers for every species return to first species and  
 a. select all rows and columns with data in them including RandomNo. But EXCLUDING column titles.

- b. Sort the page by 1) dbhclass 2) randomNo. In ASCENDING order
- c. Do the above for every species

19. Create a new Excel workbook title "<cityname>samplepulled.xls". With both workbooks open select Window>Arrange>Horizontal so you can see both work books.

You will now begin creating your field sampling data listings.

20. In new workbook label each page with a species code: for Sorbus aucuparia = SOAU

21. Then after all of these pages insert and name replacement tree pages, e.g. "SOAU replacement"

See the Anchorageinventory.xls for an example.

22. In both workbooks select the worksheet for your first species.
23. In the inventory workbook look at the table you created (Table 4 c). You will now copy and paste the number of trees you need for each dbhclass into your <cityname>pulledsample.xls file. Original inventory shows:

Address	Street	FLD003	District	FLD006	TreeNo	Sp_Code	Mtce	Caliper	DBHClass	Condition	FLD018	FLD997	Inv.Tree#	random#
0	SPENARD RD	TRUE	1	SPENARD	28.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	7235	6344	0.000977
0	ARCTIC BLVD	TRUE	1	SPENARD	3.0	SOAU	ROUTINE PR	2.5	1.0	G	5/3/97	7257	4887	0.001251
0	SPENARD RD	TRUE	1	SPENARD	514.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	7235	6471	0.002838
0	5TH AV W	TRUE	1	DOWNTOWN	1.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	7270	8965	0.004334
0	SPENARD RD	TRUE	1	SPENARD	78.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	7235	6361	0.005707
0	SPENARD RD	TRUE	1	SPENARD	22.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	7235	6338	0.013794
0	INTL AIRPORT RD W	TRUE	1	SPENARD	2.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	7297	7238	0.019135
0	PROVIDENCE DR	TRUE	6	BAYSHORE KLATT	147.0	SOAU	ROUTINE PR	2.5	1.0	G	5/3/97	7288	4773	0.019868
0	INTL AIRPORT RD W	TRUE	1	SPENARD	199.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	7293	8559	0.020356
0	4TH AV W	TRUE	1	DOWNTOWN	2.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	1444	9207	0.021882
0	LAKE OTIS PKWY	TRUE	1	UNIVERSITY AREA	103.5	SOAU	ROUTINE PR	2.0	1.0	G	4/29/97	7244	1858	0.022187
4800	OLD SEWARD HWY	FALSE	1	SPENARD	38.0	SOAU	ROUTINE PR	1.5	1.0	G	5/3/97	7264	4133	0.02298
0	A ST	TRUE	1	FAIRVIEW	2.0	SOAU	ROUTINE PR	1.0	1.0	G	5/3/97	1812	3366	0.024293
0	INTL AIRPORT RD W	TRUE	1	SPENARD	68.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	7291	8186	0.02588
0	INTL AIRPORT RD W	TRUE	1	SPENARD	366.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	7293	8576	0.029328
0	SPENARD RD	TRUE	1	SPENARD	501.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	7235	6458	0.031983
0	E ST	TRUE	1	DOWNTOWN	11.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	3385	9146	0.033479
0	ARCTIC BLVD	TRUE	1	SPENARD	18.0	SOAU	ROUTINE PR	2.5	1.0	G	5/3/97	7258	5006	0.0347
0	INTL AIRPORT RD W	TRUE	1	SPENARD	8.0	SOAU	ROUTINE PR	2.0	1.0	D	5/5/97	7291	8208	0.03473
0	4TH AV W	TRUE	1	DOWNTOWN	11.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	1452	9239	0.038759
0	LAKE OTIS PKWY	TRUE	1	UNIVERSITY AREA	357.0	SOAU	ROUTINE PR	2.0	1.0	G	4/29/97	7238	2561	0.040864
0	ARCTIC BLVD	TRUE	1	SPENARD	107.0	SOAU	ROUTINE PR	2.5	1.0	D	5/3/97	7258	4908	0.043855
0	SPENARD RD	TRUE	1	SPENARD	114.0	SOAU	ROUTINE PR	1.5	1.0	G	5/5/97	7235	6388	0.044069
0	SPENARD RD	TRUE	1	SPENARD	93.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	7235	6376	0.046754
0	SPENARD RD	TRUE	1	SPENARD	102.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	7235	6382	0.048128
0	E ST	TRUE	1	DOWNTOWN	12.0	SOAU	ROUTINE PR	2.5	1.0	G	5/5/97	3385	9147	0.048555
0	LAKE OTIS PKWY	TRUE	1	UNIVERSITY AREA	187.0	SOAU	ROUTINE PR	2.0	1.0	G	4/29/97	7238	2397	0.049654
0	INTL AIRPORT RD W	TRUE	1	SPENARD	103.0	SOAU	ROUTINE PR	2.0	1.0	G	5/5/97	7291	8189	0.050142
0	INTL AIRPORT RD W	TRUE	1	SPENARD	118.0	SOAU	REMOVE	2.0	1.0	D	5/5/97	7292	8238	0.050356

You need, according to Table 4, to select 22 trees (rows) for dbhclass 1. Select the top 22 rows, copy, then paste into samplepulled.xls species page

24. For dbhclass 2 select and paste the top 23 rows of dbhclass 2 trees, for class 3 choose the top 23 class 3 trees; for class 4 there is only one tree, so select it; class 5 also has only one tree. IN ORIGINAL DATABASE MAKE SURE YOU HIGHLIGHT THE TREES YOU HAVE SELECTED AND PASTED INTO THE FINAL SAMPLE SO THAT YOU DO NOT RESELECT THEM AGAIN IF YOU NEED ADDITIONAL TREES.

25. Select and paste the sample for all species as described in 23 through 25 above.

26. For replacement tree lists, use the same selection and pasting procedure and highlight the original inventory with a different color to denote the trees already placed on replacement lists. SELECT 10 REPLACEMENT TREES FOR EACH DBH CLASS.

27. In the pulledsample.xls workbook, sort each page by street>address>tree no.

28. Also make one new worksheet and for field use, cut and paste all individual page data onto this page. After compiling, sort this page by street>address>tree no., so you can have a list that helps you drive and walk from tree to tree in the field most efficiently.