

An Analysis of Vegetation Data from Permanent Plots on Hopewell Furnace National Historic Site

Hopewell Furnace National Historic Site preserves nearly all elements of the charcoal iron furnace activity that was common throughout Pennsylvania during the late-1700's and early- to mid-1800's. The site is presently heavily forested despite the past disturbance history. The four major forest types on the site include mixed oak-black birch; chestnut oak-scarlet oak-black oak; tulip poplar-oak; and tulip poplar-red maple. In 1988, 20 permanent vegetation plots were established for the long term monitoring of changes in overstory and understory composition and structure as well as the existing edaphic features. These plots were surveyed one time between 1988-1990. The objectives of this consulting agreement are as follows:

1. Evaluate the suitability of the forms used for data collection.
2. Evaluate the appropriate section of the vegetation monitoring manual (by Dr. E. W. B. Russell) to determine if all data summary recommendations are complete and necessary.
3. Determine if the number of plots in each vegetation type are adequate for statistically meaningful comparisons on a spatial and temporal scale.
4. Summarize and analyze all edaphic and vegetation data collected between 1988-90 as outlined in Dr. Russell's manual vis-a-vis objective 2.

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Final report concerning the analysis of vegetation data from permanent plots at Hopewell Furnace National Historic Site.

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Objective 1. In general the forms used for recording data in the field are fine. My only recommendation for improvement is to indicate plot size or transect length used for each type of data collection. For example it took me some time to figure out the transect length used to characterize shrub cover. In addition, there may be times when the plot size used will vary from that recommended in the manual and therefore should be included at all times.

Objective 2. I think the data summary portion of the manual by Dr. Russell is perfectly adequate. As you can see from the size of this report the analysis is very thorough, yet I do not think that the recommended analyses are unnecessarily thorough. Indeed, certain parks or scientists may want even more detail on plot-to-plot variation than that which was included here. Nonetheless, I think this report can serve as an example of a reasonable level of analysis of the vegetation data. It should be noted, however, that when rating species cover in plots into cover classes that the cover class mid-point be used for analysis. I don't believe that this was mentioned in the manual.

Objective 3. I recommend that herb cover data be collected as recommended in the manual. Rather than trying to guess the exact cover of a species the investigator should rate each species in a plot into one of the cover classes noted in the manual. The reason that cover classes were established was to minimize errors that were ubiquitous with trying to estimate the exact species cover. If a park is very concerned with the accuracy of cover estimates for a species group then it could adopt the line intercept method as used for shrub cover at Hopewell Furnace. I converted all individual cover values to a cover class mid-point before analyzing the data (see above).

Recommendations for future work on vegetation data at Hopewell Furnace.

1. Calculate variances among plots within each vegetation type for each plant group to determine if sampling intensity is adequate for meaningful statistical analyses on a spatial and temporal scale.
2. After completing objective 1 visit the Hopewell Furnace park to study existing plot placement and, if necessary, determine where additional plots should be located.
3. Interpret the results of this data analysis in an ecologically meaningful way. For example, describe the edaphic-vegetation relationships, successional tendencies from overstory-understory relationships, and list any rare and endangered or exotic plants at the park with their habitat conditions.
4. The summary of data included in this report was very time consuming even for an experienced ecologist. I think it would be wise for the National Park Service to develop a computer program and instruction manual to augment the database data entry program to conduct the analyses included here.

Table summary for Hopewell Furnace Vegetation Data. The organization and procedure for each table is clearly explained in the methods manual.

Tables 1 and 2. Summary of edaphic features, human activity and canopy cover by forest type.

Tables 3-6. Diameter distribution into five inch classes of tree species by forest type.

Tables 7-10. Number of tree species, importance value calculation and Shannon Index of Diversity by forest type.

Table 11. Importance values data by species and plot.

Tables 12-15. Sapling data by species and plot and the community summary for each forest type.

Tables 16-19. Seedling data by species and plot and the community summary for each forest type.

Table 20. Sorensen's Index of Similarity comparison for overstory trees and understory seedlings plus saplings by forest type.

Tables 21-24. Shrub data by species and plot and the community summary for each forest type. In the community summary, the intercepted distance is the total across all inclusive plots. The percent cover data is computed by dividing the individual intercepted distance data by the summed length of the cover transects (i.e., 20 m times the number of plots in the community). Relative cover is then derived from the percent cover data.

Tables 25-28. Herb data by species and plot and the community summary for each cover type. Total mean cover is the sum across all inclusive plots. Mean plot cover is derived by dividing the individual total mean cover values by the number of plots in the community. Relative cover is then derived from the mean plot cover data.

Table 1. Edaphic features (mean $\pm$ standard error) of four stand types with permanent vegetation plots at Hopewell Furnace National Historic Site.

Stand Type	Number of plots	Elevation (m)	Slope (deg)	Dominant Aspect	Slope Position	Hydrologic ^A Feature	Geologic ^B Substrate	Soil Type
Mixed oak - black birch	7	591 $\pm$ 86	7.9 $\pm$ 1.8	S	ridge-foot	2,3	3,4	sandy loam
Mixed oak	5	190 $\pm$ 5	9.6 $\pm$ 2.4	E	ridge-foot	5	2,5,6	sandy loam
Tulip poplar-oak	6	500 $\pm$ 61	6.8 $\pm$ 1.2	SE	midslope - depression	1,5	3	sand, silt loam
Tulip poplar - red maple	2	165 $\pm$ 0	9.0 $\pm$ 0.7	NE	midslope	5	5,6	silty loam

A. 1 = perennial stream, 2 = ephemeral stream, 3 = spring, 4 = depression, 5 = none

B. 1 = diabase, 2 = gaboro, 3 = sandstone, 4 = conglomerate, 5 = quartzite, 6 = quartizite conglomerate

C. 1 = fine, 2 = medium, 3 = coarse

Table 1. Continued.

Stand Type	Soil ^C Texture	Soil Name	Litter Depth (cm)	A Horizon Depth (cm)
Mixed oak-black birch	2	Lewisburry	9.6 $\pm$ 1.9	21.6 $\pm$ 2.0
Mixed oak	1,3	Edgemont	5.2 $\pm$ 1.5	12.4 $\pm$ 1.7
Tulip poplar oak	2	Lewisberry, Penn	9.2 $\pm$ 2.1	19.0 $\pm$ 3.2
Tulip poplar-red maple	1,2	Glenleg, Neshaming	4.0 $\pm$ 0	18.0 $\pm$ 1.4

Table 2. Human activity and canopy features of four stand types at Hopewell Furnace.

Stand Type	Logging	Agriculture	Pits	Stonewalls	Road	Charcoal Pits	Canopy Cover (%)
Mixed oak - black birch	no	no	no	no	some	no	80.9 $\pm$ 2.1
Mixed oak	yes	no	yes	no	some	some	81.7 $\pm$ 3.0
Tulip poplar - oak	yes	no	no	yes	some	some	83.8 $\pm$ 2.4
Tulip poplar - red maple	some	yes	no	no	no	no	81.8 $\pm$ 3.8

Table 3. Diameter distribution (cm) from plot totals for tree species in mixed oak - black birch forests in Hopewell Furnac

Species	5<10	10<15	15<20	20<25	25<30	30<35	35<40	40<45	45<50	50<55	55<60	60<65	65<70	70<75	75<80	80<90	85<9
Betlen	13	3	7	4		1		2	1					1			
Viblen	3																
Corflo	3	1															
Acerub	7	6	6	1		1											
Nyssyl	20	6	2	2	1												
Quepri	1	1	1			1											
Quecoc					3			2	2	3	3		1				1
Cargla			1	1													
Cartom	1		2	1													
Lirtul	2	2	2	1	1		1	1	2	1		1					
Querub					1					1							
Quealb						1								1			
Quevel					1				1								
Faggra	3	2		1	2												
Carova	2	1					1										
Sasalb	3	1															
Acesac			1														
Carcar	1																
Unknown				1													
Total	59	23	22	12	9	4	2	5	6	5	3	2	1	1	0	0	1

Table 4. Diameter distribution (cm) from plot totals for tree species in mixed oak forests in Hopewell Furnace.

Species	5<10	10<15	15<20	20<25	25<30	30<35	35<40	40<45	45<50	50<55	55<60	60<65	65<70
Lirtul		1	1				1	2					
Acrrub	19	13	5		1								
Nyssyl	25	5	2										
Corflo	29												
Carova	2		1			1							
Quepri	4	5	6	8	3	1	4	2					
Betlen	1												
Quecoc		1	5	4	8	4	2						
Amecan	2												
Sasalb	5	3	1										
Casden	1												
Cargla	3	1		1									
Popgra		1	3	7	8	1	1						
Quevel		2	2	1	2			1					1
Quealb				1									
Cartom	4	1											
Unknown	1												
Total	96	33	26	22	22	7	8	5					1

Table 5. Diameter distribution (cm) from plot totals for tree species in tulip poplar-oak forests in Hopewell Furnace.

Species	5<10	10<15	15<20	20<25	25<30	30<35	35<40	40<45	45<50	50<55	55<60	60<65	65<70	70<75	75<80	80<85
Nyssyl	15	5	4	1	1											
Betlen	7	6	3	1	3	2										
Acerub	12	5	3								1					
Corflo	18	2														
Quealb		1	1		1		1	1			1		1			1
Lirtul	3	10	7		1	2	1		2				1			
Carasp.	2															
Cartom	1			1												
Quecoc								1		2	1					
Sasalb	2	1														
Quevel					1	1			1	3						
Carlac			1		1				1							
Carova				1												
Cargla						1										
Querub			1							2						
Unknown	1															
Total	61	30	20	4	8	6	2	2	4	7	3		2			1

Table 6. Diameter distribution (cm) from plot totals for tree species in tulip poplar-red maple forests in Hopewell Furnace

Species	5<10	10<15	15<20	20<25	25<30	30<35	35<40	40<45	45<50
Acerub	8	2	3	2	2		1		
Lirtul	3	4	2	2	7	10	4		1
Nyssyl		3	1						
Pruser	2	4	1	1	1				
Corflo	3	1	1						
Ulmame	1			1					
Sasalb	1								
Junvir		1							
Pinsp.				1					
Total	18	15	8	7	10	10	5		1

Table 7. Summary of tree data for mixed oak-black birch forests at Hopewell Furnace.

1. Number of species

plot 9 = 9
 12 = 6
 13 = 7
 14 = 11

plot 15 = 9
 16 = 8
 17 = 6
 Total = 19

2. Community importance value data

Species	Freq.	Rel. Freq.	Density	Rel. Density	Dom.	Rel. Dom.	IV
Betlen	100.0	12.7	4.57	20.6	4.83	16.5	19
Viblen	14.3	1.8	0.43	1.9	.02	0.1	1
Corflo	28.6	3.6	0.57	2.6	.06	0.2	1
Acerub	85.7	10.9	3.00	13.5	1.24	4.3	9
Nyssyl	85.7	10.9	4.43	20.0	1.14	3.9	12
Quepri	28.6	3.6	0.57	2.6	.44	1.5	2
Quecoc	71.4	9.1	2.14	9.7	11.47	39.3	24
Cargla	28.6	3.6	0.43	1.9	.31	1.1	2
Cartom	42.9	5.5	0.43	1.9	.23	0.8	1
Lirtul	42.9	5.5	2.00	9.0	4.56	15.7	12
Querub	28.6	3.6	0.14	0.6	.90	3.1	2
Quealb	28.6	3.6	0.43	1.9	1.53	5.2	4
Unknown	14.3	1.8	0.14	0.6	.18	0.6	1
Quevel	28.6	3.6	0.29	1.3	.90	3.1	2
Faggra	28.6	3.6	1.14	5.2	.76	2.6	4
Carova	42.9	5.5	0.57	2.6	.45	1.6	2
Sasalb	57.1	7.3	0.57	2.6	.07	0.2	1
Acesac	14.3	1.8	0.14	0.6	.08	0.3	.7
Carcar	14.3	1.8	0.14	0.6	.01	0.0	.3

3. Shannon Index of diversity = .984

Table 8. Summary of tree data for mixed oak forests at Hopewell Furnace.

1. Number of species

plot 1 = 8
5 = 5
6 = 6

plot 7 = 11
8 = 7
Total = 17

2. Community importance value data

Species	Freq.	Rel. Freq.	Density	Rel. Density	Dom.	Rel. Dom.	IV
Lirtul	20	2.7	1.00	2.3	2.01	6.7	5
Acerub	80	10.8	7.40	17.0	1.88	6.3	12
Nyssyl	60	8.1	6.60	15.1	1.11	3.7	9
Corflo	60	8.1	5.40	12.4	.51	1.7	7
Carova	40	5.4	0.80	1.8	.54	1.8	2
Quepri	80	10.8	6.60	15.1	7.63	25.5	20
Betlen	20	2.7	0.20	0.5	.02	0.1	.2
Quecoc	80	10.8	4.80	11.0	6.57	22.0	17
Sasalb	80	10.8	1.80	4.1	.35	1.2	3
Casden	20	2.7	0.20	0.5	.02	0.1	.3
Cargla	40	5.4	1.00	2.3	.28	1.0	2
Unknown	20	2.7	0.20	0.5	.01	0.0	.2
Amecan	20	2.7	0.40	0.9	.03	0.1	1
Popgra	40	5.4	4.20	9.6	4.89	16.4	13
Quevel	40	5.4	1.80	4.1	3.61	12.1	8
Quealb	20	2.7	0.20	0.5	.20	0.7	1
Cartom	20	2.7	1.00	2.3	.17	0.6	1

3. Shannon Index of diversity = 1.00

Table 9. Summary of tree data for tulip poplar-oak forests at Hopewell Furnace.

1. Number of species

plot 2 = 7
 10 = 7
 11 = 7

plot 18 = 8
 19 = 5
 20 = 10
 Total = 16

2. Community importance value data

Species	Freq.	Rel. Freq.	Density	Rel. Density	Dom.	Rel. Dom.	IV
Nyssyl	100	13.6	4.50	17.9	1.37	4.8	11
Betlen	100	13.6	4.17	16.6	2.39	8.3	12
Acerub	100	13.6	3.00	11.9	1.66	5.8	9
Corflo	83.3	11.4	3.33	13.2	.34	1.2	7
Quealb	50	6.8	1.33	5.3	6.12	21.4	13
Lirtul	83.3	11.4	4.50	17.9	5.59	19.5	19
Carsp	16.7	2.3	0.33	1.3	.03	0.1	1
Cartom	16.7	2.3	0.33	1.3	.20	0.7	1
Quecoc	16.7	2.3	0.67	2.6	3.33	11.6	7
Sasalb	33.3	4.5	0.50	2.0	.11	0.4	1
Quevel	33.3	4.5	1.00	4.0	4.16	14.5	9
Carlac	33.3	4.5	0.50	2.0	1.02	3.6	3
Unknown	16.7	2.3	0.17	0.7	.02	0.1	.4
Querub	16.7	2.3	0.50	2.0	1.89	6.6	4
Carova	16.7	2.3	0.17	0.7	.15	0.5	1
Cargla	16.7	2.3	0.17	0.7	.29	1.0	1

3. Shannon Index of diversity = 1.03

Table 10. Summary of tree data for tulip poplar-red maple forests at Hopewell Furnace.

1. Number of species

plot 3 = 5
 4 = 9
 Total = 9

2. Community importance value data

Species	Freq.	Rel. Freq.	Density	Rel. Density	Dom.	Rel. Dom.	IV
Acerub	100	14.3	6.00	24.3	5.3	14.8	20
Lirtul	100	14.3	11.00	44.6	25.7	71.7	58
Nyssyl	100	14.3	1.33	5.4	.7	2.0	4
Pruser	100	14.3	2.33	9.5	2.2	6.2	8
Corflo	100	14.3	2.33	9.5	.6	1.6	6
Ulmame	50	7.1	0.67	2.7	.5	1.5	2
Sasalb	50	7.1	0.33	1.4	.1	0.2	1
Junvir	50	7.1	0.33	1.4	.1	0.4	1
Pinsp	50	7.1	0.33	1.4	.5	1.5	1

3. Shannon Index of diversity = .582

Table 11. Importance value data by species and plot at Hopewell Furnace.

* = value < .5. IV = rel. density + rel. dom.

Species	Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Lirtul	density	28	11	63	34							20	46		15	12			18	35	23
	dom	48	22	77	66							37	56		8	8			24	27	7
	IV	38	16	70	50							28	51		11	10			21	31	15
Acerub	density	11	21	19	28	8	43	32		8	13	7	13	21	22	8		16	12	4	13
	dom	3	3	15	14	4	16	11		10	2	3	1	7	8	2		5	1	29	4
	IV	7	12	17	21	6	29	22		9	8	5	7	14	15	5		11	6	17	9
Nyssyl	density	22	18	4	6	41		5		36	17	33		17	26	15	15	20	12	9	13
	dom	6	3	1	4	12		1		11	3	11		9	9	1	1	3	1	8	5
	IV	14	11	2	5	27		3		24	10	22		13	18	8	8	11	6	8	9
Corflo	density	6	21	7	11			4	44	8	26	13					15		18		3
	dom	*	2	*	3			*	6	1	3	1					1		2		*
	IV	3	11	4	7			2	25	5	14	7					8		10		2
Carova	density	11						4							4	8	8				3
	dom	12						*							9	*	2				2
	IV	12						2							6	4	5				3
Quepri	density	11				32	36	2		8				8							
	dom	17				38	80	1		1				18							
	IV	14				35	58	1		5				13							
Betlen	density	6	7							8	9	10	20	37	11	23	31	20	6	48	20
	dom	*	2							2	1	2	24	13	1	4	89	19	7	36	9
	IV	3	4							5	5	6	22	25	6	14	60	19	6	42	15
Quecoc	density	6				18		16	6	12	17			8	4	23		12			
	dom	13				46		32	16	68	84			32	21	80		56			
	IV	9				32		24	11	40	51			20	12	51		34			

Table 11. Continued.

[illegible]

Table 11. Continued.

Species	Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cargla	density dom IV						4 3 3		7 1 4	4 2 3					4 3 3		8 5 6				3 5 4
Unknown	density dom IV						4 * 2						7 3 5						6 * 3		
Amecan	density dom IV							4 * 2													
Popgra	density dom IV							16 37 27	22 35 29												
Quevel	density dom IV							7 9 8	9 39 24			13 45 29		4 11 8	4 15 9						7 34 20
Cartom	density dom IV								9 2 6	4 2 3	9 5 7				4 3 4		8 1 4				
Viblen	density dom IV									12 1 6											
Querub	density dom IV												7 14 10								10 32 21
Faggra	density dom IV													4 10 7				28 16 22			

Table 11. Continued.

Species	Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Acesac	density dom IV															4 1 2					
Carcar	density dom IV																8 1 4				
Carlac	density dom IV																		12 18 15	3 2 2	

Table 12. Sapling data for mixed oak-black birch forests at Hopewell Furnace.

Plot #	Species	Number of Saplings (Σ Subplots)	Plot #	Species	Number of Saplings (Σ Subplots)
9	Nyssyl	2	14	Acerub	2
	Viblen	11		Betlen	3
	Acerub	2		Sasalb	1
	Corflo	10	15	Betlen	4
	Vibace	4		Carova	2
12	Acerub	11		Pruvir	1
	Betlen	5	16	Sasalb	1
	Quepri	1		Carsp	1
13	Acerub	1		Nyssyl	3
	Lirtul	10	17	Cartom	1
	Nyssyl	2		Faggra	1
	Betlen	1		Lirtul	1
	Sasalb	1		Nyssyl	1

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Nyssyl	4	57.1	15.4	1.14	9.6
Viblen	1	14.3	3.8	1.57	13.3
Acerub	4	57.1	15.4	2.29	19.3
Corflo	1	14.3	3.8	1.43	12.0
Vibace	1	14.3	3.8	0.57	4.8
Betlen	4	57.1	15.4	1.86	15.7
Quepri	1	14.3	3.8	0.14	1.2
Lirtul	2	28.6	7.7	1.57	13.3
Sasalb	3	42.9	11.5	0.43	3.6
Carova	1	14.3	3.8	0.29	2.4
Pruvir	1	14.3	3.8	0.14	1.2
Carsp	1	14.3	3.8	0.14	1.2
Cartom	1	14.3	3.8	0.14	1.2
Faggra	1	14.3	3.8	0.14	1.2
Total	26			11.85	

Table 13. Sapling data for mixed oak forests at Hopewell Furnace.

Plot #	Species	Number of Saplings (Σ Subplots)			
1	---	--			
5	Nyssyl	3			
6	Casden	2			
7	Nyssyl	1			
	Acerub	1			
8	Corflo	1			

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Nyssyl	2	40	40	0.80	50.0
Casden	1	20	20	0.40	25.0
Acerub	1	20	20	0.20	12.5
Corflo	<u>1</u>	20	20	<u>0.20</u>	12.5
Total	5			1.60	

Table 14. Sapling data for mixed tulip poplar-oak forests at Hopewell Furnace.

Plot #	Species	Number of Saplings (Σ Subplots)			
2	---	---			
10	Corflo Nyssyl	4 2			
11	Nyssyl Corflo	1 1			
18	Faggra Corflo	1 1			
19	Faggra Carcar Nyssyl Pruser	2 5 1 1			
20	Betlen Faggra Nyssyl	3 2 2			

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Nyssyl	4	66.7	30.8	1.00	23.1
Corflo	3	50.0	23.1	1.00	23.1
Faggra	3	50.0	23.1	0.83	19.2
Carcar	1	16.7	7.7	0.83	19.2
Pruser	1	16.7	7.7	0.17	3.8
Betlen	<u>1</u>	16.7	7.7	<u>0.50</u>	11.5
Total	13			4.33	

Table 15. Sapling data for mixed tulip poplar-red maple forests at Hopewell Furnace.

Plot #	Species	Numberof Saplings (Σ Subplots)
3	Corflo	2
	Fraame	2
4	Acerub	1

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Corflo	1	50	33.3	1.00	40
Fraame	1	50	33.3	1.00	40
Acerub	<u>1</u>	50	33.3	<u>0.50</u>	20
Total	3			2.50	

Table 16. Seedling data for mixed oak-black birch forests at Hopewell Furance.

Plot #	Species	Number of Seedlings (Σ quadrats)	Plot #	Species	Number of Seedlings (Σ quadrats)
9	Nyssyl	2	14	Acerub	6
	Queroc	2		Sasalb	1
	Acerub	1	15	Quealb	1
	Carcar	3		Acerub	5
	Betlen	2		Lirtul	1
12	Acerub	20	16	Acerub	1
	Quepri	3		Carsp	2
	Sasalb	11		Nyssyl	3
	Betlen	4		Lirtul	3
	Quealb	1		Betlen	1
13	Acerub	14	17	Quealb	1
	Nyssyl	1		Quevel	1
	Quepri	1		Acerub	5
	Sasalb	3		Lirtul	1
	Betlen	2		Quealb	1

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Nyssyl	3	42.9	10.0	0.86	5.8
Quecoc	1	14.3	3.3	0.29	1.9
Acerub	7	100.0	23.3	7.43	50.5
Carcar	1	14.3	3.3	0.43	2.9
Betlen	4	57.1	13.3	1.29	8.7
Quepri	2	28.6	6.7	0.57	3.9
Sasalb	3	42.9	10.0	2.14	14.6
Quealb	4	57.1	13.3	0.57	3.9
Lirtul	3	42.9	10.0	0.71	4.8
Carsp	1	14.3	3.3	0.29	1.9
Quevel	1	14.3	3.3	0.14	1.0
Total	30			14.72	

Table 17. Seedling data for mixed oak forests at Hopewell Furance.

Plot #	Species	Number of Seedlings (Σ quadrats)	Plot #	Species	Number of Seedlings (Σ quadrats)
1	Acerub	16	7	Acerub	18
	Quealb	2		Quepri	2
	Sasalb	3		Quevel	2
	Quepri	1		Nyssyl	1
	Quevel	1		Quecoc	1
	Pruser	2		Sasalb	1
5	Acerub	31	8	Amecan	5
	Nyssyl	4		Carsp	1
	Quepri	5		Pruser	2
	Ostvir	2		Acerub	7
	Sasalb	2		Sasalb	1
6	Acerub	41		Corflo	2
	Quevel	2			
	Sasalb	5			
	Quepri	36			
	Fraame	4			
	Unknown	1			

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Acerub	5	100	17.2	22.60	56.5
Quealb	1	20	3.4	0.40	1.0
Nyssyl	2	40	6.9	1.00	2.5
Sasalb	5	100	17.2	2.40	6.0
Quepri	4	80	13.8	8.80	22.0
Quevel	3	60	10.3	1.00	2.5
Pruser	2	40	6.9	0.80	2.0
Ostvir	1	20	3.4	0.40	1.0
Fraame	1	20	3.4	0.80	2.0
Unknown	1	20	3.4	0.20	.5
Quecoc	1	20	3.4	0.20	.5
Amecan	1	20	3.4	1.00	2.5
Carsp	1	20	3.4	0.20	.5
Corflo	1	20	3.4	0.40	1.0
Total	29			40.20	

Table 18. Seedling data for tulip poplar-oak forests at Hopewell Furance.

Plot #	Species	Number of Seedlings (Σ quadrats)	Plot #	Species	Number of Seedlings (Σ quadrats)
2	Acerub	4	18	Acerub	15
	Sasalb	3		Quealb	28
	Quealb	4		Sasalb	2
	Lirtul	4		Lirtul	2
	Quesp	2	19	Lirtul	3
	Pruser	1		Acerub	5
	Ostvir	1		Quealb	1
	Quecoc	1			
10	Acerub	3	20	Acerub	2
	Corflo	1			
11	Lirtul	1			

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Acerub	5	83.3	26.3	4.83	34.9
Sasalb	2	33.3	10.5	0.83	6.0
Quealb	3	50.0	15.8	5.50	39.8
Lirtul	4	66.7	21.1	1.67	12.1
Quesp	1	16.7	5.3	0.33	2.4
Pruser	1	16.7	5.3	0.17	1.2
Ostvir	1	16.7	5.3	0.17	1.2
Quecoc	1	16.7	5.3	0.17	1.2
Corflo	<u>1</u>	16.7	5.3	<u>0.17</u>	1.2
Total	19			13.83	

Table 19. Seedling data for tulip poplar-red maple forests at Hopewell Furnace.

Plot #	Species	Number of Seedlings (Σ quadrats)
3	Ostvir	3
	Lirtul	1
	Carsp	1
	Acerub	2
	Pruser	12
	Sasalb	1
4	Carsp	1
	Corflo	1
	Pruser	44
	Queval	2
	Acerub	2

Species	Number of Plots	Frequency	Rel. Frequency	Density	Rel. Density
Ostvir	1	50	9.1	1.50	4.3
Lirtul	1	50	9.1	0.50	1.4
Carsp	2	100	18.2	1.00	2.9
Acerub	2	100	18.2	2.00	5.7
Pruser	2	100	18.2	28.00	80.0
Sasalb	1	50	9.1	0.50	1.4
Corflo	1	50	9.1	0.50	1.4
Quevel	<u>1</u>	50	9.1	<u>1.00</u>	2.9
Total	11			35.00	

Table 20. Sorensen's Index comparison of overstory (trees) versus understory (seedlings and saplings).

<u>Forest Type</u>	<u>Sorensen's Index</u>
1. mixed oak-black birch	75.7
2. mixed oak	68.7
3. tulip poplar-oak	55.2
4. tulip poplar-red maple	55.6

Table 21. Shrub data for mixed oak-black birch forests at Hopewell Furance.

Plot #	Species	Total Intercepted Distance (m)	Plot #	Species	Total Intercepted Distance (m)
9	Gaybac	.7	14	Vibace	4.7
	Rubsp	.1		Vibden	.3
	Vibace	3.8	15	Linben	4.1
	Viblen	1.3		Vibace	1.4
12	Hamvir	.5	16	Linben	1.4
	Ruball	.3		Rubocc	2.0
	Rubocc	.4		Vibace	3.7
	Vacsta	.4	17	Smirot	1.8
	Vibace	.4		Vacsta	.6
	Viblen	.2		Vibace	.1
13	Vacsta	.3		Vibden	.3
	Vibace	1.0			
	Vibden	.2			

Species	Number of Plots	Frequency	Rel. Frequency	Inter. Dist. (140 m)	Percent Cover (100 m)	Rel. Cover
Gaybac	1	14.3	4.4	.7	.5	2.4
Rubsp	1	14.3	4.4	.1	.1	.3
Vibace	7	100.	30.4	15.1	10.8	51.3
Viblen	1	14.3	4.4	1.3	.9	4.3
Hamvir	1	14.3	4.4	.5	.4	1.9
Ruball	1	14.3	4.4	.3	.2	1.0
Rubocc	2	28.6	8.8	2.4	1.7	8.1
Vacsta	2	28.6	8.8	1.0	.7	3.3
Linben	2	28.6	8.8	5.5	3.9	18.5
Smirot	1	14.3	4.4	1.8	1.2	5.7
Vibden	4	57.1	17.4	1.0	.7	3.3
Total	23			29.7	21.1	

Table 22. Shrub data for mixed oak forests at Hopewell Furance.

Plot #	Species	Total Intercepted Distance (m)	Plot #	Species	Total Intercepted Distance (m)
1	Rubhis	.5	7	Gaybac	.9
	Vacvac	.2		Kallat	.3
	Vibace	2.1		Rhoper	.2
5	Vacsta	1.2		Vacvac	.2
	Vacvac	5.7		Vibace	1.1
6	Gaybac	1.0	8	Linben	1.0
	Vacsta	.4		Vibace	4.1
	Vibace	.9		Viblen	.1
	Vibpru	.3			

Species	Number of Plots	Frequency	Rel. Frequency	Inter. Dist. (100 m)	Percent Cover (100 m)	Rel. Cover
Rubhis	1	20	5.9	.5	.5	2.5
Vacvac	3	60	17.6	6.1	6.1	30.2
Vibace	4	80	23.5	8.2	8.2	40.6
Vacsta	2	40	11.8	1.6	1.6	7.9
Gaybac	2	40	11.8	1.9	1.9	9.4
Vibpru	1	20	5.9	.3	.3	1.5
Kallat	1	20	5.9	.3	.3	1.5
Rhoper	1	20	5.9	.2	.2	.1
Linben	1	20	5.9	1.0	1.0	5.0
Viblen	<u>1</u>	20	5.9	<u>.1</u>	<u>.1</u>	.5
Total	17			20.2	20.2	

Table 23. Shrub data for tulip poplar-oak forests at Hopewell Furnace.

Plot #	Species	Total Intercepted Distance (m)	Plot #	Species	Total Intercepted Distance (m)
2	Linben	.2	18	Linben	.3
	Vibace	.5		Ruball	.2
	Vibpru	3.9		Rubocc	2.6
10	Corflo	6.2		Vibace	2.5
	Linben	1.5		Smirot	1.2
	Parqui	.1	19	Carcar	.2
	Vibace	.2		Vibace	3.6
				Vibden	.6
11	Linben	.9	20	Vacsta	2.2
	Rubocc	1.1		Vibace	2.5
	Vibace	1.5			

Species	Number of Plots	Frequency	Rel. Frequency	Inter. Dist. (120 m)	Percent Cover (100 m)	Rel. Cover
Linben	4	66.7	20	2.9	2.4	9.0
Vibace	6	100.	30	10.8	9.0	33.7
Vibpru	1	16.7	5	3.9	3.2	12.0
Corflo	1	16.7	5	6.2	5.2	19.5
Parqui	1	16.7	5	.1	.1	.4
Rubocc	2	33.3	10	3.7	3.1	11.6
Ruball	1	16.7	5	.2	.2	.7
Smirot	1	16.7	5	1.2	1.0	3.8
Carcar	1	16.7	5	.2	.2	.7
Vibden	1	16.7	5	.6	.5	1.9
Vacsta	<u>1</u>	16.7	5	<u>2.2</u>	<u>1.8</u>	6.7
Total	20			32.0	26.7	

Table 24. Shrub data for tulip poplar-red maple forests at Hopewell Furnace.

Plot #	Species	Total Inter. Dist. (m)
3	Linben Vibpru	10.0 .1
4	Linben Vibpru Vibden	1.0 .9 .1

Species	Number of Plots	Frequency	Rel. Frequency	Inter. Dist. (40 m)	Percent Cover (100 m)	Rel. Cover
Linben	2	100	40	11.0	27.5	91.1
Vibpru	2	100	40	1.0	2.5	8.3
Vibden	<u>1</u>	50	20	<u>.1</u>	<u>.2</u>	.7
Total	5			12.1	30.2	

Table 25. Herb data (per plot) for mixed oak-black birch forests at Hopewell Furnace.

Plot #	Species	Mean Cover (%)	Plot #	Species	Mean Cover (%)
9	Ariatr	0.25	15	Aritri	0.75
	Dessp	0.25		Drymar	0.25
	Parqui	0.75		Galcir	1.00
	Rubsp	1.50		Grass	22.37
	Salcir	0.25		Parqui	2.00
	Simps	0.25		Polvir	1.87
	Unknown #1	0.25		Ruball	0.25
	Unknown #2	0.25		Rubocc	2.50
	Unknown #3	0.25		Smirac	0.25
	Uvuses	0.25		Viosp	1.00
12	Galsp	0.25	16	Aritri	4.00
	Grass	0.50		Aster	0.25
	Rubocc	4.00		Astsp	0.25
	Vibace	2.12		Desnud	0.25
13	Denpun	1.87		Euprug	0.25
	Linben	0.25		Fravir	1.50
	Smirac	0.25		Galcir	2.62
	Vacsta	0.25		Galsp	0.25
	Vibace	6.12		Germac	0.25
	Vibden	0.25		Grass	9.25
14	Aritri	0.50		Mitrep	1.00
	Fernsp	19.50		Oxaeur	2.12
	Medvir	0.25		Parqui	2.37
	Parqui	0.50		Rosmul	0.50
	Rubocc	2.50		Ruball	1.87
	Smiraci	0.25		Rubocc	6.87
	Toxrad	0.25		Scuser	0.75
				Smirac	0.25
				Smirot	0.25
				Uvuper	0.25
				Viosp	1.25
			17	Mitrep	.50

Table 25. Continued.

Species	Number of Plots	Frequency	Relative Frequency	Total Mean Cover	Mean Plot Cover	Relative Cover
Aritri	3	42.9	5.30	1.65	0.236	1.51
Aster	1	14.3	1.75	0.25	0.036	.23
Astsp	1	14.3	1.75	0.25	0.036	.23
Denpun	1	14.3	1.75	1.87	0.268	1.72
Desnud	1	14.3	1.75	0.25	0.036	.23
Dessp	1	14.3	1.75	0.25	0.036	.23
Drymar	1	14.3	1.75	0.25	0.036	.23
Euprug	1	14.3	1.75	0.25	0.036	.23
Fernsp	1	14.3	1.75	19.50	2.786	17.90
Fravir	1	14.3	1.75	1.50	0.214	1.37
Galcir	2	28.6	3.50	3.62	0.518	3.32
Galsp	2	28.6	3.50	0.50	0.071	.46
Germac	1	14.3	1.75	0.25	0.036	.23
Grass	3	42.9	5.30	32.12	4.589	29.50
Linben	1	14.3	1.75	0.25	0.036	.23
Medvir	1	14.3	1.75	0.25	0.036	.23
Mitrep	2	28.6	3.50	1.50	0.214	1.37
Oxaeur	1	14.3	1.75	2.12	0.304	1.95
Parqui	4	57.1	7.00	5.62	0.804	5.16
Polvir	1	14.3	1.75	1.87	0.268	1.72
Rosmul	1	14.3	1.75	0.50	0.071	.46
Ruball	2	28.6	3.50	2.12	0.304	1.95
Rubocc	4	57.1	7.00	15.87	2.268	14.60
Rubsp	1	14.3	1.75	1.50	0.214	1.37
Salcir	1	14.3	1.75	0.25	0.036	.23
Scuser	1	14.3	1.75	0.75	0.107	.69
Simsp	1	14.3	1.75	0.25	0.036	.23
Smirac	3	42.9	5.30	0.75	0.107	.69
Smirot	1	14.3	1.75	0.25	0.036	.23
Toxrad	1	14.3	1.75	0.25	0.036	.23
Unkn #1	1	14.3	1.75	0.25	0.036	.23
Unkn #2	1	14.3	1.75	0.25	0.036	.23
Unkn #3	1	14.3	1.75	0.25	0.036	.23
Uvuper	1	14.3	1.75	0.25	0.036	.23
Uvuses	1	14.3	1.75	0.25	0.036	.23
Vacsta	1	14.3	1.75	0.25	0.036	.23
Vibace	2	28.6	3.50	8.25	1.179	7.57
Vibden	1	14.3	1.75	0.25	0.036	.23
Viosp	2	28.6	3.50	2.12	0.304	1.95
Total	57				15.58	

Table 26. Herb data (per plot) for mixed oak forests at Hopewell Furance.

Plot #	Species	Mean Cover (%)	Plot #	Species	Mean Cover (%)
1	Carlax	2.37	7	Dessp	0.25
	Dessp	1.75		Uvuses	0.25
	Grass	0.25	8	Dessp	5.25
	Impcap	0.25		Gaccir	0.25
	Lysqua	1.00		Galapa	0.25
	Maican	1.50		Galcir	1.25
	Osmlon	0.25		Galsp	0.25
	Parqui	1.00		Grass	1.00
	Podpel	0.25		Impcap	0.50
	Potrec	0.25		Oxasp	0.25
	Pyrell	0.25		Parqui	1.00
	Ruball	2.62		Polacr	0.50
	Rubsp	0.75		Potsim	1.00
	Solces	0.25		Rubsp	3.37
	Solses	0.50		Unkn #1	0.50
	Uvuper	0.75		Unkn #2	0.25
	Uvuses	0.75		Unkn #3	0.25
	Vibpru	0.25		Unkn #4	0.25
	Viosp	1.25		Uvuper	0.50
	Vitsp	0.50		Uvuses	1.00
6	Grass	0.25		Viosp	1.50
	Rubsp	0.25		Vitsp	0.25

Table 26. Continued.

Species	Number of Plots	Frequency	Relative Frequency	Total Mean Cover	Mean Plot Cover	Relative Cover
Carlax	1	20	2.3	2.37	0.47	6.4
Dessp	3	60	6.8	7.25	1.45	19.6
Gaccir	1	20	2.3	0.25	0.05	0.7
Galapa	1	20	2.3	0.25	0.05	0.7
Galcir	1	20	2.3	1.25	0.25	3.4
Galsp	1	20	2.3	0.25	0.05	0.7
Grass	3	60	6.8	1.50	0.30	4.1
Impcap	2	40	4.5	0.75	0.15	2.0
Lysqua	1	20	2.3	1.00	0.20	2.7
Maican	1	20	2.3	1.50	0.30	4.1
Osmlon	1	20	2.3	0.25	0.05	0.7
Oxasp	1	20	2.3	0.25	0.05	0.7
Parqui	2	40	4.5	2.00	0.40	5.4
Podpel	1	20	2.3	0.25	0.05	0.7
Polacr	1	20	2.3	0.50	0.10	1.4
Potrec	1	20	2.3	0.25	0.05	0.7
Potsim	1	20	2.3	1.00	0.20	2.7
Pyrell	1	20	2.3	0.25	0.05	0.7
Ruball	1	20	2.3	2.62	0.52	7.1
Rubsp	3	60	6.8	4.15	0.83	11.2
Solces	1	20	2.3	0.25	0.05	0.7
Solses	1	20	2.3	0.50	0.10	1.4
Unkn #1	1	20	2.3	0.50	0.10	1.4
Unkn #2	1	20	2.3	0.25	0.05	0.7
Unkn #3	1	20	2.3	0.25	0.05	0.7
Unkn #4	1	20	2.3	0.25	0.05	0.7
Uvuper	2	40	4.5	1.25	0.25	3.4
Uvuses	3	60	6.8	2.00	0.40	5.4
Vibpru	1	20	2.3	0.25	0.05	0.7
Viosp	2	40	4.5	2.75	0.55	7.5
Vitsp	<u>2</u>	40	4.5	0.75	<u>0.15</u>	2.0
Total	44				7.38	

Table 27. Herb data (per plot) for tulip poplar-oak forests at Hopewell Furance.

Plot #	Species	Mean Cover (%)	Plot #	Species	Mean Cover (%)
2	Calvir	0.25	11	Aritri	4.25
	Carlax	0.50		Drymar	2.12
	Carsp	0.25		Galcir	6.12
	Dessp	0.75		Galspi	1.87
	Galapa	2.37		Grass	0.25
	Galcir	3.37		Parqui	0.50
	Gallan	0.25		Polacr	1.87
	Galsp	1.75		Rubocc	2.37
	Gevcan	0.25		Sarcan	1.87
	Impcap	1.75		Viosp	2.87
	Maican	0.50	18	Aritri	0.50
	Mitrep	0.50		Ciralp	0.75
	Osmcla	0.50		Fravir	2.62
	Osmlon	0.25		Galsp	0.50
	Parqui	0.50		Grass	0.75
	Podpel	0.25		Lycsp	0.25
	Polvir	0.75		Maican	0.75
	Potrec	0.50		Marvul	0.50
	Prealt	0.75		Medvir	1.00
	Rosmul	0.25		Mitrep	1.00
	Rubhis	0.25		Oxasp	0.25
	Rubocc	0.25		Parqui	1.25
	Spisp	0.25		Polacr	1.87
	Toxrad	0.25		Smirac	0.75
	Unknown	0.50		Toxrad	0.25
	Uvuper	0.50		Unknown	0.25
	Uvuses	1.00		Viosp	1.25
	Viosp	1.25	19	Denpun	4.75
	Vitsp	0.75		Drymar	11.62
10	Aritri	1.0		Grass	2.37
	Consp	1.87		Maican	1.75
	Grass	0.25		Mitrep	1.75
	Lonjap	0.25		Polari	0.25
	Parqui	0.50		Smirec	0.25
	Ruball	0.25		Viosp	0.50
	Rubocc	1.25	20	Chimac	.25
	Toxrad	0.25		Denpun	32.50
	Vibace	0.75		Maican	.50
	Viosp	0.50		Medvir	.75
				Smirac	.50
				Viosp	.50

Table 27. Continued.

Species	Number of Plots	Frequency	Relative Frequency	Total Mean Cover	Mean Plot Cover	Relative Cover
Aritri	3	50.0	3.75	5.75	0.958	4.59
Calvir	1	16.7	1.25	0.25	0.042	.20
Carlax	1	16.7	1.25	0.50	0.083	.40
Carsp	1	16.7	1.25	0.25	0.042	.20
Chimac	1	16.7	1.25	0.25	0.042	.20
Ciralp	1	16.7	1.25	0.75	0.125	.60
Consp.	1	16.7	1.25	1.87	0.313	1.50
Denpun	2	33.3	2.50	37.25	6.208	29.70
Dessp	1	16.7	1.25	0.75	0.125	.60
Drymar	2	33.3	2.50	13.75	2.292	11.00
Fravir	1	16.7	1.25	2.62	0.438	2.10
Galapa	1	16.7	1.25	2.37	0.396	1.90
Galcir	2	33.3	2.50	9.50	1.583	7.58
Gallan	1	16.7	1.25	0.25	0.042	0.20
Galsp	3	50.0	3.75	4.12	0.688	3.30
Gevcan	1	16.7	1.25	0.25	0.042	0.20
Grass	4	66.7	5.00	3.62	0.604	2.89
Impcap	1	16.7	1.25	1.75	0.292	1.40
Lonjap	1	16.7	1.25	0.25	0.042	.20
Lycsp	1	16.7	1.25	0.25	0.042	.20
Maican	4	66.7	5.00	3.50	0.583	2.79
Marvul	1	16.7	1.25	0.50	0.083	.40
Medvir	2	33.3	2.50	1.75	0.292	1.40
Mitrep	3	50.0	3.75	3.25	0.542	2.60
Osmcla	1	16.7	1.25	0.50	0.083	.40
Osmlon	1	16.7	1.25	0.25	0.042	.20
Oxasp	1	16.7	1.25	0.25	0.042	.20
Parqui	4	66.7	5.00	2.75	0.458	2.19
Podpel	1	16.7	1.25	0.25	0.042	.20
Polacr	2	33.3	2.50	3.75	0.625	2.99
Polari	1	16.7	1.25	0.25	0.042	.20
Polvir	1	16.7	1.25	0.75	0.125	.60
Potrec	1	16.7	1.25	0.50	0.083	.40
Prealt	1	16.7	1.25	0.75	0.125	.60
Rosmul	1	16.7	1.25	0.25	0.042	.20
Ruball	1	16.7	1.25	0.25	0.042	.20
Rubhis	1	16.7	1.25	0.25	0.042	.20
Rubocc	3	50.0	3.75	3.87	0.646	3.09
Sarcana	1	16.7	1.25	1.87	0.313	1.50
Smirac	2	33.3	2.50	1.25	0.208	1.00
Smirec	1	16.7	1.25	0.25	0.042	.20
Spisp	1	16.7	1.25	0.25	0.042	.20
Toxrad	3	50.0	3.75	1.00	0.167	.80
Unknown	2	33.3	2.50	0.75	0.125	.60
Uvuper	1	16.7	1.25	0.50	0.083	.40
Uvuses	1	16.7	1.25	1.00	0.167	.80
Vibace	1	16.7	1.25	0.75	0.125	.60
Viosp	6	100.0	7.50	6.87	1.146	5.49
Vitsp	1	16.7	1.25	0.75	0.125	.60
Total	80				20.88	

Table 28. Herb data (per plot) for tulip poplar-red maple forests at Hopewell Furnace.

Plot #	Species	Mean Cover (%)	Plot #	Species	Mean Cover (%)
3	Allvin	0.50	4	Agrsp	0.25
	Ampbra	0.75		Allvin	1.25
	Aritri	0.25		Astsp	0.50
	Botdis	1.50		Botdis	1.25
	Carsp	0.25		Carsp	1.00
	Cimrac	0.25		Fravir	0.25
	Clavir	0.50		Galada	0.25
	Galcir	1.75		Galapa	0.25
	Grass	0.25		Galcir	2.00
	Guilac	0.25		Galspe	0.25
	Impcap	1.00		Galsp	1.75
	Impcas	0.25		Geulac	0.25
	Lonjap	1.25		Geumac	0.25
	Micvim	0.50		Grass	0.75
	Osmcla	1.75		Impcap	1.75
	Oxasp	0.50		Lonjap	3.37
	Parqui	0.75		Mitrep	0.50
	Plamad	0.25		Osmcla	1.75
	Polper	0.25		Oxasp	1.50
	Polvir	0.75		Parqui	0.50
	Potrec	0.50		Polacr	2.37
	Sancan	2.00		Potrec	3.12
	Sangre	1.00		Pyrame	0.25
	Toxrad	1.75		Rubsp	0.25
	Unkn #3	0.25		Sancan	0.75
	Unkn #4	0.25		Sancla	0.25
	Uvuses	0.50		Sangre	0.50
	Viosp	1.00		Singre	0.25
	Vitsp	0.50		Spisp	0.25
				Toxrad	1.75
				Unkn #3	0.25
				Unknown	0.50
				Uvuses	0.25
				Veroff	0.25
				Viosp	1.75
				Vitsp	1.75

Table 28. Continued.

Species	Number of Plots	Frequency	Relative Frequency	Total Mean Cover	Mean Plot Cover	Relative Cover
Agrsp	1	50	1.5	0.25	0.125	.45
Allvin	2	100	3.1	1.75	0.875	3.15
Ampbra	1	50	1.5	0.75	0.375	1.35
Aritri	1	50	1.5	0.25	0.125	.45
Astsp	1	50	1.5	0.50	0.250	.90
Botdis	2	100	3.1	3.00	1.500	5.39
Carsp	2	100	3.1	1.25	0.625	2.25
Cimrac	1	50	1.5	0.25	0.125	.45
Clavir	1	50	1.5	0.50	0.250	.90
Fravir	1	50	1.5	0.25	0.125	.45
Galada	1	50	1.5	0.25	0.125	.45
Galapa	1	50	1.5	0.25	0.125	.45
Galcir	2	100	3.1	3.75	1.875	6.74
Galspe	1	50	1.5	0.25	0.125	.45
Galsp	1	50	1.5	1.75	0.875	3.15
Geulac	1	50	1.5	0.25	0.125	.45
Geumac	1	50	1.5	0.25	0.125	.45
Grass	2	100	3.1	1.00	0.500	1.80
Guilac	1	50	1.5	0.25	0.125	.45
Impcap	2	100	3.1	2.75	1.375	4.94
Impcas	1	50	1.5	0.25	0.125	.45
Lonjap	2	100	3.1	4.62	2.313	8.32
Micvim	1	50	1.5	0.50	0.250	.90
Mitrep	1	50	1.5	0.50	0.250	.90
Osmcla	2	100	3.1	3.50	1.750	6.29
Oxasp	2	100	3.1	2.00	1.000	3.60
Parqui	2	100	3.1	1.25	0.625	2.25
Plamad	1	50	1.5	0.25	0.125	.45
Polacr	1	50	1.5	2.37	1.188	4.27
Polper	1	50	1.5	0.25	0.125	.45
Polvir	1	50	1.5	0.75	0.375	1.35
Potrec	2	100	3.1	3.62	1.813	6.52
Pyrame	1	50	1.5	0.25	0.125	.45
Rubsp	1	50	1.5	0.25	0.125	.45
Sancan	2	100	3.1	2.75	1.375	4.94
Sancla	1	50	1.5	0.25	0.125	.45
Sangre	2	100	3.1	1.50	0.750	2.70
Singre	1	50	1.5	0.25	0.125	.45
Spisp	1	50	1.5	0.25	0.125	.45
Toxrad	2	100	3.1	3.50	1.750	6.29
Unkn #3	2	100	3.1	0.50	0.250	.90
Unkn #4	1	50	1.5	0.25	0.125	.45
Unk	1	50	1.5	0.50	0.250	.90
Uvuses	2	100	3.1	0.75	0.375	1.35
Veroff	1	50	1.5	0.25	0.125	.45
Viosp	2	100	3.1	2.75	1.375	4.94
Vitsp	2	100	3.1	2.25	1.125	4.04
Total	65				27.81	