

Deer Exclosure Vegetation Study In Fallow Fields
At
Fort Necessity National Battlefield

by
Doug Hutter

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Introduction

Browsing of tree seedlings by white-tailed deer (*Odocoileus virginianus*), as well as past land use, has initiated changes in plant species and growth form composition in some areas of Fort Necessity National Battlefield. As a result, restoration of the historic scene has been delayed or prevented entirely. The effects of white-tailed deer on forest tree regeneration, species composition, and density have been abundantly documented (Marquis 1975). Information on tree regeneration, shifts in species composition, and stocking is limited. Records on the long-term developments of a stand affected by deer, or the proportions of stands affected are insufficient. Furthermore, distribution of *Solidago* spp. and grasses appears to interfere with species composition, secondary succession, and plant physiology. The objective of this study was to assess impact of white-tailed deer on species composition and tree regeneration on a fallow field.

A one-acre deer enclosure was created to provide records on vegetational data in the fallow field east-south-east of the stockade Fort. This is a report on species composition and vegetational transitions within the deer enclosure and control area.

Study Methods

During February 1987, local eagle scouts and Fort Necessity personnel installed a one-acre deer enclosure approximately 2,000 feet east-south-east from reconstructed Fort Necessity. The enclosure (Figure 1a) is located within property purportedly cultivated from 1856 to 1923 (Strach, unpublished). Vegetation studies were made in June of 1987 and 1988 both within and outside of the deer enclosure.

A line transect was located inside and continued outside of the enclosure. One diagonal line tending south-south-west to north-north-east was considered satisfactory; unless there is a great diversity of plant communities over the area one transect is generally sufficient (McLean and Cook 1968) (Figure 1). Also, the transect line outside of the enclosure was located in an area similar to that inside the fence. The number of sample plots necessary to adequately sample the vegetation can be determined by a species-area curve. Sampling was adequate when a 10 percent increase in sample area resulted in an increase of species equaling 10 percent of the total present (Phillips 1959). The total number of species present in transect one was 20. 10 percent of the total present was 2.0. Therefore, adequate sampling occurred somewhere between 24 and 25 meters (Figure 1.1).

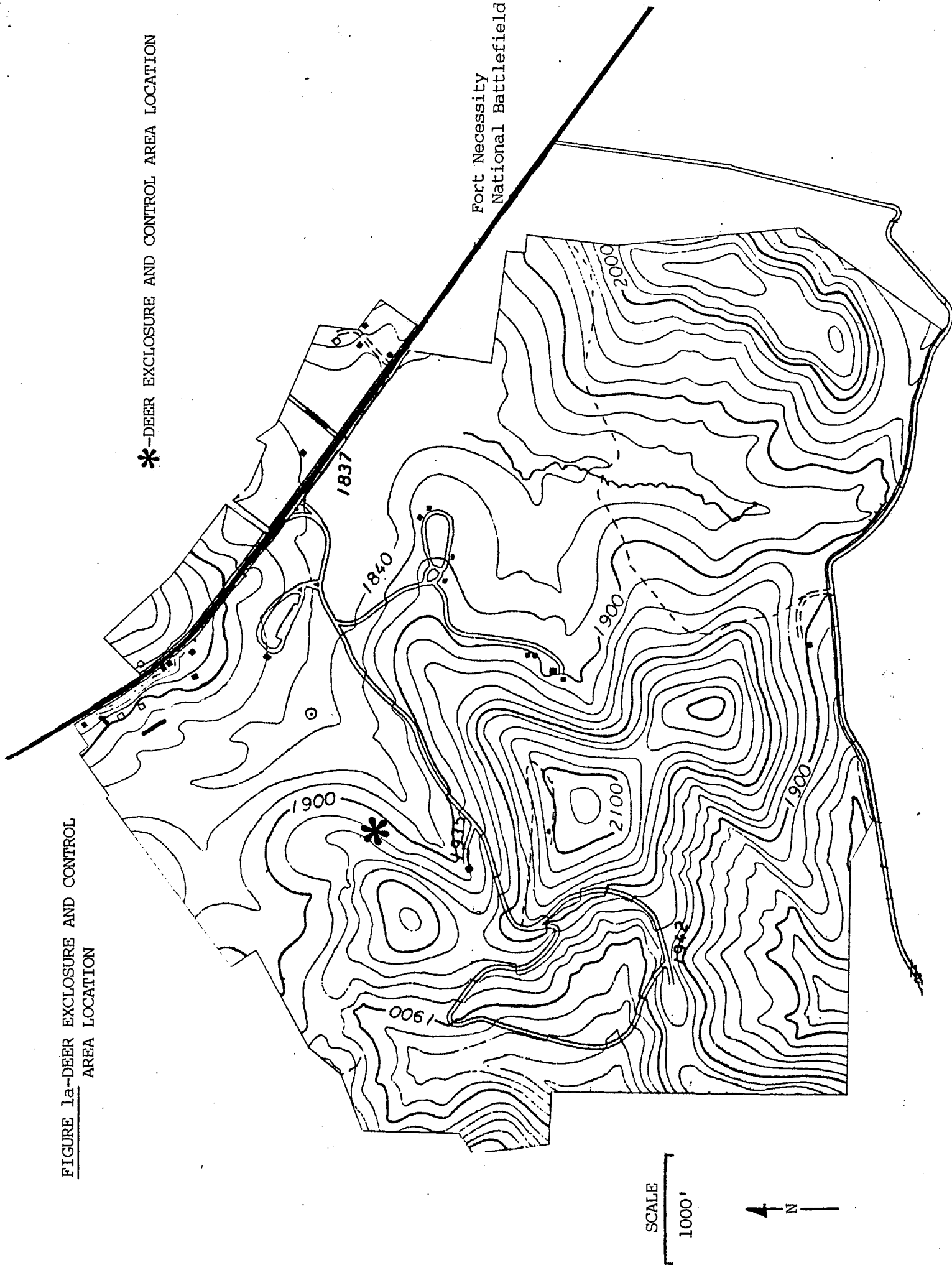
The 98 sample plots used in this study each year would not provide an adequate sample on which to assess the impact of deer and plant interference on the entire fallow hillside, but may provide a prognosis for recreating the historic scene.

Sample plots were located at successive 2 meter intervals. A meterstick with 10 16d nails spaced 10 cm apart was used to sample the vegetation. The meter stick was placed perpendicular to the transect line and each plant species touched by a nail tip was recorded. Table 1 shows the relative frequency of each species recorded. This percent was obtained by dividing the number of points of occurrence of the species by the number of points of occurrence of all species and multiplying by 100. Species composition of the entire enclosure was inventoried before sampling occurred (Table 2).

Stakes were placed 10 ft. (3m) apart for systematic plant inventory (Figure 2) and plant species were recorded after verification by formal botany keys. Specimens unable to be identified in the field were collected, pressed, and later studied. Remaining unidentified specimens were marked in the field with stakes for later observation at anthesis (Figure 3).

FIGURE 1a-DEER EXCLOSURE AND CONTROL
AREA LOCATION

*-DEER EXCLOSURE AND CONTROL AREA LOCATION



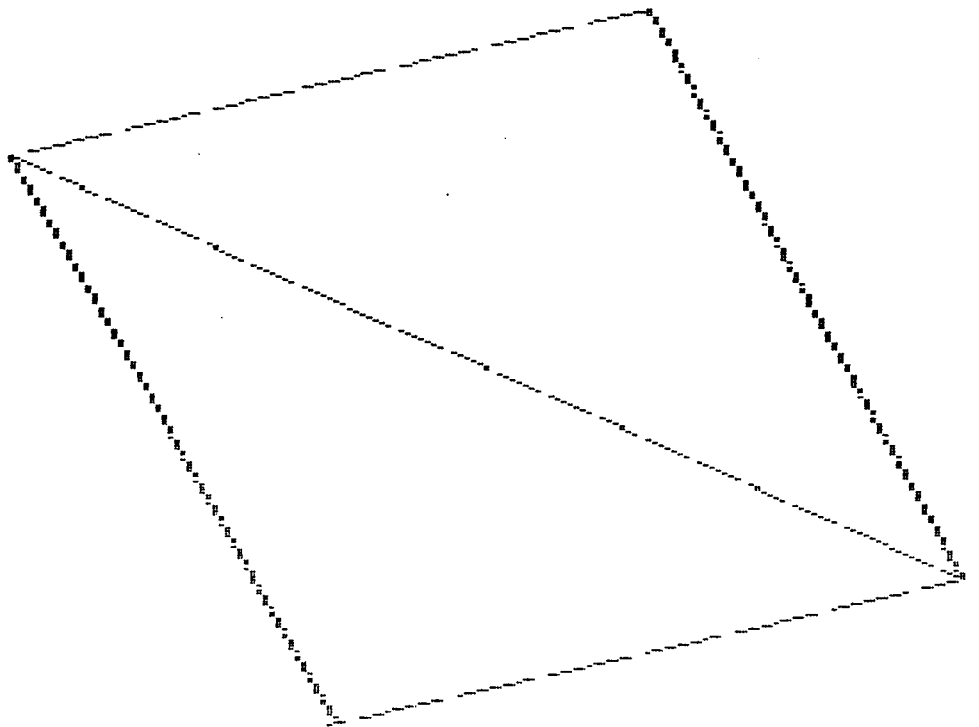


FIGURE 1.-DEER EXCLOSURE WITH
DIAGONAL TRANSECT LINE

SCALE: 1 in = 60 feet
FAVETTE County, PA

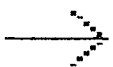


Figure 1.1: Species Area Curve

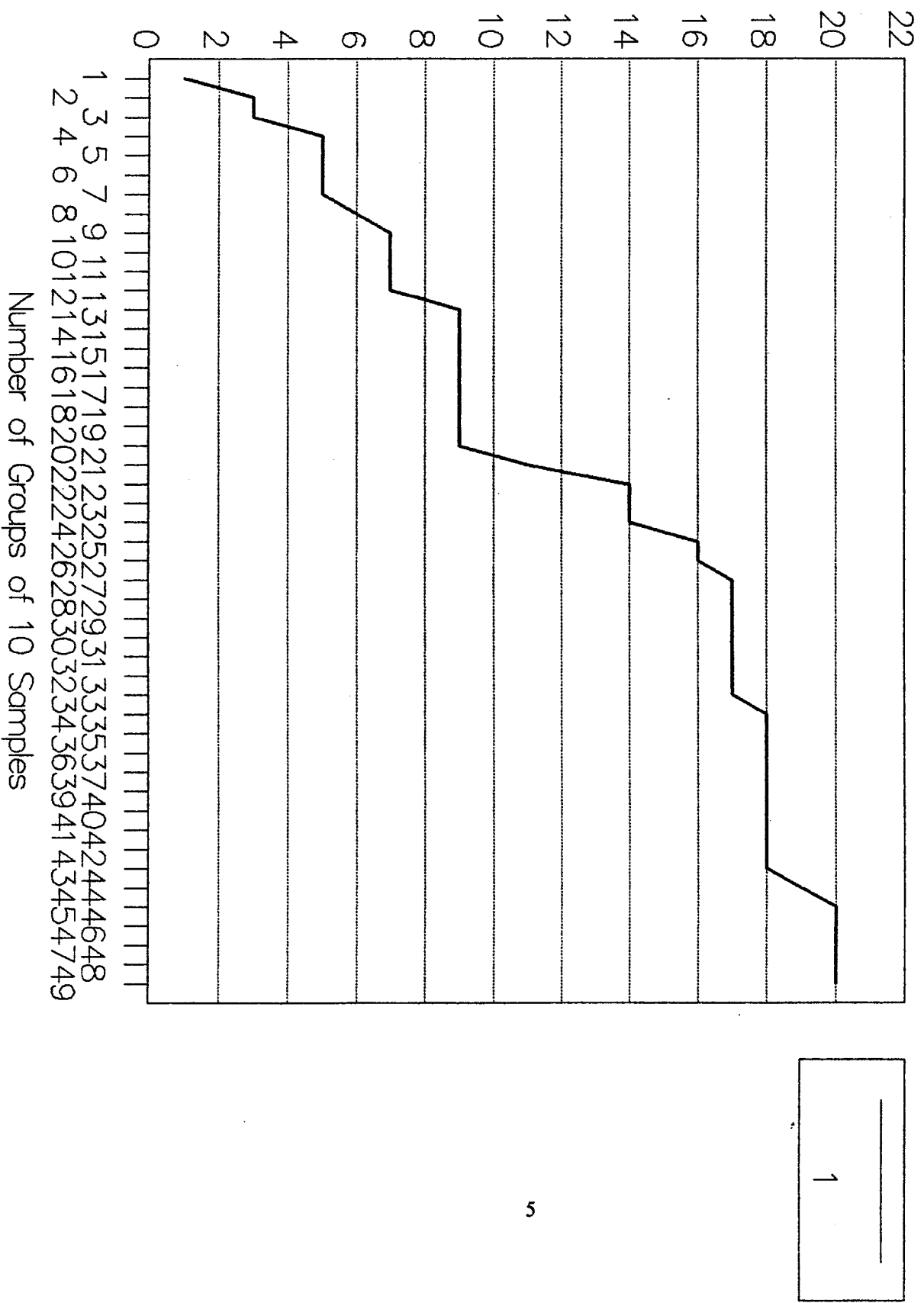


TABLE 1.-RELATIVE FREQUENCY OF PLANT SPECIES RECORDED BY TRANSECT

CODE	T	FREQ	CODE	T	FREQ	CODE	T	FREQ	CODE	T	FREQ
RAAC	1	0.21	39	2	0.21	PLMA	3	0.2	VEOF	4	0.2
34	1	0.21	PLMA	2	0.21	COSE	3	0.2	CEVU	4	0.2
TRAG	1	0.21	VIRE	2	0.21	40	3	0.2	TRSP	4	0.2
4	1	0.21	OXEU	2	0.21	TRAG	3	0.2	SOCA	4	0.2
PLMA	1	0.21	RAAC	2	0.21	RAAC	3	0.2	CRSP	4	0.2
5	1	0.41	PRVU	2	0.21	RUSP	3	0.2	COSE	4	0.41
TAOF	1	0.41	36	2	0.41	CASP	3	0.2	ROMU	4	0.41
RUHI	1	0.82	RUAC	2	0.41	MESA	3	0.2	STGR	4	0.61
ACHI	1	0.82	2	2	0.41	CRSP	3	0.2	PLLA	4	1.02
RUSP	1	0.82	TAOF	2	0.41	TAOF	3	0.2	RAAC	4	1.02
PLLA	1	1.03	4	2	0.62	VESP	3	0.2	TAOF	4	1.43
VOSP	1	1.03	COSE	2	1.03	ACHI	3	0.41	POSI	4	1.84
FRVI	1	1.64	ROMU	2	1.23	5	3	0.41	RUSP	4	2.24
CHLE	1	2.05	ACHI	2	2.26	LYSI	3	0.41	VISP	4	2.24
LLMO	1	3.29	POSI	2	2.88	VISP	3	1.02	CHLE	4	2.24
POSI	1	4.52	PLLA	2	3.09	PLLA	3	1.84	ACHI	4	2.86
SAVU	1	8.42	VOSP	2	3.91	CHLE	3	2.45	SAVU	4	3.27
HIPR	1	13.55	HIPR	2	8.23	POSI	3	4.09	HIPR	4	9.39
SOSP	1	24.45	SOSP	2	9.88	LOMO	3	5.11	LOMO	4	10.2
GRSP	1	35.51	LOMO	2	10.29	SAVU	3	7.98	SOSP	4	13.46
			SAVU	2	10.91	HIPR	3	11.23	GRSP	4	46.12
			GRSP	2	42.8	SOSP	3	28.22			
						GRSP	3	34.36			

TABLE 2. -DEER EXCLOSURE PLANT INVENTORY

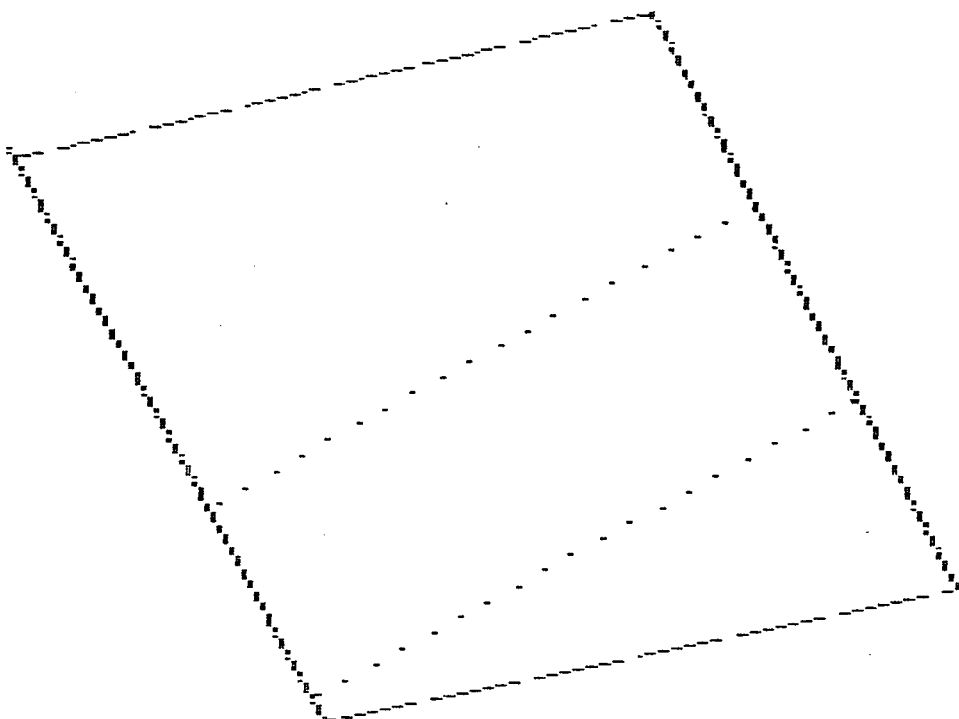
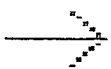
FAMILY	GENUS	SPECIES	COMMON_NAME	CODE
LYCOPODIACEAE	Lycopodium	spp.	Groundpine	LYSP
POLYPODIACEAE	Dennstaedtia	punctilobula	Hay-scented fern	DEPU
POLYPODIACEAE	Pteridium	aquilinum	Bracken	PTAQ
GRAMINEAE	Andropogon	spp.	Beardgrass	ANSP
GRAMINEAE	Panicum	clandestinum	Deertongue grass	PACL
GRAMINEAE	Anthoxanthum	odoratum	Sweet vernal grass	ANOD
GRAMINEAE	Phleum	pratense	Timothy	PHPR
GRAMINEAE	Agrostis	alba	Redtop	AGAL
GRAMINEAE	Holcus	lanatus	Velvet grass	HOLA
GRAMINEAE	Danthonia	compressa	Mountain oat-grass	DACO
GRAMINEAE	Dactylis	glomerata	Orchard grass	DAGL
GRAMINEAE	Poa	spp.	Bluegrass	PASP
CYPERACEAE	Eleocharis	spp.	Spikebrush	ELSP
CYPERACEAE	Carex	spp.	Sedge	CASP
JUNCACEAE	Juncus	tenuis	Dooryard rush	JUTE
IRIDACEAE	Sisyrinchium	angustifolium	Narrow-leaved blue-eyed grass	SIAN
POLYGONACEAE	Rumex	acetosella	Field sorrel, Sheep sorrel	RUAC
POLYGONACEAE	Polygonum	spp.	Smart weed	POSP
CARYOPHYLLACEAE	Stellaria	graminea	Lesser stitchwort	STGR
CARYOPHYLLACEAE	Cerastium	vulgatum	Common mouse-ear chickweed	CEVU
CARYOPHYLLACEAE	Dianthus	armeria	Deptford pink	DIAR
RANUNCULACEAE	Clematis	spp.	Wild clematis	CLSP
RANUNCULACEAE	Ranunculus	acris	Tall or meadow buttercup	RAAC
RANUNCULACEAE	Anemone	virginiana	Thimbleweed	ANVI
MAGNOLIACEAE	Magnolia	acuminata	Cucumber tree	MAAC
MAGNOLIACEAE	Liriodendron	tulipifera	Tulip tree, Yellow-poplar	LITU
BRASSICACEAE	Barbarea	vulgaris	Winter cress, Yellow rocket	BAVU
ROSACEAE	Fragaria	virginiana	Wild strawberry	FRVI
ROSACEAE	Potentilla	recta	Upright cinquefoil	PORE
ROSACEAE	Potentilla	simplex	Common cinquefoil	POSI
ROSACEAE	Geum	canadense	White avens	GECA
ROSACEAE	Rubus	spp.		RUSP
ROSACEAE	Rosa	multiflora	Multiflora rose	ROMU
ROSACEAE	Crataegus	spp.	Hawthorn	CRSP
ROSACEAE	Prunus	serotina	Wild black cherry	PRSE
LEGUMINOSAE	Medicago	sativa	Alfalfa	MESA
LEGUMINOSAE	Trifolium	pratense	Red clover	TRPR
LEGUMINOSAE	Trifolium	agrarium	Yellow hop clover	TRAG
LEGUMINOSAE	Trifolium	spp.	Clover	TRSP

TABLE 2.-DEER EXCLOSURE PLANT INVENTORY (continued)

FAMILY	GENUS	SPECIES	COMMON NAME	CODE
OXALIDACEAE	Oxalis	europaea	European yellow wood sorrel	OXEU
ANACARDIACEAE	Toxicodendron	radicans	Poison Ivy	TORA
ACERACEAE	Acer	rubrum	Red maple	ACRU
BALSAMINACEAE	Impatiens	spp.	Jewelweed	IMSP
VITACEAE	Vitis	spp.	Grape	VTSP
GUTTIFERAE	Hypericum	perforatum	Common St. Johnswort	HYPE
VIOLACEAE	Viola	spp.	Violet	VOSP
ONAGRACEAE	Oenothera	spp.	Evening-primrose	OESP
UMBELLIFERAE	Daucus	carota	Wild carrot, Queen Anne's lace	DACA
PRIMULACEAE	Lysimachia	cllata	Fringed loosestrife	LYCI
PRIMULACEAE	Lysimachia	lanceolata	Yellow loose strife	LYLA
APOCYNACEAE	Apocynum	spp.	Dogbane	APSP
ASCLEPIADACEAE	Asclepias	spp.	Milkweed	ASSP
ASCLEPIADACEAE	Asclepias	tuberosa	Butterfly weed	ASTU
ASCLEPIADACEAE	Asclepias	syriaca	Common milkweed	ASSY
ASCLEPIADACEAE	Asclepias	sepium	Hedge bindweed	COSE
CONVOLVULACEAE	Convolvulus	americanus	Water horehound	LYAM
LABIATAE	Lycopus	americanus	European selfheal, Heal-all	PRVU
LABIATAE	Prunella	vulgaris	Field basil	SAVU
LABIATAE	Satureja	vulgaris	Horse-nettle	SOCA
SOLANACEAE	Solanum	carolinense	Common ground-cherry	PHHE
SOLANACEAE	Physalis	heterophylla	Speedwell	VESP
SCROPHULARIACEAE	Veronica	spp.	Thyme-leaved speedwell	VESE
SCROPHULARIACEAE	Veronica	serpyllifolia	Common speedwell	VEOF
SCROPHULARIACEAE	Veronica	officialis	Great plantain	PLMA
PLANTAGINACEAE	Plantago	major	Buckhorn plantain, English plantain	PLIA
PLANTAGINACEAE	Plantago	lanceolata	Sweet-scented bedstraw	GATR
RUBIACEAE	Galium	triflorum	Large summer bluet	HOPU
RUBIACEAE	Houstonia	purpurea	Morrow's honeysuckle	LOMO
RUBIACEAE	Lonicera	morrowi	Arrowwood	VBSP
CAPRIFOLIACEAE	Viburnum	spp.	Indian tobacco	LOIN
CAPRIFOLIACEAE	Viburnum	inflata	Ironweed	VENO
LOBELIACEAE	Lobelia	noveboracensis	White snakeroot	EURU
COMPOSITAE	Vernonia	rugosum	Goldenrod	SOSP
COMPOSITAE	Eupatorium	spp.	Aster	ATSP
COMPOSITAE	Solidago	spp.	Daisy fleabane	ERAN
COMPOSITAE	Aster	annuus	Common ragweed	AMAR
COMPOSITAE	Erigeron	artemisifolia	Ox-eye daisy	CHLE
COMPOSITAE	Ambrosia	leucanthemum	Black-eyed Susan	RUHI
COMPOSITAE	Chrysanthemum	hirta	Yarrow	ACMI
COMPOSITAE	Rudbeckia	millefolium	Golden ragwort	SEAU
COMPOSITAE	Achillea	aurus	Dandelion	TAOF
COMPOSITAE	Senecio	officinalis	Field hawkweed	HIPR
COMPOSITAE	Taraxacum	pratense		
COMPOSITAE	Hieracium			

FIGURE 2.-STAKE PLACEMENT FOR
SYSTEMATIC PLANT INVENTORY

SCALE: 1 in = 60 feet
FAYETTE County, PA



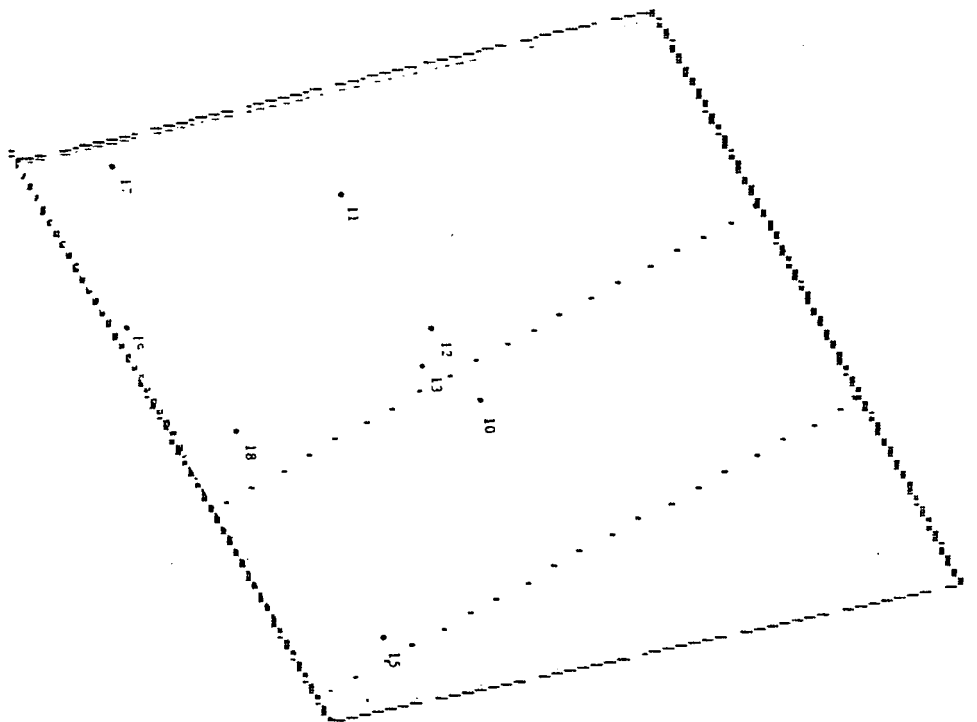
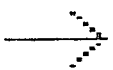


FIGURE 3.-LOCATIONS OF UNIDENTIFIED
PLANTS WITHIN ENCLOSURE

SCALE: 1 in = 60 feet
FAYETTE County, PA



Percentage cover was estimated visually. Estimations of cover are commonly used in broad surveys; however, they are subject to personal errors because of each observer's different conception of the actual amount of cover. Nonetheless, an initial percentage cover estimate follows:

50% Solidago spp.
 35% Grass spp.
 10% Hieracium pratense
 5% Satureja vulgaris

Tree regeneration was also evaluated in 1988 to determine advance reproduction. 20 sample plots with a radius of six feet were established in both exclosure and control areas (Figure 4). Stems were recorded by species and height (Tables 3a and 3b). All stems were less than 0.5 inch dbh.

TABLE 3a.-REGENERATION TALLY BY SPECIES IN 20 6-FT. RADIUS PLOTS WITHIN EXCLOSURE

TREE CODE	HEIGHT	TREE CODE	HEIGHT	TREE CODE	HEIGHT	TREE CODE	HEIGHT	TREE CODE	HEIGHT
ACRU	0.2	CRSP	0.2	PRSE	0.2	ROPS	1.0	VBSP	6.7
ACRU	0.4	CRSP	0.3	PRSE	0.3	ROPS	1.8	VBSP	1.8
ACRU	0.5	CRSP	0.4	PRSE	0.3	ROPS	2.6	VBSP	2.3
ACRU	0.6	CRSP	0.4	PRSE	0.3	ROPS	3.0	VBSP	2.6
		CRSP	0.4	PRSE	0.3	ROPS	3.8		
		CRSP	0.4	PRSE	0.3	ROPS	4.7		
		CRSP	0.5	PRSE	0.3	ROPS	4.8		
		CRSP	0.5	PRSE	0.4	ROPS	5.0		
		CRSP	0.6	PRSE	0.5	ROPS	5.3		
		CRSP	0.7	PRSE	0.6	ROPS	5.8		
		CRSP	0.7	PRSE	0.8	ROPS	6.0		
		CRSP	0.7	PRSE	0.8	ROPS	6.7		
		CRSP	0.8	PRSE	0.8				
		CRSP	0.9	PRSE	0.8				
		CRSP	1.1	PRSE	0.8				
		CRSP	1.9	PRSE	0.8				
		CRSP	2.2	PRSE	0.8				
		CRSP	2.2	PRSE	1.0				
		CRSP	2.3	PRSE	1.1				
		CRSP	2.9	PRSE	2.0				
		CRSP	4.3						

TABLE 3b.-REGENERATION TALLY BY SPECIES IN 20 6-FT. RADIUS PLOTS WITHIN CONTROL AREA

TREE CODE	HEIGHT	TREE CODE	HEIGHT	TREE CODE	HEIGHT	TREE CODE
CRSP	0.2	PRSE	0.3	VBSP	1.3	X
CRSP	0.4	PRSE	0.5	VBSP	1.9	X
CRSP	0.4	PRSE	0.6	VBSP	2.1	X
CRSP	0.5	PRSE	0.7	VBSP	2.7	X
CRSP	0.5	PRSE	0.7			X
CRSP	0.6	PRSE	1.1			X
CRSP	0.7	PRSE	1.2			X
CRSP	0.7					X
CRSP	0.8					
CRSP	0.8					
CRSP	0.8					
CRSP	1.2					
CRSP	1.4					
CRSP	1.7					
CRSP	1.9					
CRSP	1.9					
CRSP	2.1					
CRSP	2.2					

TREE CODE	SPECIES
ACRU	Acer rubrum
CRSP	Crataegus spp.
PRSE	Prunus serotina
ROPS	Robinia pseudoacacia
VBSP	Viburnum spp.
X	None present

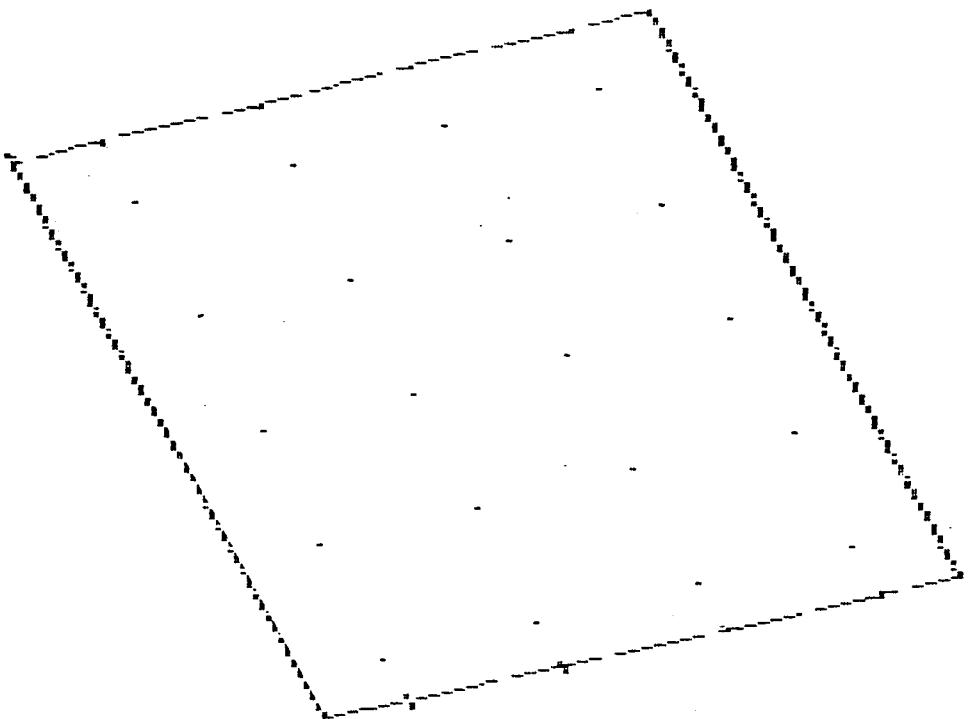
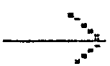


FIGURE 4.-REGENERATION PLOT CENTERS
WITHIN ENCLOSURE

SCALE: 1 in = 60 feet
FAYETTE COUNTY, PA



Deer populations within Fayette County established by the Pennsylvania Game Commission were 19 deer/square mile in 1987. Deer population estimates during the years 1983 to 1986 were respectively 18, 16, 16, and 17 deer/sq. mi. (Dale Scheffer, pers. commun.).

Prior to Park acquisition, the study area was grazed by cattle and horses and mowed periodically. Mowing of the study area last occurred in the summer of 1982 or 1983. Solidago spp. were salient after grazing ceased in 1977 (Frank Marhefka, pers. commun.).

Since the realization that a large degree of error is inherent in subjective evaluation of abundance, ecologists have become increasingly conscious of the necessity of using quantitative measures to describe vegetation (Kershaw 1973). The line transect method was chosen because it may more closely represent the dissemination pattern of vegetation than does the use of square plots within some associations (Phillips 1959)

The chi-square test of independence was used to evaluate results between the enclosure and control area. Null and alternative hypotheses were formulated for comparisons between both area transects. Level of significance chosen was .05.

Line transects within the enclosure and control areas were compared to determine whether there were significant differences in species composition with respect to type of area. Specifically, the null and alternative hypotheses were stated as follows:

Null hypothesis: There is no significant difference in vegetation composition between the control and enclosure areas.

Alternative hypothesis: There is a significant difference in vegetation composition between the enclosure and control areas.

The general distribution of species in relation to each other within transects was tested for significance. Samples taken in the first half of a transect (2m-48 meters) were compared with samples taken in the second half of the same transect (50-98 meters). The appropriate null and alternative hypotheses follow:

Null hypothesis: There is no significant difference in vegetation composition between samples 2m through 48m and samples 50 m through 98m.

Alternative hypothesis: There is a significant difference in vegetation composition between samples 2m through 48m and 50m through 98m.

Also, the null hypothesis that there is no significant difference between enclosure in 1987 and 1988 and control in 1987 and 1988 was tested.

Results

Chi-square was computed from expected frequencies greater than five. In general, frequency is a useful measure of abundance where comparisons are to be made on a large scale (Kershaw 1973).

A series of bar graphs in Figures 5-8 show relative frequencies of plant species along each transect. Grasses were the most numerous species on all transects accounting for more than 34% of the species present; Solidago spp. were the next most abundant (Table 1).

The regeneration survey showed about twice as many trees per acre in the exclosure plots as in the control plots. However, only 5% of the exclosure plots had two or more stems taller than 5 feet. The median heights of stems were 0.8 and 1.9 feet, respectively, on exclosure and control plots. The control plots had no stems taller than 2.7 feet. All of these plots contained fewer than 5 stems over 3 feet tall.

Crataegus spp. and Prunus serotina were the most abundant tree species on exclosure plots (Table 3a). Crataegus spp. accounted for 62% of the tree species present in control plots (Table 3b).

Seedlings in control plots did not emerge above the herbaceous cover. Thus, deer browsing probably had no effect on control area seedlings.

Plant composition did not differ significantly between transects in 1987 and 1988 within the exclosure. Similarly there was no significant difference between plots 2m through 48m and plots 50m through 98m within each transect. By contrast, chi-square values were significant between exclosure and control transects and between control transects in both years.

Figure 5: Relative Frequency >2

Transect 1

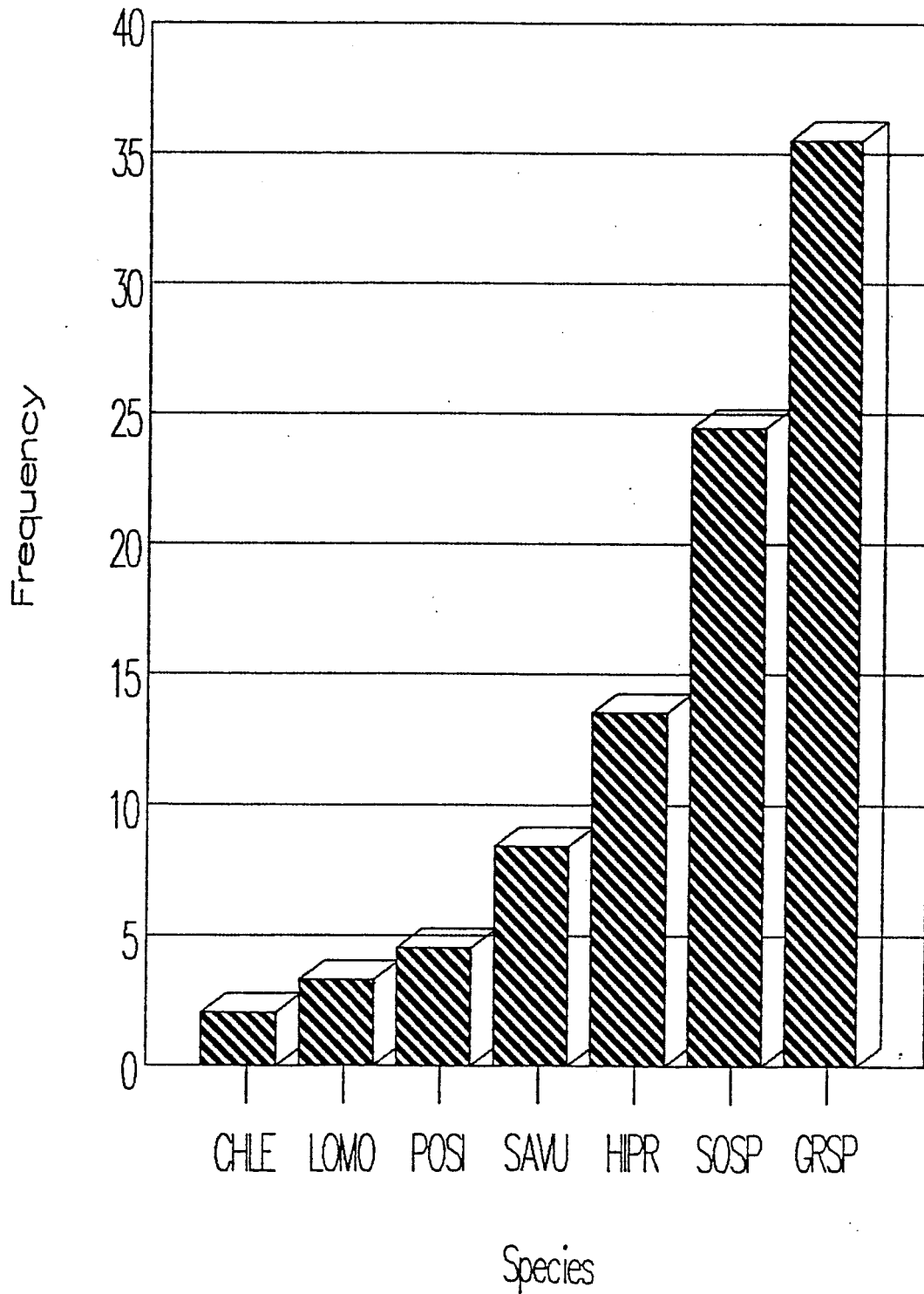


Figure 6: Relative Frequency >2

Transect 2

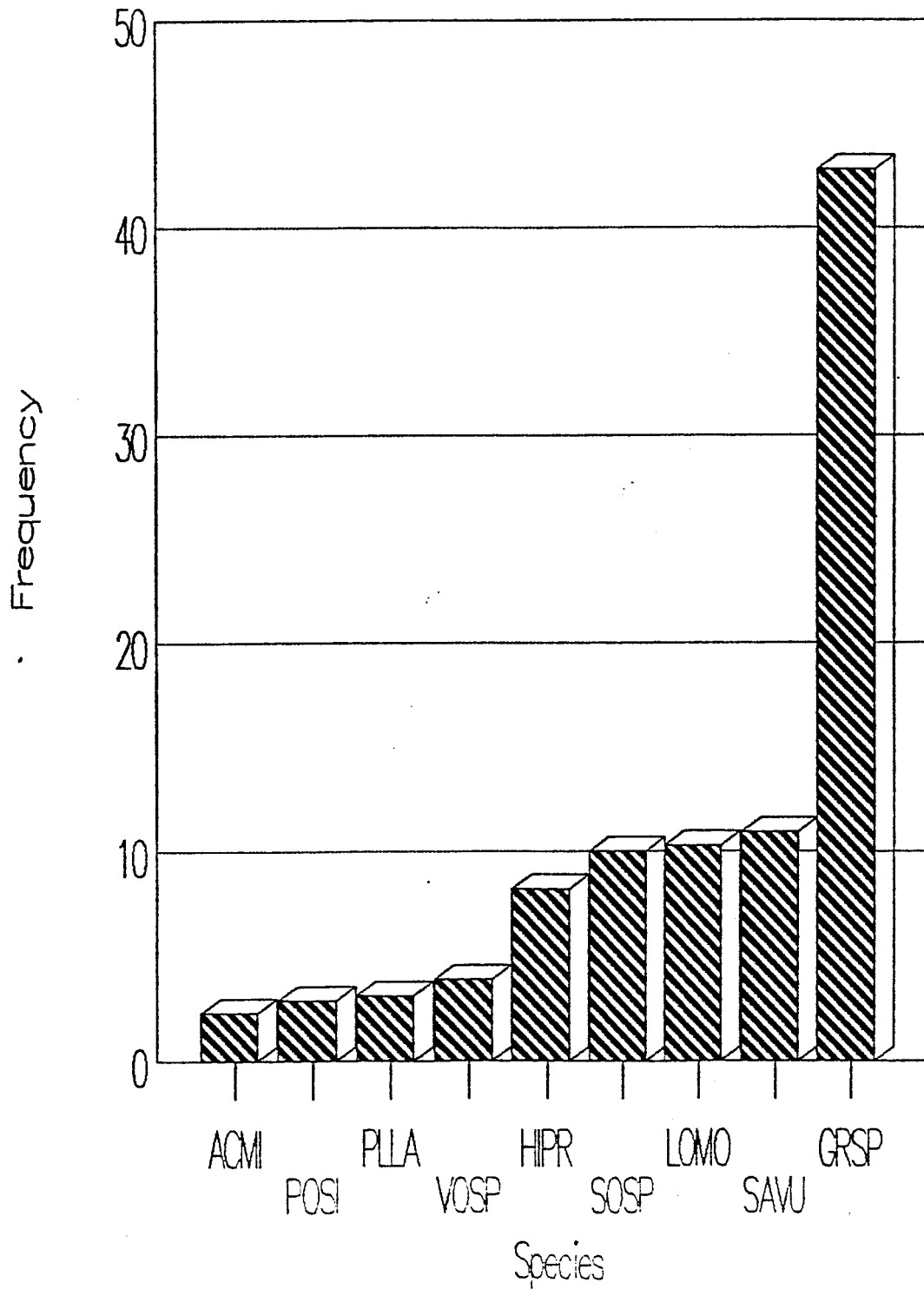


Figure 7: Relative Frequency >2

Transect 3

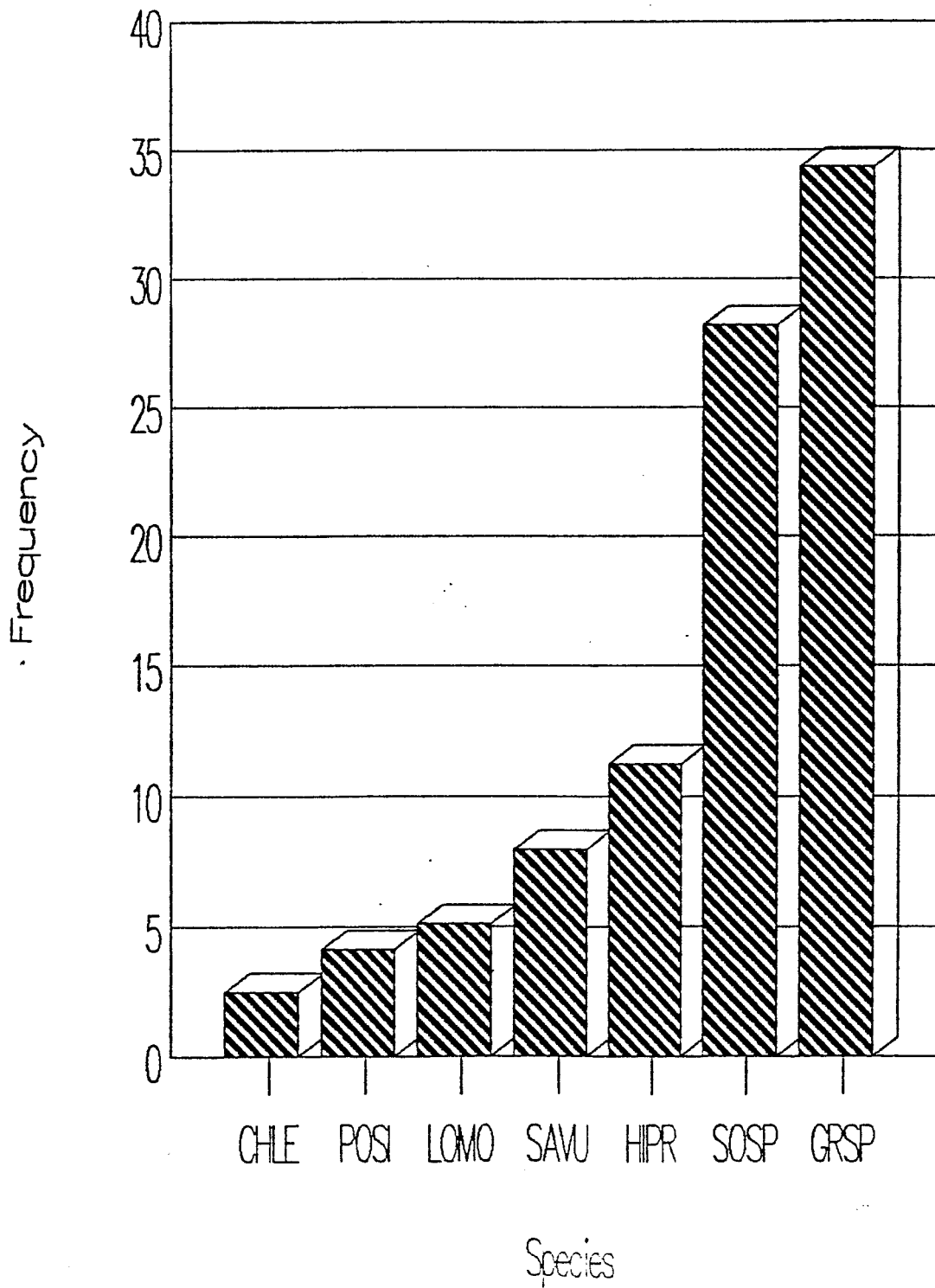
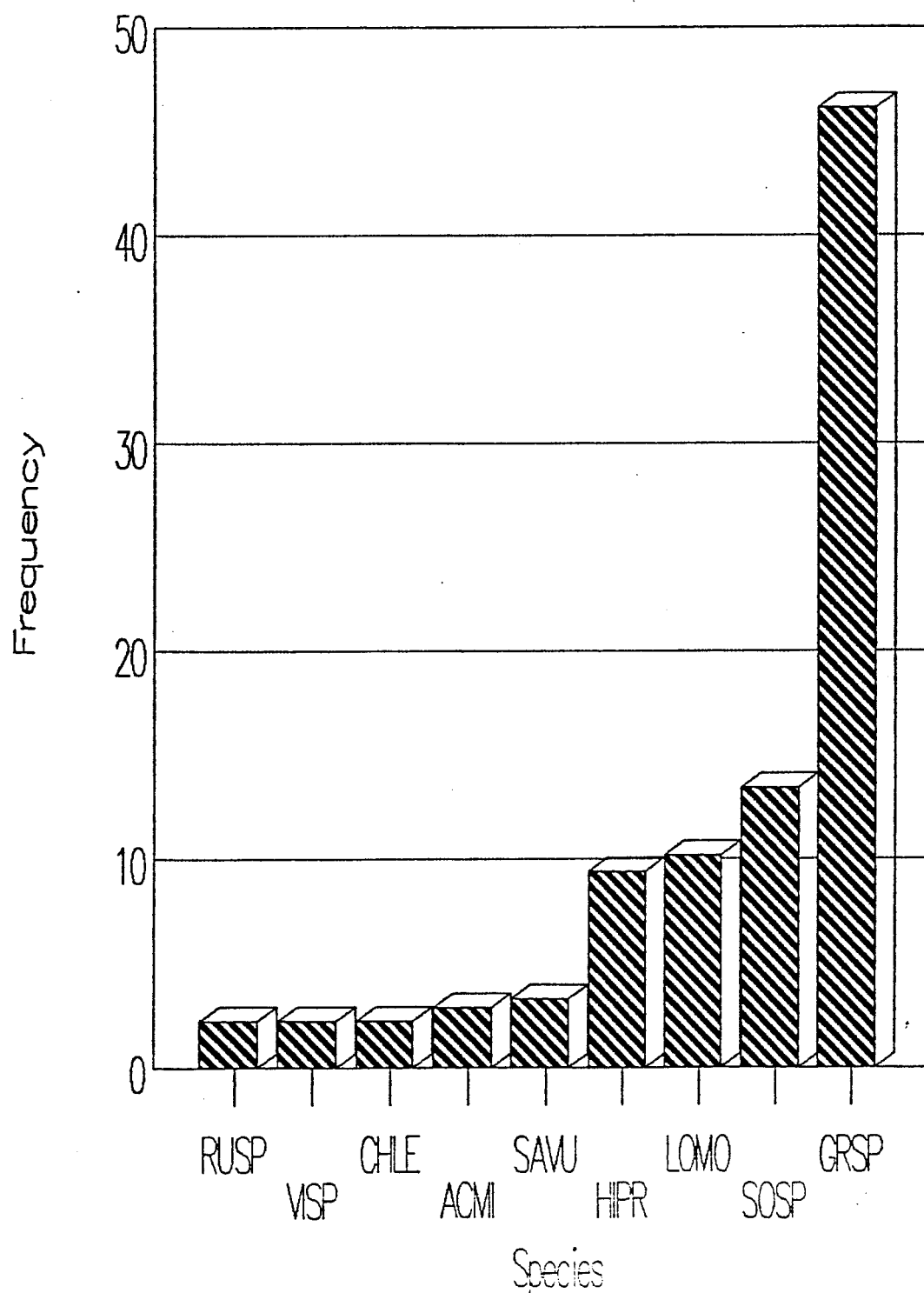


Figure 8: Relative Frequency >2

Transect 4



Discussion

The chi-square test of independence was chosen for the analysis of frequency data. Observed and expected frequencies were compared for testing hypotheses about the proportions of individuals which fell in respective categories, namely plant species and transect. However, restrictions on the use of chi-square were considered before appropriate data analyses.

There were quite small expected frequencies in many of the cells from the contingency tables. The distribution of chi-square may take different values from those shown in the statistical table if any expected frequency is less than 5 (Spence et al. 1976); therefore, relative frequencies less than two percent were not included in the contingency tables.

Hypotheses were formulated and tested to draw inferences, not proof. If the discrepancy between the observed and expected frequencies was too great to be due to chance when the null hypothesis was true the null hypothesis was rejected. Contrarily, failure to reject the null hypothesis was attributed to lack of statistical significance (Boldt 1987).

These observations do not prove that deer browsing has a direct effect on vegetation composition between fenced and unfenced areas. Rejection of the null hypothesis indicates that there is a relationship between transect location and species composition. However, vegetation patterns a priori dismiss deer influence. Conversely, comparisons between plots 2m and 48m and plots 50m through 98m within each transect retained the null hypothesis that the variables species composition and transect plots are not related. Additional time and line transect data are needed to provide interpretive results about the direct or indirect influence of deer on species composition and vegetational transition.

Further, the large discrepancy between the observed and expected frequencies of Satureja vulgaris warranted rejection of the null hypothesis that there was no significant difference in vegetation composition between experimental and control area transects in both years. This discrepancy is attributed to divergent, nonpermanent transect lines because local or small-area patterns enter into the measure of frequency (Mueller-Dombois and Ellenberg 1974).

Tree Regeneration

Tree regeneration is small and the percentage of plots stocked with 2 stems over 5 feet or 5 stems over 3 feet is unsatisfactory. Current guidelines for evaluation of regeneration stocking after clearcutting require that 70% of the 6-foot radius plots in a stand contain at least two stems over 5 feet in height (Marquis 1981).

To provide a measure of the overall impact of deer browsing on tree reproduction, approximately 5 years is needed to assess regeneration since the plots stocked with 2 stems over 5 feet may increase within the enclosure. And other measures are required to determine deer influence by forest type since deer selection of forest habitats is related to abundance of ground-level vegetation (Wigley and Garner 1987).

Ground Cover Vegetation

The perennial ground cover dominated by grasses and Solidago spp. may interfere with hardwood reproduction. Although these observations do not prove an allelopathic interference among plants, previous studies have demonstrated the ability of toxic organic chemicals to affect species composition of vegetation, rate of succession, and plant productivity. For example, the presence of coumarins in sweet vernal grass (Anthoxanthum odoratum) are easily leached, and have been identified as the cause of allelopathic phenomena (Horsley, unpublished).

Herbaceous Weed Control

Forest openings dominated by bracken fern (Pteridium aquilinum), wild oat grass (Danthonia compressa), rough goldenrod (Solidago rugosa), and flattop aster (Aster umbellatus) dramatically reduce seedling survival and growth of black cherry, red maple and other desirable hardwoods necessary for natural reproduction (Horsley 1981). If these herbaceous plants are removed physically or chemically, seedling survival and growth are substantially increased.

Conclusion

There is no direct evidence that deer browsing affects species composition or tree regeneration within control and experimental plots. But this study suggests, at least, that secondary succession has been redirected to a subclimax sere in which regeneration of tree species would be improbable. Thus, an allelopathic interference from grass and goldenrod cannot be dismissed.

I recommend mechanical or chemical removal of herbaceous vegetation within the enclosure area between July 1 and September 1. Glyphosate (Roundup) is the most economical choice for treatment. Extant herbaceous cover can be controlled with glyphosate at 1.1 kg/ha (16 oz/ac). It is not possible to say what levels of weed control are necessary; however, in previous studies, 70% weed control 3 years after treatment was set as the standard against which satisfactory weed control was measured for both forest stands and openings (Horsley 1981).

Since glyphosate also kills most woody plants at the time of application, new reproduction from seed stored in the field floor and seed dispersal by wind and animals must facilitate adequate stocking. For this reason, broadcast seeding 10,000 black cherry and red maple seeds per acre will be needed.

In addition, I recommend further examination of: a) seasonal shifts in deer density, and b) effects of allelopathic chemicals in fallow field communities. First, enclosure construction within different forest stands will be needed to determine deer selection and impact. Secondly, field herbicide application within additional enclosures offers one means of evaluating allelopathic plant interference. Nevertheless, additional studies will provide further experience and data on the question raised about white-tailed deer and allelopathic plant influences.

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