ILLINOIS NATURAL HISTORY SURVEY

CENTER FOR WILDLIFE ECOLOGY

HABITAT USE BY SMALL MAMMALS IN AN INTENSIVELY MANAGED GRASSLAND WILDLIFE SANCTUARY--
FINAL YEAR

FINAL REPORT FOR FY 99

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HABITAT USE BY SMALL MAMMALS IN AN INTENSIVELY MANAGED GRASSLAND WILDLIFE SANCTUARY - FINAL YEAR

Final Report for FY 99 to Illinois Wildlife Preservation Fund

Dr. Edward J. Heske, Illinois Natural History Survey

Introduction

The Short-eared Owl (*Asio flammeus*) and the Northern Harrier (*Circus cyaneus*) are listed as endangered in Illinois (IESPB 1992). Both species of raptor have become regular winter residents at Prairie Ridge State Natural Area (PRSNA; formerly, the Prairie Chicken Sanctuary) in Jasper Co., and have recently begun nesting there in the spring. Apparently, management practices implemented to benefit the endangered Greater Prairie Chicken (*Tympanuchus cupido*) also have benefited these endangered raptors and other species of grassland-associated birds.

Small mammals constitute the major prey items for Short-eared Owls and Northern Harriers (Colvin and Spaulding 1983, Collopy and Bildstein 1987), and analysis of contents of pellets indicates that this is true at the PRSNA (J. Walk, unpublished data; E. Heske, personal observation). An abundant supply of diurnal and crepuscular small mammals, in addition to extensive areas of grassland and wetland habitat suitable for roosting and nest sites, is necessary for successful overwintering and nesting of these raptors. Management practices at the PRSNA such as the planting and maintenance of

blocks of different types of vegetation undoubtedly affect the dispersion, abundance, and productivity of populations of small mammals (e.g., Getz 1985). Further, many species of small mammal exhibit pronounced annual or multiannual fluctuations in abundance (Taitt and Krebs 1985). Some habitat types may be important refuge areas for small mammals during population lows, and provide a ready source of colonists for vacant habitats during population increases.

The purpose of this study was to compare the species composition and relative abundance of small mammals in patches of different types of habitat at PRSNA. The study was conducted over four years to assess patterns of population fluctuations and identify the habitats, if any, that were most important during periods of low numbers. Because several of the plots were burned during the course of regular management activities at PRSNA, it was also possible to assess the short-term responses of small mammal assemblages to prescribed burns.

Methods

Study area.-- Prairie Ridge State Natural Area in Jasper Co., Illinois, was established in the early 1960's to preserve and maintain grassland habitat for nesting, brood cover, foraging areas, and roosting sites for the Greater Prairie Chicken. PRSNA (combining areas in both Jasper and Marion counties) now includes 2400 acres of intensively managed grassland and is the second largest state-managed grassland in Illinois. PRSNA also provides habitat for 35 species of vertebrates of special concern (i.e., species recorded so far at the site): 17 State Endangered Species, 7 State Threatened Species, 6 species on the state watch list, and 5 area-sensitive species (Simpson and Esker 1997). Management goals for PRSNA are expanding from single-species management to

grassland-ecosystem management in response, thus including concern for all endangered and threatened species recorded at the site while maintaining preservation of the Greater Prairie Chicken as the top priority.

Habitat types.-- This study quantified differences in species composition and abundance of small mammals inhabiting four major types of vegetation maintained at Prairie Ridge: brome fields (*Bromus inermis*), red-top fields (*Agrostis alba*), native prairie restorations, and fields lightly seeded with legumes and left weedy to provide brood cover. Twelve study plots were selected for small mammal surveys in the fall of 1995 in consultation with Ron Westemeier, Illinois Natural History Survey (map showing Jasper County study areas in Fig. 1). Three replicates of each of the four habitat types were selected. To account for spatial variation, study plots were distributed among three separate tracts (each in a different square-mile section, see Fig. 1): Donnelly tracts (3 and 9 in Fig. 1), Marshall Field III (10 in Fig. 1), and Donsbach-McCormack tracts (6 and 16 in Fig. 1). Study plots representing each habitat type were located as close to each other in each tract as possible so that the same local population of small mammals could potentially occupy all plots in a tract. Replicates of habitat types were as similar to each other as possible given existing vegetation. Each plot was ca. 10 acres.

Survey Protocol.-- Small mammals were surveyed in each study plot by live-trapping. Surveys were conducted in the fall (late Sept./Oct. - time of arrival of overwintering raptors) and spring (March - just prior to nesting season for raptors and chickens) of each year from fall 1995 through spring 1999. In each survey (n = 8), each study plot (n = 12) was live-trapped for 3 nights and days using Sherman live traps baited with mixed bird seed. Live traps were spaced 10 m apart in three parallel lines spaced ca. 20 m apart, for

a total of 100 traps (300 trap-nights) per study plot. Traps were set on day 1 of a survey, then checked on the following 3 mornings. Because voles (*Microtus* sp.) and bog lemmings (*Synaptomys cooperi*) are the principal prey items of raptors at PRSNA (J. Walk, unpublished data) and these species of small mammals are active throughout the day, traps were left open and in place throughout each survey until collected after the final check on day 4. In most surveys, six plots could be trapped simultaneously (i.e., plots on one and a half tracts). Thus, each survey required about 8 days of trapping.

Data collected from each small mammal captured included species, weight, sex, approximate age (adult or juvenile), and reproductive condition. In the first two surveys, all small mammals were individually marked with metal ear-tags to determine if individuals persisted from survey to survey, and if movements between adjacent plots occurred. Only four individuals were recorded on adjacent plots and only three ear-tagged individuals were recorded in sequential surveys; thus, the added expense and effort of ear-tagging was not considered worthwhile. After spring 1996, captured individuals were only marked by fur-clipping a small patch on the rump so that animals recaptured within a single survey could be identified.

Results and Discussion

Eight small mammal surveys were conducted. Two were conducted using personal funds (21 October - 1 November 1995, 11-17 March 1996), and six were supported by the Illinois Wildlife Preservation Fund (25 October - 1 November 1996, 21-29 March 1997, 20 October - 2 November 1997, 22-29 March 1998, 2 - 11 October 1998, 19-29 March 1999).

Species captured.-- A total of 3, 370 small mammals was captured during these surveys: 2,070 prairie voles (*Microtus ochrogaster*), 175 meadow voles (*Microtus pennsylvanicus*), 171 southern bog lemmings (*Synaptomys cooperi*), 706 deer mice (*Peromyscus maniculatus*), 164 house mice (*Mus musculus*), 70 least shrews (*Cryptotis parva*), 7 northern short-tailed shrews (*Blarina brevicauda*), 5 white-footed mice (*Peromyscus leucopus*), and 2 meadow jumping mice (*Zapus hudsonius*). In addition, 2 long-tailed weasels (*Mustela frenata*) were captured.

The records of meadow voles are particularly noteworthy, as this species has not previously been reported to occur this far south in Illinois (Hoffmeister 1989). Because meadow voles and prairie voles can sometimes be difficult to distinguish, three presumed meadow voles were collected so that their molar teeth could be examined to confirm species designations. All three presumed meadow voles had the extra loop of enamel on their upper third molar, confirming that they were indeed *Microtus pennsylvanicus* (Hoffmeister 1989, page 228). Thus, the data herein constitute a range extension for this species.

Population dynamics.-- Numbers of small mammals captured per survey ranged from 175 to 818 (Table 1, Fig. 2). Prairie voles were the most abundant species in all surveys (Fig. 1). Meadow voles became abundant on some plots during 1998 - 1999, however, and were the second most abundant species in the final survey in spring 1999. In all other years, deer mice were the second most common species. Although numbers of small mammals fluctuated considerably, the variation reported herein (approximately 4-fold change in numbers) is much less than that reported for populations of microtines considered "cyclic" (100-fold changes, often ranging from virtually none to 200-400 per

acre, Taitt and Krebs 1985). Most population cycles of microtine rodents occur over a 4-year interval, with rapid crashes following population peaks (Taitt and Krebs 1985). Thus, although 4 years is a short length of time over which to evaluate cycles, the consistently moderate to high numbers of small mammals at PRSNA in these surveys suggests that voles here did not cycle as they do in some other areas. The methods used provide only a comparative index of small mammal abundance on each plot and not a measure of density (which would have required setting up trapping grids on each plot rather than using line transects), but it appears from our data that the management practices at PRSNA are maintaining a productive environment for small mammals.

Response to prescribed burns.-- Selected fields are burned in the winter or early spring by managers at PRSNA to benefit native vegetation, reduce the amount of litter buildup, provide woody plant control, improve nest and brood cover, and maintain sod longevity for cool season grasses (Simpson and Esker 1997). During this study, one red-top field (Donnelly tract) was burned prior to the small mammal survey in spring 1997, one legume/weed field (Donsbach/McCormack tract) was burned prior to the survey in spring 1998, and prairie restorations were burned four times prior to spring surveys (Donnelly and Marshall tracts in 1997, Donsbach/McCormack tract in 1998, and Donnelly again in 1999). In addition, the Marshall prairie plot was hayed to a low height prior to the survey in fall 1997 and cover was still reduced in spring 1998.

In the springs following burns, burned plots had virtually no vegetative cover. Microtine rodents were absent from these plots on the Donsbach/McCormack and Donnelly tracts at such times, and only a few voles were captured on the burned Marshall tract plot along the edge of the plot where strips of roadside vegetation remained intact

(Figs. 3-5). Vegetation recovered quickly as the season warmed, however, and burned plots were quickly recolonized by small mammals. By the fall surveys, burned plots had numbers of microtines as high or higher than those on unburned plots in each tract. The only exception was the Marshall tract prairie plot in fall 1997, where haying apparently reduced cover again in the late summer and consequently the number of voles on this plot had recovered somewhat but was still less than that on other plots in the tract (Fig. 4).

In contrast to microtine rodents, numbers of deer mice remained high on burned plots (Figs. 6-8). The apparent increases on the burned plots may have resulted from competitive release due to the absence of microtines, or may be an artifact of increased trappability (traps are more obvious because there is no obstructing vegetation, or the bait is more attractive because most resources have been destroyed by fire). In any case, deer mice did not show avoidance of plots with little to no cover.

Deer mice rarely appeared in raptor pellets at PRNSA (J. Walk, unpublished data; E. Heske, personal observation), and microtine rodents are the principal small mammal prey consumed. Thus, prescribed burns reduce prey availability on some plots during the overwintering and nesting period for Northern Harriers and Short-eared Owls at PRSNA. On the other hand, recovery is quick and the reduced litter and fresh growth may promote higher numbers of microtines in the following year. Thus, burning does not seem to harm the prey base for raptors, and may even benefit it, as long as burns are scattered (leaving adjacent unburned habitat as a refuge and later source of colonists). Current practices appear sound in this regard.

Habitat use by small mammals.-- This study was original designed to be analyzed by repeated measures analysis of variance (3 replicates of 4 habitat types, sampled

repeatedly for 8 surveys). However, several factors acting after initiation of the study complicated this analysis. First, the prescribed burns were not anticipated (my own inexperience with the site to blame), disrupting the repeated measures (gaps in the data in 3 years for some plots). Second, although replicate plots were selected to be as similar to each other as possible, successional changes occurred quickly during the study, changing the character of some plots over time. These will be described below. Finally, habitats critical as population refuges can only be identified in a low year; small mammals are generally widespread during years of high numbers. As numbers never declined to low levels typical of population crashes, differences among habitats were subtle. Data will be further analyzed before submission for publication in a scientific journal (I anticipate 1-2 papers co-authored by D. Rosenblatt, who frequently assisted with the field work; copies of manuscripts will be submitted to the Wildlife Preservation Fund as they are completed later this summer). Here, qualitative differences in the study lots are noted first, followed by discussion of apparent responses of the small mammals.

Brome plots: The brome plots on the Donsbach/McCormack and Marshall tracts were almost monocultures, with few dicots or other types of grasses apparent in the dense cover of brome. The Marshall brome plot was slightly more diverse than the Donsbach/McCormack plot, with some orchard grass along the eastern and southern edges and a few tall weeds. In contrast, the brome plot on the Donnelly tract contained diverse vegetation in addition to the dominant cover of brome, including dewberry, lespediza, and several kinds of weedy dicots. The brome plots did not change much in character during the study (i.e., showed little evidence of succession). Brome plots were generally mowed to a height of about 15 inches prior to fall small mammal surveys.

Red-top plots: Red-top plots contained diverse vegetation on all three tracts. The Donnelly red-top plot was the most densely vegetated, with large amounts of dewberry, weedy dicots, and timothy mixed in with the dominant red top. This plot was not usually mowed. The Donsbach/McCormack and Marshall red-top fields were also diverse. The Marshall field had large amounts of dewberry and lespediza, and the Donsbach/McCormack field had considerable timothy and weedy dicots. The latter two fields were generally mowed to a height of 15 inches before the fall surveys, but the Donsbach/McCormack field was not mowed in fall 1998, resulting in dense cover of timothy, goldenrod and other tall weeds in the fall 1998 and spring 1999 surveys.

Prairie plots: Each prairie restoration was slightly different. The Donnelly plot was dominated by big bluestem that rose to about 8 feet in height in summer and fall. This plot had tough, mature hummocks of big bluestem and a thick thatch groundcover during the first three surveys, but the ground surface opened considerably and many more small dicots were noted on this plot after it was burned in spring 1997. The Donsbach/McCormack prairie plot was lightly grazed by cattle and was dominated by shorter warm-season grasses such as Indian grass and little bluestem, with a moderate amount of weedy dicots mixed in. The Marshall plot had scattered big bluestem, particularly along the western side, but was much more open than the Donnelly plot and was dominated more by Indian grass mixed with weedy dicots on the eastern half. The Donnelly plot was generally combined to a height of about 20 inches to harvest grass seeds about the time of the fall surveys. As noted above, the Marshall plot was hayed (to a height of about 5-10 inches) in summer 1997, and the Donsbach/McCormack plot was

mowed to a height of 15 inches in fall 1998. Otherwise, except for the changes wrought by prescribed burns, these plots changed little in general appearance over the surveys.

Legume/weed plots: The legume/weed plots were the most variable as a group and showed the most drastic changes over time. The Donnelly plot had a dense, moderately tall growth of weeds and light growth of alfalfa and clover on its northern half at the start of the study in 1995, and graded into brome grass on the southern half. This plot was mowed to a height of 15 inches each fall. By spring 1997, the weedy growth and legumes had declined considerably, and brome began to dominate throughout the field. By the final survey, the Donnelly legume/weed field appeared almost a monoculture of brome and strongly resembled the brome plots on the Donsbach/McCormack and Marshall tracts. The legume/weed plot on the Donsbach/McCormack tract was dominated by dense hummocks of orchard grass, with moderate to dense cover of tall weeds mixed with sparse, old alfalfa and a few patches of timothy on the western half in 1995. This was the most mesic plot, and was often soggy or partially flooded during spring surveys. The dense, tall weeds provided thick cover until the plot was burned in spring 1998, after which the weeds were thin and the legumes were absent, but orchard grass recovered quickly and dominated the ground cover. The Marshall legume/weed plot was planted with timothy, wheat, alfalfa, some clover, and mixed tall weeds in 1995. It had the most open ground layer at this time, with little grassy cover other than the patches of timothy. This plot was narrower than the others, with only half of the 10 acres planted each year. Alternate sides of this plot half were disced in fall and replanted (or let grow to weeds), thus, one half of this field was always open, bare soil and the other was covered by tall weeds in each survey. During the latter four surveys, this plot tended to

have more dense, grassy ground cover and tall, shrubby composites on its northern end than it did in the early surveys.

Microtine rodents: The distribution of microtine rodents among plots on each tract is shown in Figures 3-5. During surveys with high numbers of microtines (e.g., spring 1996, fall 1997, spring 1998), microtines were common wherever there was good ground cover. In most years, microtines were less common on the brome plots that were not vegetatively diverse. Thus, the brome plots on the Donsbach/McCormack and Marshall tracts typically had low numbers of microtines, and the legume/weed plot on the Donnelly tract had low numbers in the last two surveys after it became predominantly a monoculture of brome. In contrast, the more diverse brome field on the Donnelly tract generally supported moderate numbers of microtines. *Bromus inermis* is a low-quality for food for voles after it matures in summer (G. O. Batzli, personal communication), and thus, although brome provides excellent cover, monocultures of brome may provide poor nutrition for populations of microtines.

Red-top fields consistently supported moderate to good numbers of microtines, and the highest numbers recorded in this study were in the red-top field on the Donnelly tract after this plot was burned in 1997. The prairie plots on the Donsbach/McCormack and Marshall tracts also supported moderate numbers of microtines, primarily prairie voles. The Donnelly prairie plot had few voles when it was dominated by tough, older hummocks and thatch of big bluestem, but supported good numbers of voles after it was burned. Finally, the legume/weed plots were variable in their support of microtines. The Marshall plot had few microtines when there was sparse ground cover, but numbers increased in the northern half of this plot when cover was good.

In sum, microtine rodents appeared to maintain moderate numbers in most habitat types surveyed, but did not do well in fields that became too dominated by brome (e.g., Marshall brome plot, Donsbach/McCormack brome plot, Donnelly legume/weed plot in last two surveys), that lacked substantial ground cover (e.g., Marshall legume/weed plot in first four surveys, and southern end of this plot in later surveys), or that were dominated by old, dense growth of tough perennial grasses like big bluestem (e.g., Donnelly prairie plot before the burn). Among the microtines, the largest numbers of prairie voles (642) and meadow voles (104) were captured in red-top fields, but the largest number of southern bog lemmings (63) was captured in brome fields (Table 2).

Deer mice: The distribution of deer mice among plots on each tract is shown in Figures 6-8. Deer mice were most common in prairie and legume/weed plots on the Donsbach/McCormack and Marshall tracts in most years, but also occurred in lower numbers in red-top fields. Deer mice were also more abundant I the Donnelly prairie plot, particularly after it was burned. Like the microtines, deer mice did not occur in substantial numbers in fields strongly dominated by brome (Table 2).

House mice: The distribution of house mice among plots on each tract is shown in Figures 3-5. House mice did not appear in every survey, and were particularly abundant in fall 1995, fall 1997, fall 1998, and spring 1999. On the Donnelly tract, house mice were most common in the prairie plot, but at low numbers and in only a few years. House mice were most common in the legume/weed plots on the Donsbach/McCormack and Marshall tracts, and to a lesser extent in the prairie plot on the Marshall tract (Table 2). These plots were the nearest to human structures (barns and storage sheds), and the

Marshall legume/weed plot in particular often had the most open ground layer (where the house mice occurred) and the most seed-producing weeds.

Other small mammals: Distributions of other species of small mammals are based on fewer captures. Least shrews, in contrast to most other species, were captured most frequently in the brome fields (Table 2). Northern short-tailed shrews were captured in only one field, the Donnelly legume/weed plot, in two surveys (Table 2).

Summary: A species list and relative abundances of species of small mammals at Prairie Ridge State Natural Area is provided. This list includes all species of small mammals associated with grasslands expected for this region. No evidence of population cycles was detected during the four years of this study, and numbers were consistently moderate to high, suggesting that a productive environment for small mammals is being maintained (although the factors causing cycles are still debated). Small mammals that constitute the main prey for raptors at PRSNA were absent from recently burned plots, but recolonized plots quickly when vegetation recovered. Prescribed burns may even benefit populations of small mammals in some cases by reducing cover by tough, unpalatable species and promoting fresh growth and plant diversity. Most types of habitats supported populations of important prey species, but monocultures of brome grasses supported few small mammals (with the possible exception of small numbers of southern bog lemmings and least shrews) and a weed plots that was disced each year supported mostly house mice and deer mice which are not preferred prey. In general, current management practices appear good for small mammals at PRSNA, but caution should be observed to 1) disperse sites selected for burns each year so that burned areas are adjacent to unburned habitat that can provide refuge for microtine rodents and later provide a source of colonists, and

2) occasionally lightly seed or otherwise enhance vegetative diversity in brome fields if increased numbers of small mammals in these fields is desired; otherwise, promote and maintain vegetative diversity in red-top, prairie, and weed fields.

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Table 1

Survey and habitat type	Donnelly plots	Marshall plots	Donsbach plots	Total for all 3 tracts
Fall 1995				
Brome	15	5	20	40
Red-top	29	18	40	87
Prairie	17	40	12	69
Legume/weed	25	27	37	89 (285 total)
Spring 1996				
Brome	45	26	13	84
Red-top	24	33	44	101
Prairie	21	75	35	131
Legume/weed	71	37	109	217 (533 total)
Fall 1996				
Brome	20	9	8	37
Red-top	25	25	13	63
Prairie	30	24	3	57
Legume/weed	21	25	26	72 (229 total)
Spring 1997				
Brome	65	11	27	103
Red-top	6*	61	35	102
Prairie	8*	20*	39	67
Legume/weed	51	16	40	107 (379 total)
Fall 1997				
Brome	51	47	24	122
Red-top	154	86	40	280
Prairie	103	62	54	219
Legume/weed	67	82	48	197 (818 total)
Spring 1998				
Brome	92	15	30	137
Red-top	83	35	24	142
Prairie	82	21**	18*	121
Legume/weed	85	76	16*	177 (577 total)
Fall 1998				
Brome	46	11	4	61
Red-top	60	16	11	87
Prairie	54	29	50	133
Legume/weed	8	55	30	93 (374 total)

Survey and habitat type	Donnelly plots	Marshall plots	Donsbach plots	Total for all 3 tracts
Spring 1999				
Brome	12	7	1	20
Red-top	18	14	25	57
Prairie	4*	28	18	50
Legume/weed	0	30	18	48 (175 total)
Total 1995-99				
Brome	346 (297)	131 (108)	127 (98)	604 (503)
Red-top	399 (330)*	288 (257)	232 (196)	919 (783)*
Prairie	319 (170)**	299 (186)*	229 (171)*	847 (527)****
Legume/weed	328 (267)	348 (108)	324 (225)*	1000 (600)*

*burned plots (in Total, number of * equals number of burned plots included)
**hayed previous fall

Table 1. Numbers of small mammals captured in different habitat types. Total numbers for all years given in bottom row; number of microtines (*M. ochrogaster, M. pennsylvanicus, S. cooperi*) in parentheses.

Table 2

Table 2. Numbers of each species captured in different habitat types.

Survey and habitat type	M. ochr.	M. penn.	S. coop.	P. manic.	M. mus.	C. parva	B. brev.
Fall 1995							
Brome	21	0	1	5	9	4	0
Red-top	56	4	1	11	13	2	0
Prairie	20	1	3	24	20	1	0
Legume/weed	39	0	0	21	28	1	0
Spring 1996							
Brome	62	2	10	3	1	6	0
Red-top	84	0	10	3	0	4	0
Prairie	109	3	7	6	2	4	0
Legume/weed	170	2	0	24	20	0	1
Fall 1996							
Brome	29	0	1	7	0	0	0
Red-top	54	4	0	4	0	1	0
Prairie	24	2	10	20	1	0	0
Legume/weed	35	0	0	30	7	0	0
Spring 1997							
Brome	80	6	13	4	0	0	0
Red-top*	84	7	3	7	0	1	0
Prairie**	35	2	3	27	0	0	0
Legume/weed	61	3	5	37	1	0	0
Fall 1997							
Brome	71	0	17	14	1	19	0
Red-top	227	5	4	36	3	5	0
Prairie	106	0	1	99	8	3	0
Legume/weed	103	0	20	48	9	11	6
Spring 1998							
Brome	112	0	11	14	0	0	0
Red-top	77	39	7	19	0	0	0
Prairie*	50	7	9	54	1	0	0
Legume/weed*	72	2	4	90	6	0	0
Fall 1998							
Brome	39	4	5	10	0	3	0
Red-top	41	22	1	20	1	2	0
Prairie	80	11	1	39	0	1	0
Legume/weed	47	6	3	14	21	1	0

Survey and habitat type	M. ochr.	M. penn.	S. coop.	P. manic.	M. mus.	C. parva	B. brev.
Spring 1999							
Brome	12	2	5	0	0	1	0
Red-top	19	23	10	4	0	0	0
Prairie	32	10	5	3	0	0	0
Legume/weed	19	8	1	8	12	0	0
Total 1995-99							
Brome	426	14	63	57	11	33	0
Red-top*	642	104	36	104	17	15	0
Prairie****	456	36	39	272	32	9	0
Legume/weed*	546	21	33	272	104	13	7

*includes 1 burned plot
**includes 2 burned plots
****includes 4 burned plots

Species names:

M. ochr.	*Microtus ochrogaster*, Prairie vole
M. penn.	*Microtus pennsylvanicus*, Meadow vole
S. coop.	*Synaptomys cooperi*, Southern bog lemming
P. manic.	*Peromyscus maniculatus*, Deer mouse
M. mus.	*Mus musculus*, House mouse
C. parva	*Cryptotis parva*, Least shrew
B. brev.	*Blarina brevicauda*, Northern short-tailed shrew

Not included in table: 2 *Zapus hudsonius*, Meadow jumping mouse, captured in Fall 1997, and 5 *Peromyscus leucopus*, White-footed mouse, 2 captured in Spring 1998, 2 captured in Fall 98, and 1 captured in Spring 99.

Figure legends

Fig. 1.-- Study areas at Prairie Ridge State Natural Area, Jasper County. Map taken from Simpson and Esker 1997, with study plots in each tract marked as black rectangles.

Fig. 2.-- Population fluctuations in small mammals at Prairie Ridge State Natural Area, fall 1995 - spring 1999.

Fig. 3.-- Captures of microtine rodents (prairie voles, meadow voles, and southern bog lemmings) on study plots on the Donnelly tract.

Fig. 4.-- Captures of microtine rodents (prairie voles, meadow voles, and southern bog lemmings) on study plots on the Marshall tract.

Fig. 5.-- Captures of microtine rodents (prairie voles, meadow voles, and southern bog lemmings) on study plots on the Donsbach/McCormack tract.

Fig. 6.-- Captures of deer mice on study plots on the Donnelly tract.

Fig. 7.-- Captures of deer mice on study plots on the Marshall tract.

Fig. 8.-- Captures of deer mice on study plots on the Donsbach/McCormack tract.

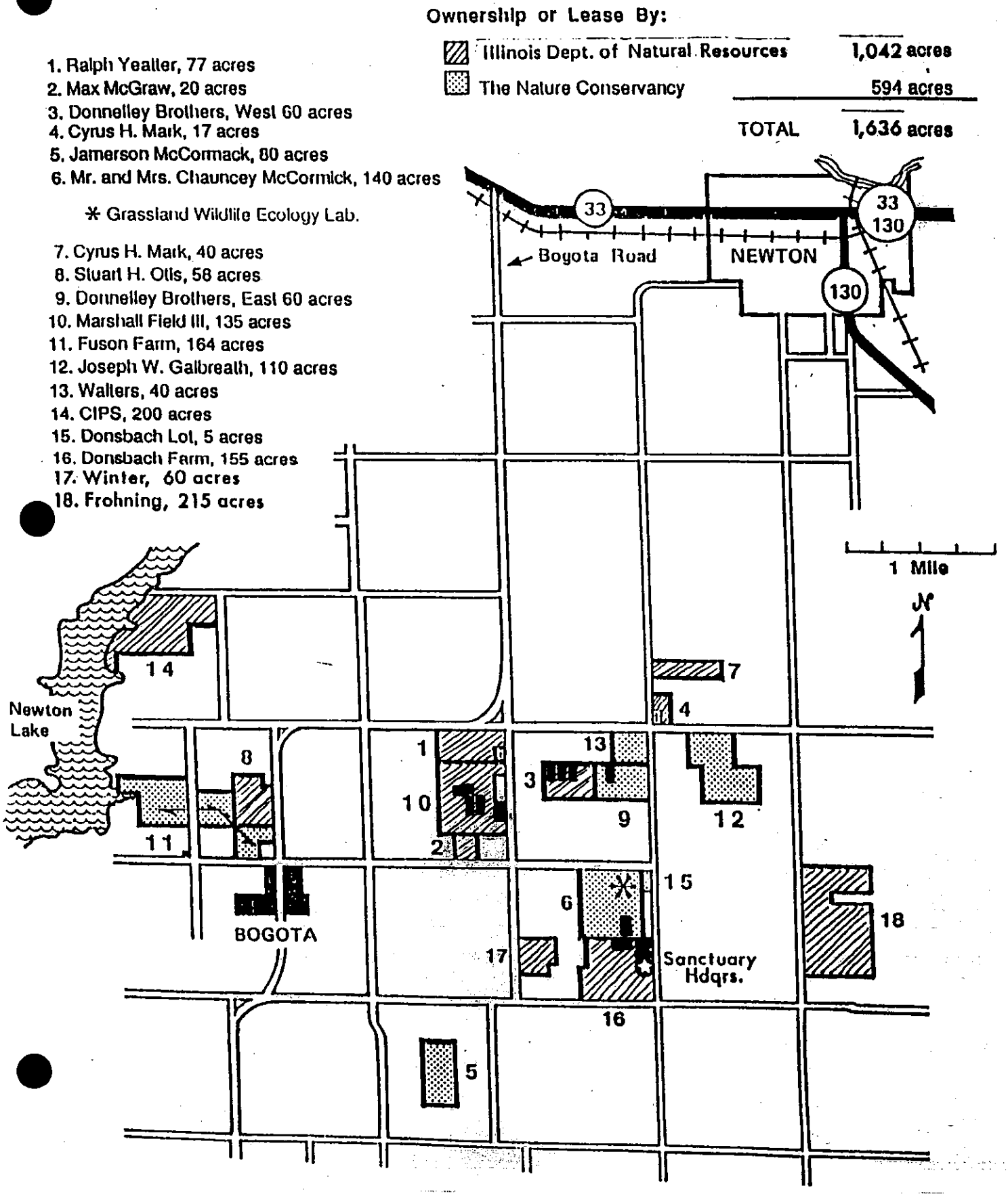
Fig. 9.-- Captures of house mice on study plots on the Donnelly tract.

Fig. 10.-- Captures of house mice on study plots on the Marshall tract.

Fig. 11.-- Captures of house mice on study plots on the Donsbach/McCormack tract.

Fig. 1

Figure 1. Prairie Ridge State Natural Area - Jasper County



Fluctuation in Numbers

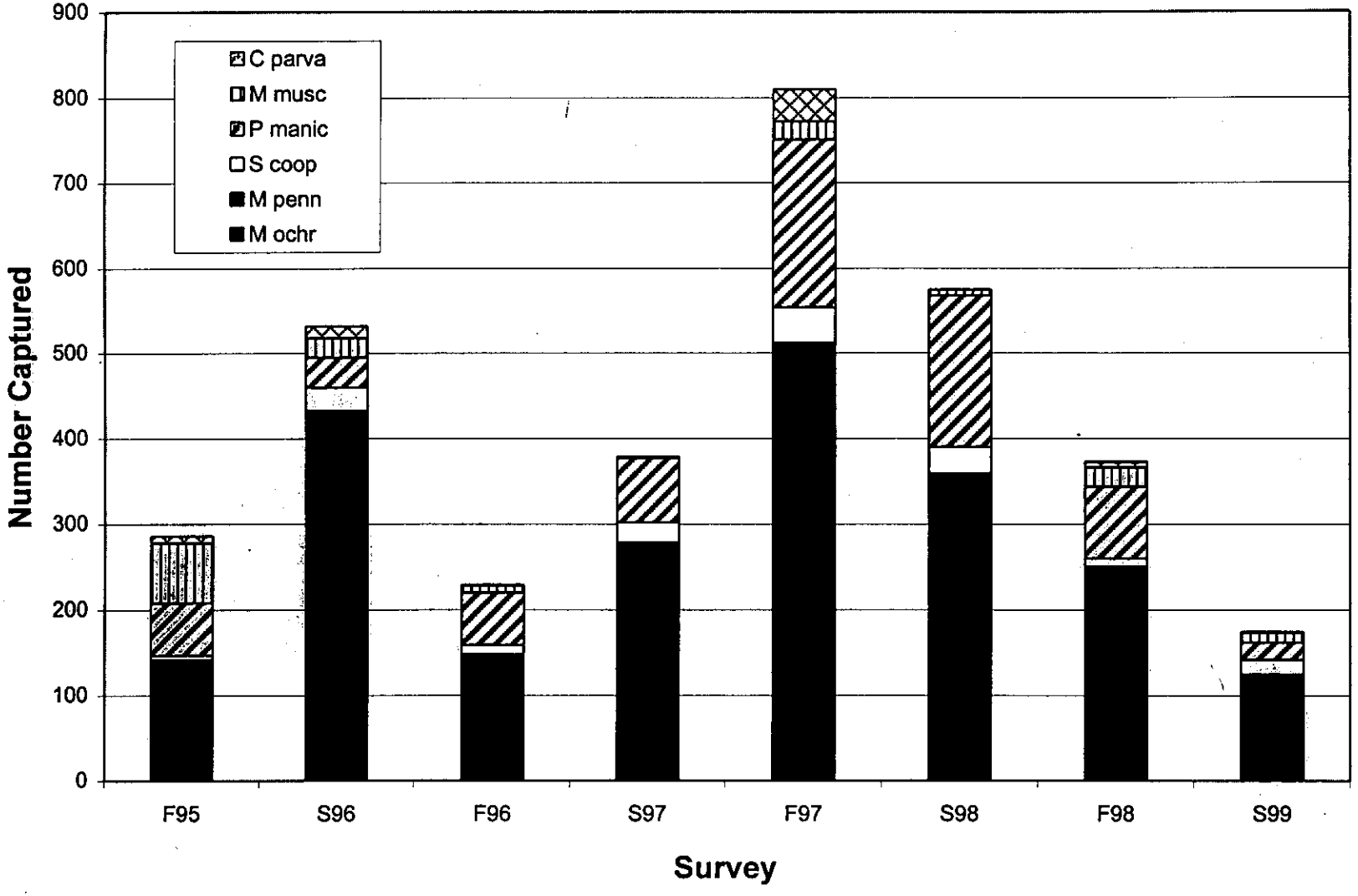


Fig. 2

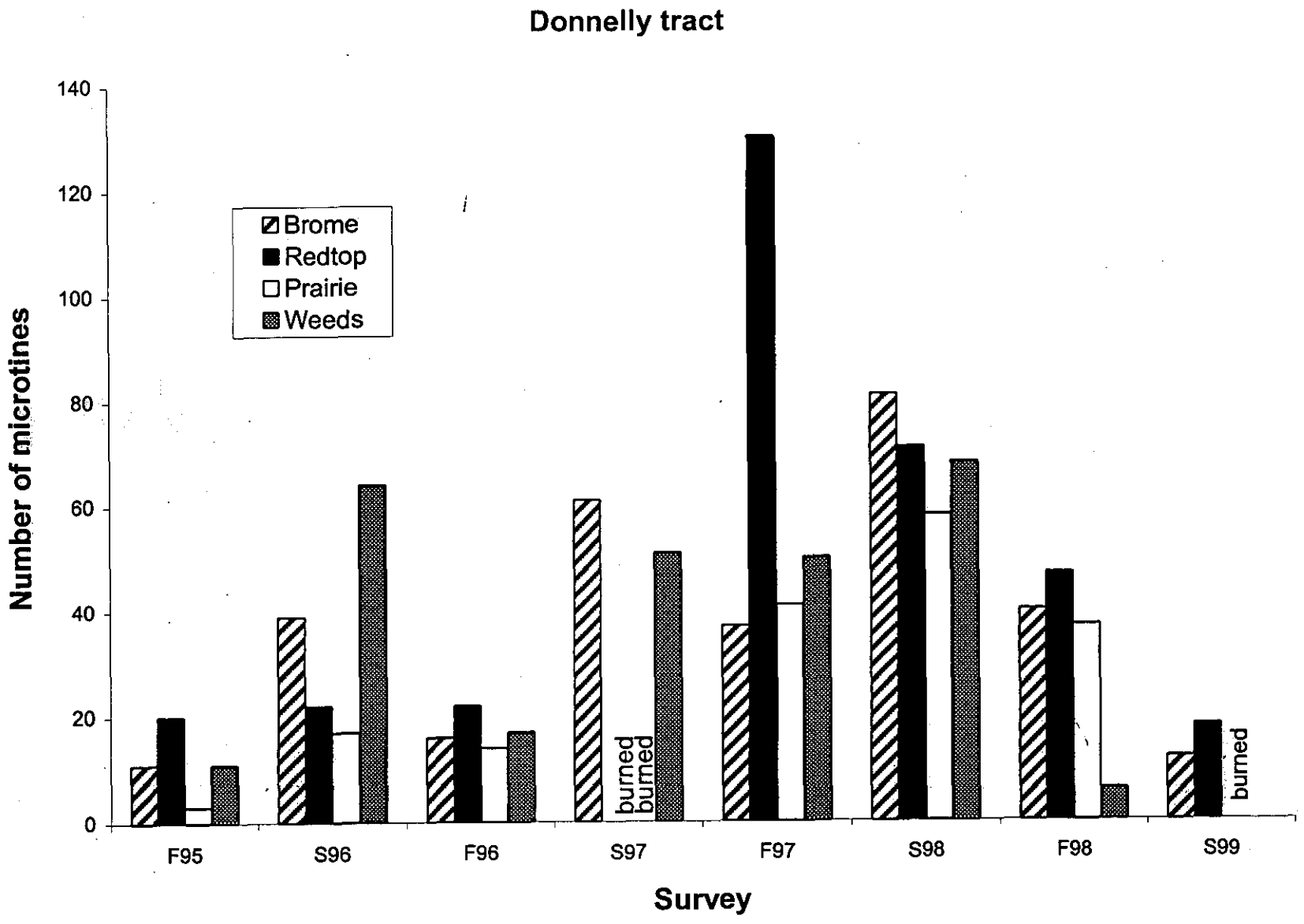

Donnelly tract
Number of microtines
140
120
100
80
60
40
20
0
Brome
Redtop
Prairie
Weeds
burned
burned
burned
F95
S96
F96
S97
F97
S98
F98
S99
Survey

Fig. 3

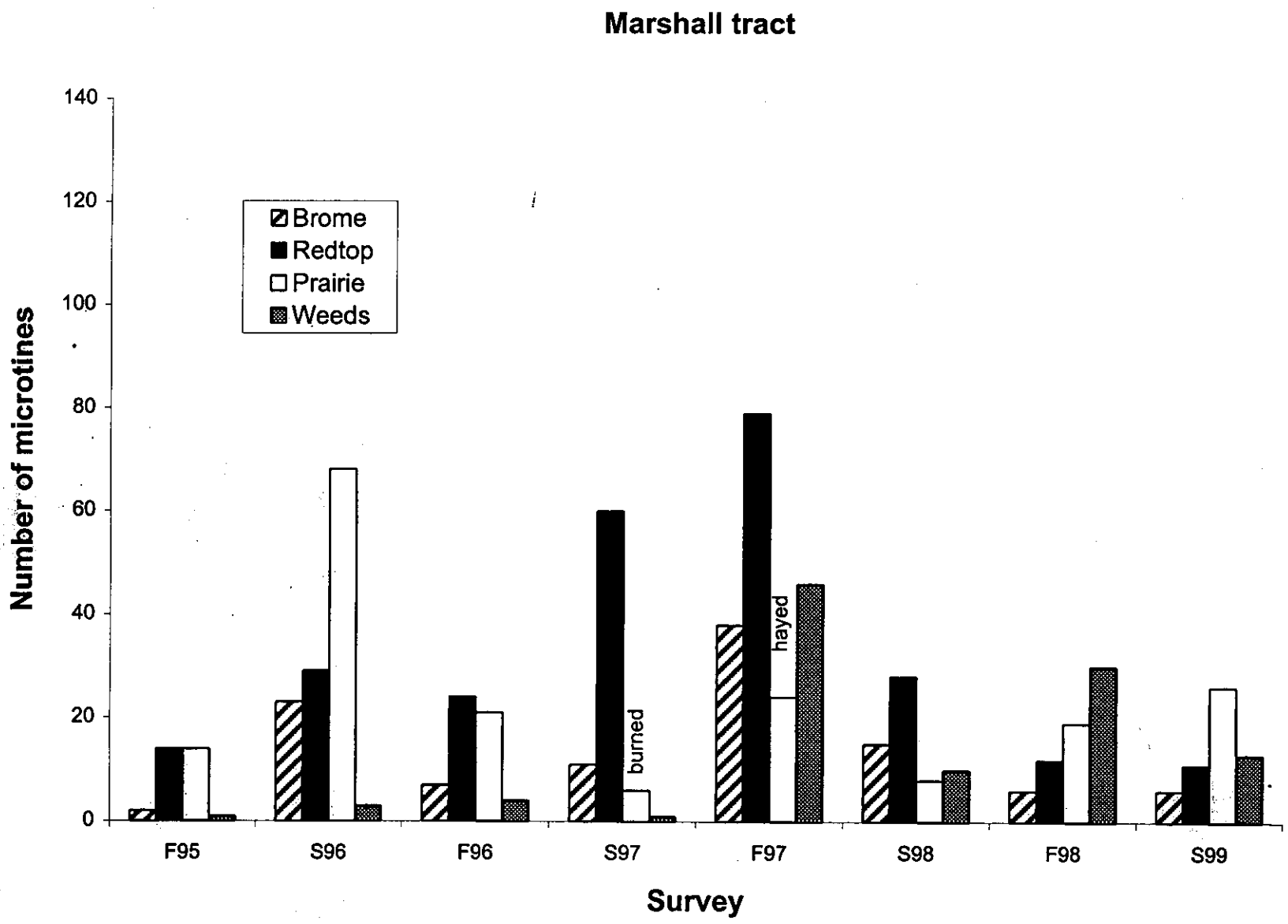
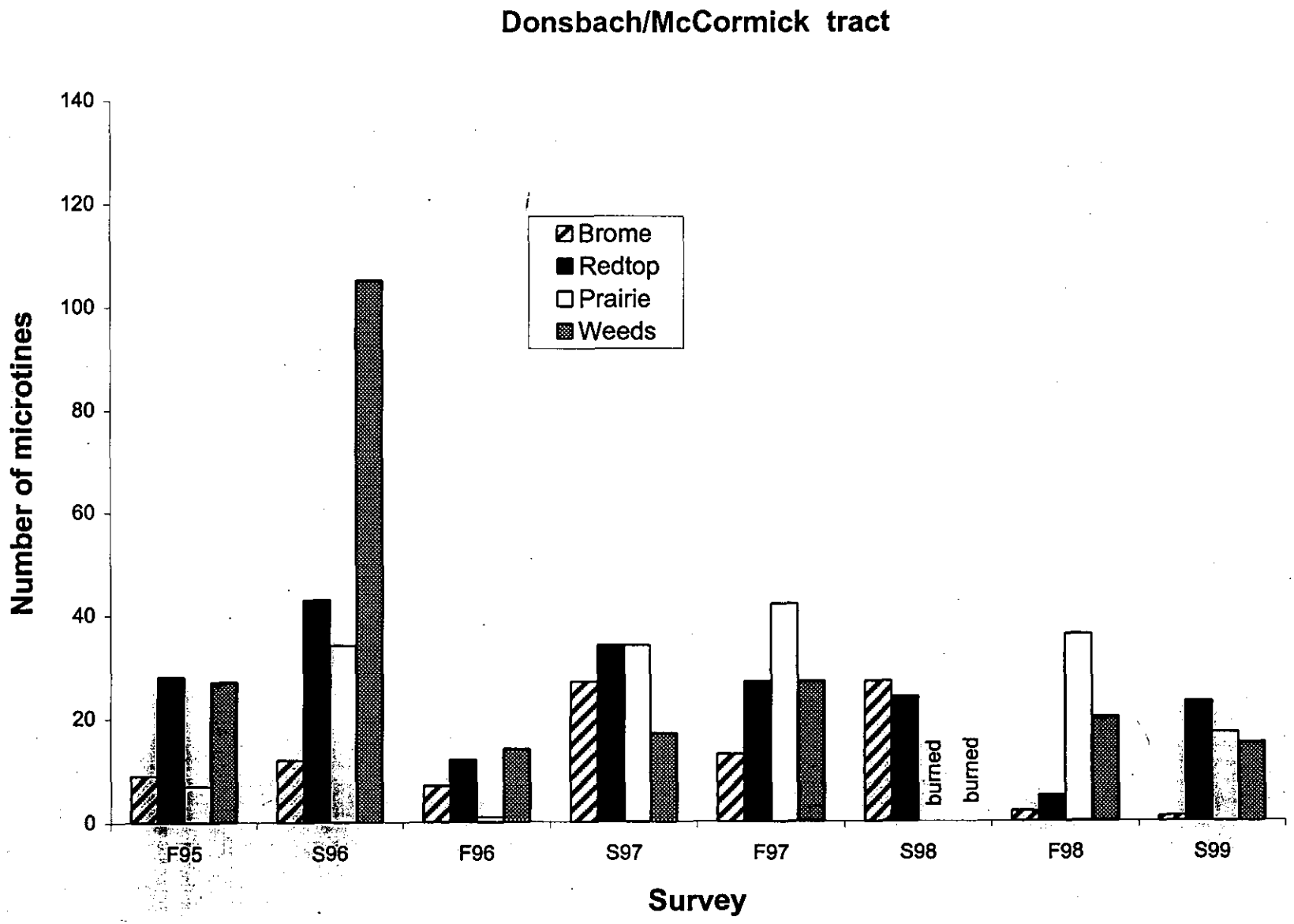

Marshall tract
Number of microtines
140
120
100
80
60
40
20
0
Brome
Redtop
Prairie
Weeds
burned
hayed
F95
S96
F96
S97
F97
S98
F98
S99
Survey

Fig. 4


Donsbach/McCormick tract
Number of microtines
140
120
100
80
60
40
20
0
Brome
Redtop
Prairie
Weeds
burned
burned
F95
S96
F96
S97
F97
S98
F98
S99
Survey

F-9, S

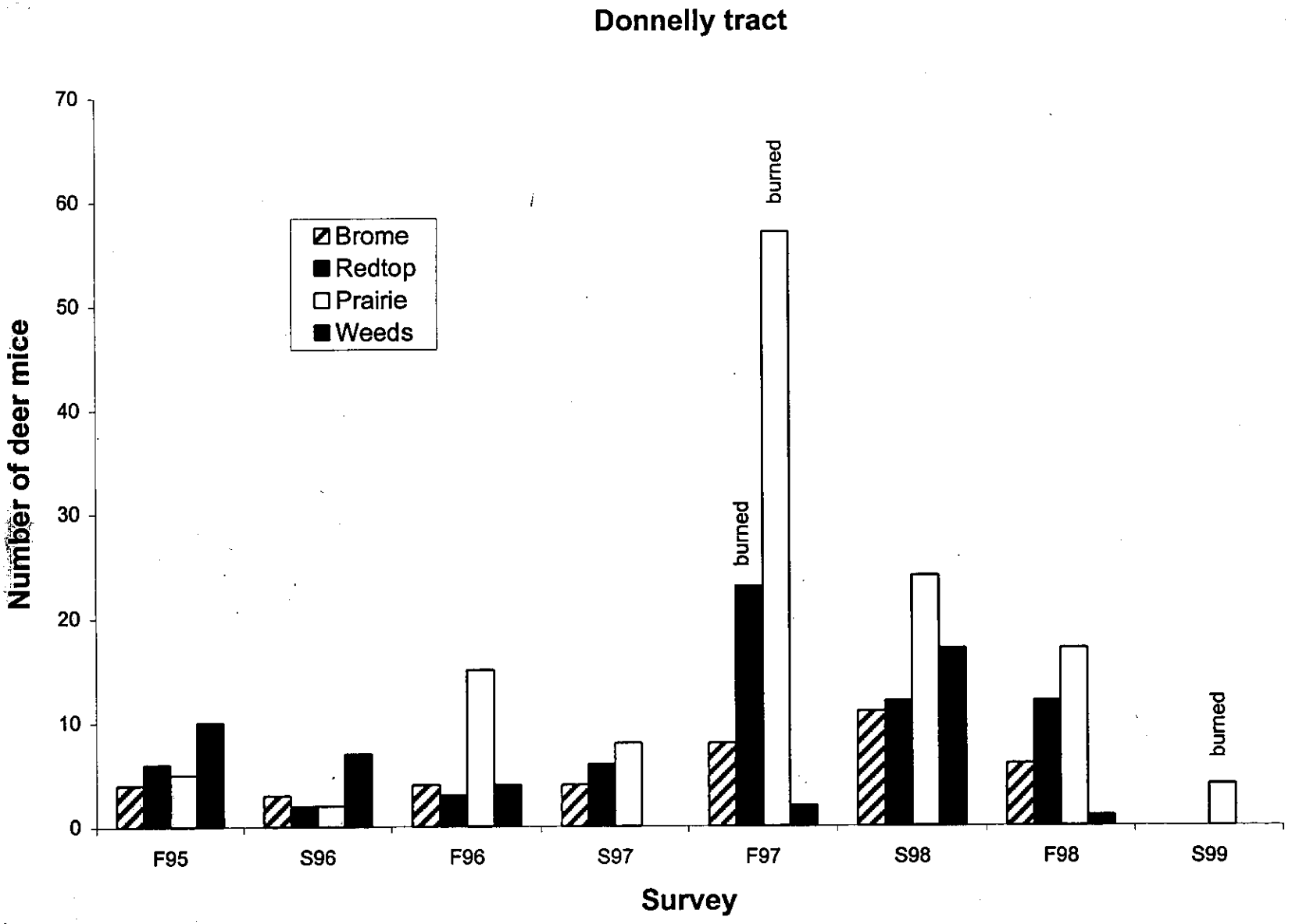

Donnelly tract
Number of deer mice
70
60
50
40
30
20
10
0
Brome
Redtop
Prairie
Weeds
burned
burned
burned
F95
S96
F96
S97
F97
S98
F98
S99
Survey

Fig. 4

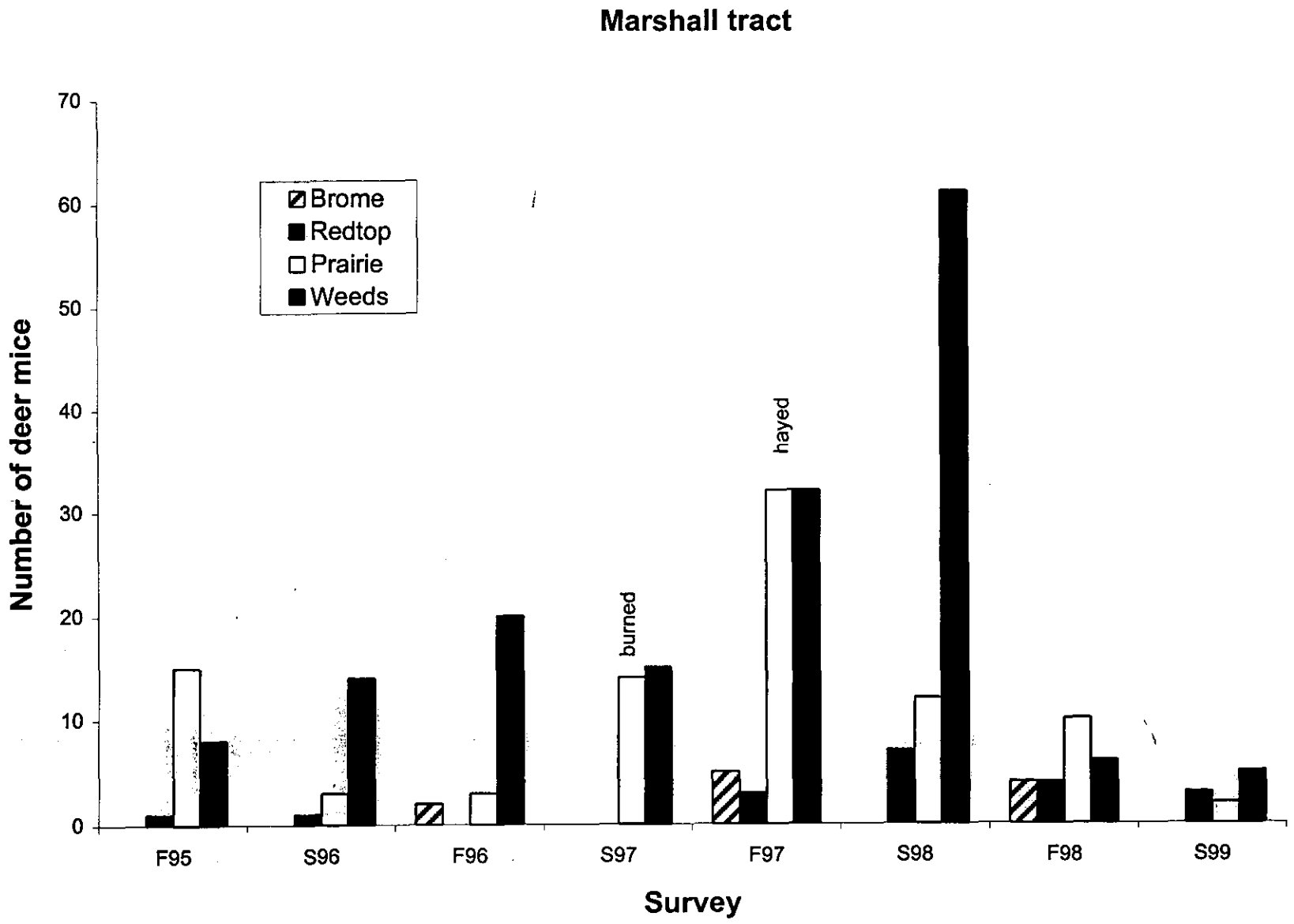

Marshall tract
Brome
Redtop
Prairie
Weeds
Number of deer mice
70
60
50
40
30
20
10
0
burned
hayed
F95
S96
F96
S97
F97
S98
F98
S99
Survey

Fig. 7

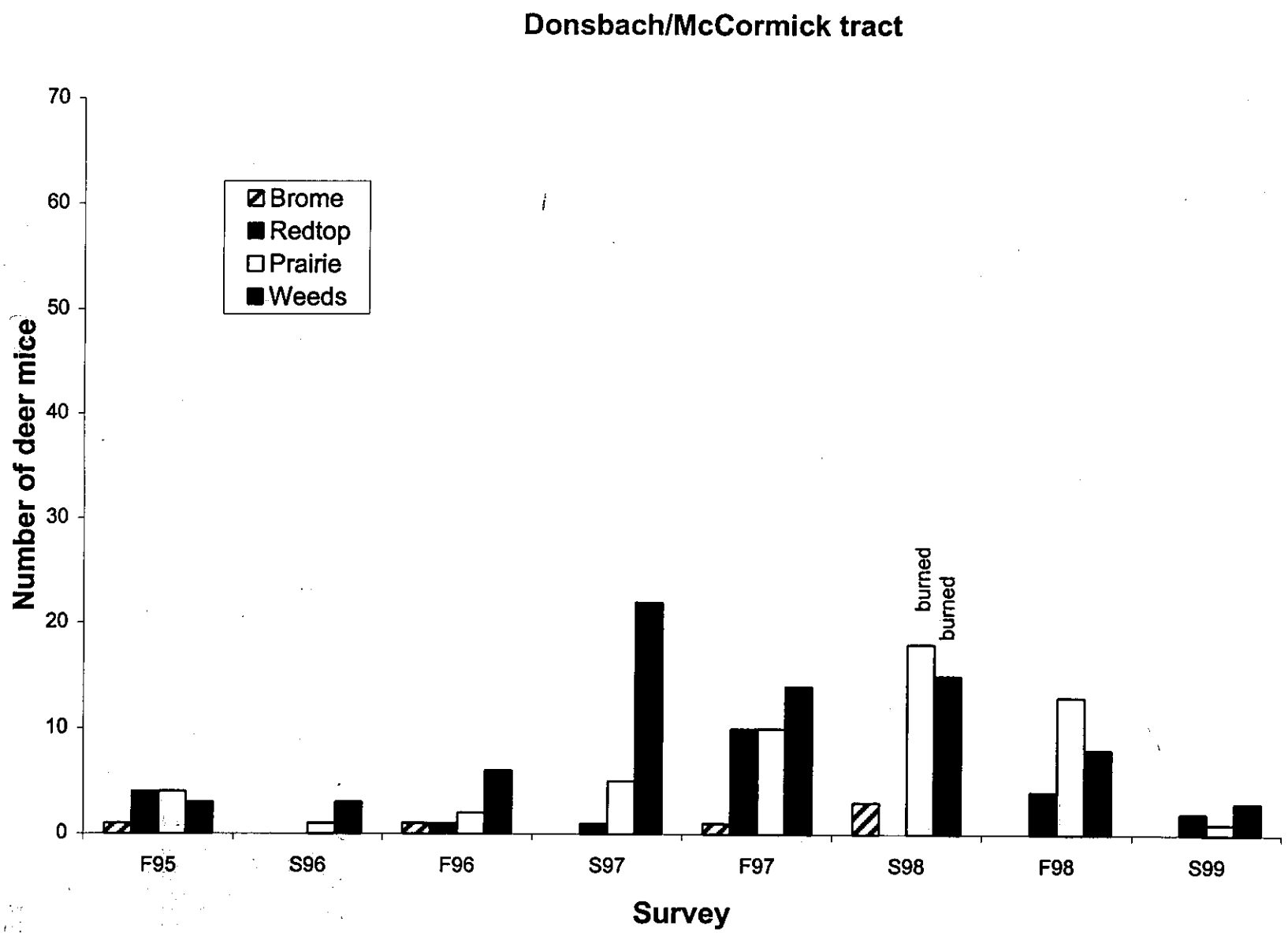
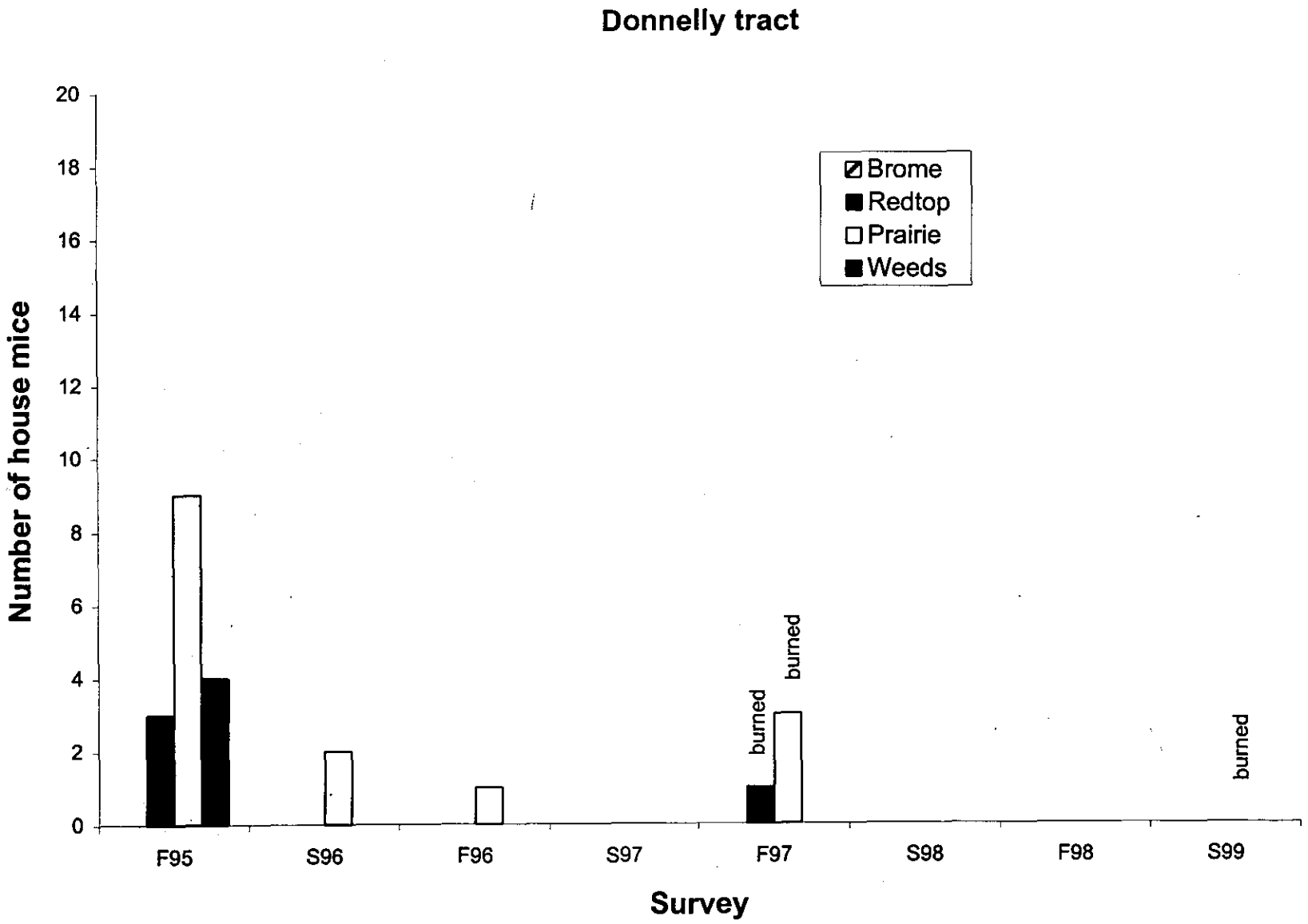

Donsbach/McCormick tract
Brome
Redtop
Prairie
Weeds
Number of deer mice
70
60
50
40
30
20
10
0
burned
burned
F95
S96
F96
S97
F97
S98
F98
S99
Survey

Fig. 8


Donnelly tract
Brome
Redtop
Prairie
Weeds
Number of house mice
20
18
16
14
12
10
8
6
4
2
0
burned
burned
burned
F95
S96
F96
S97
F97
S98
F98
S99
Survey

F.5.4

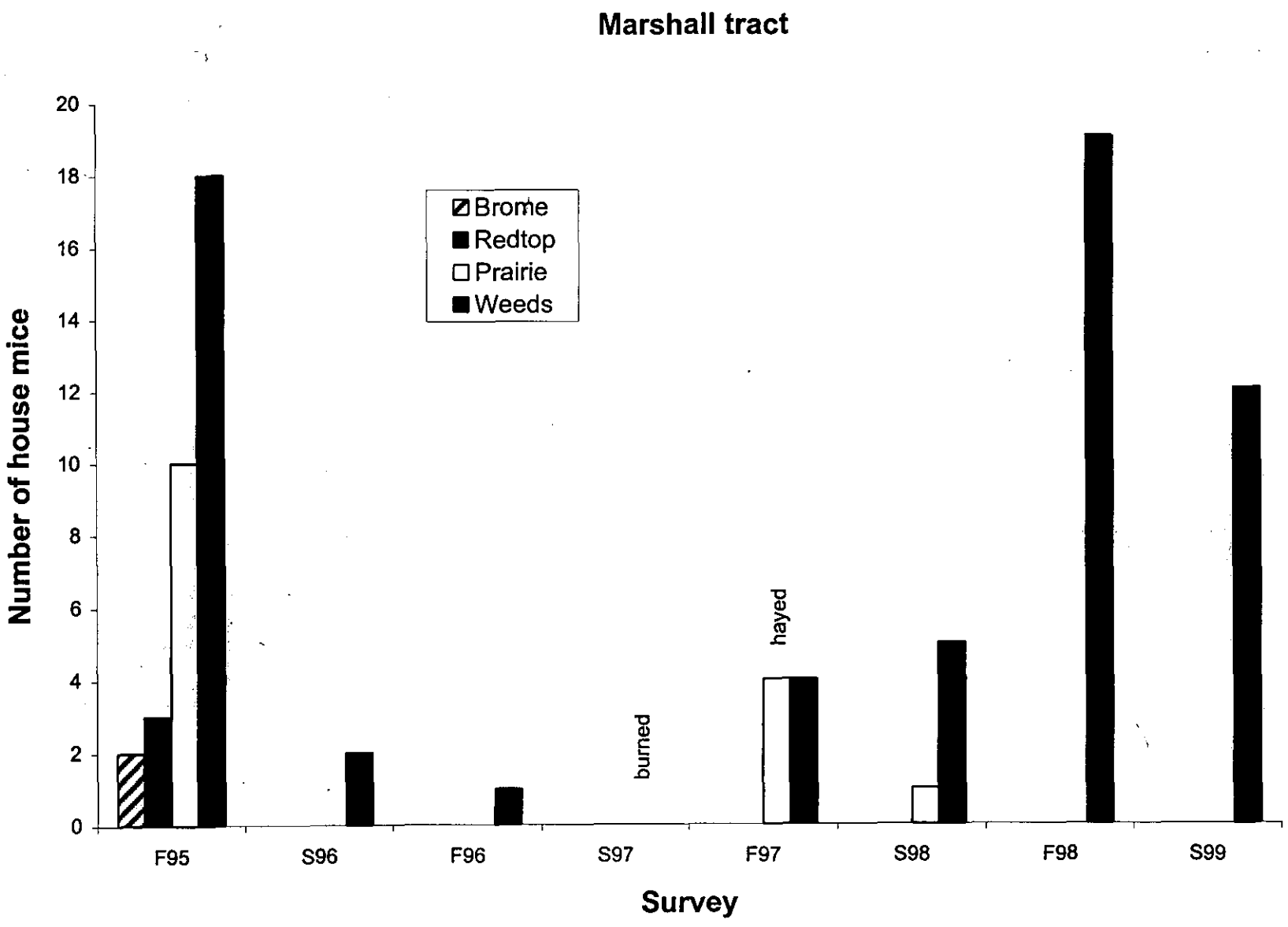

Marshall tract
Number of house mice
20
18
16
14
12
10
8
6
4
2
0
Brome
Redtop
Prairie
Weeds
burned
hayed
F95
S96
F96
S97
F97
S98
F98
S99
Survey

Fig. 10

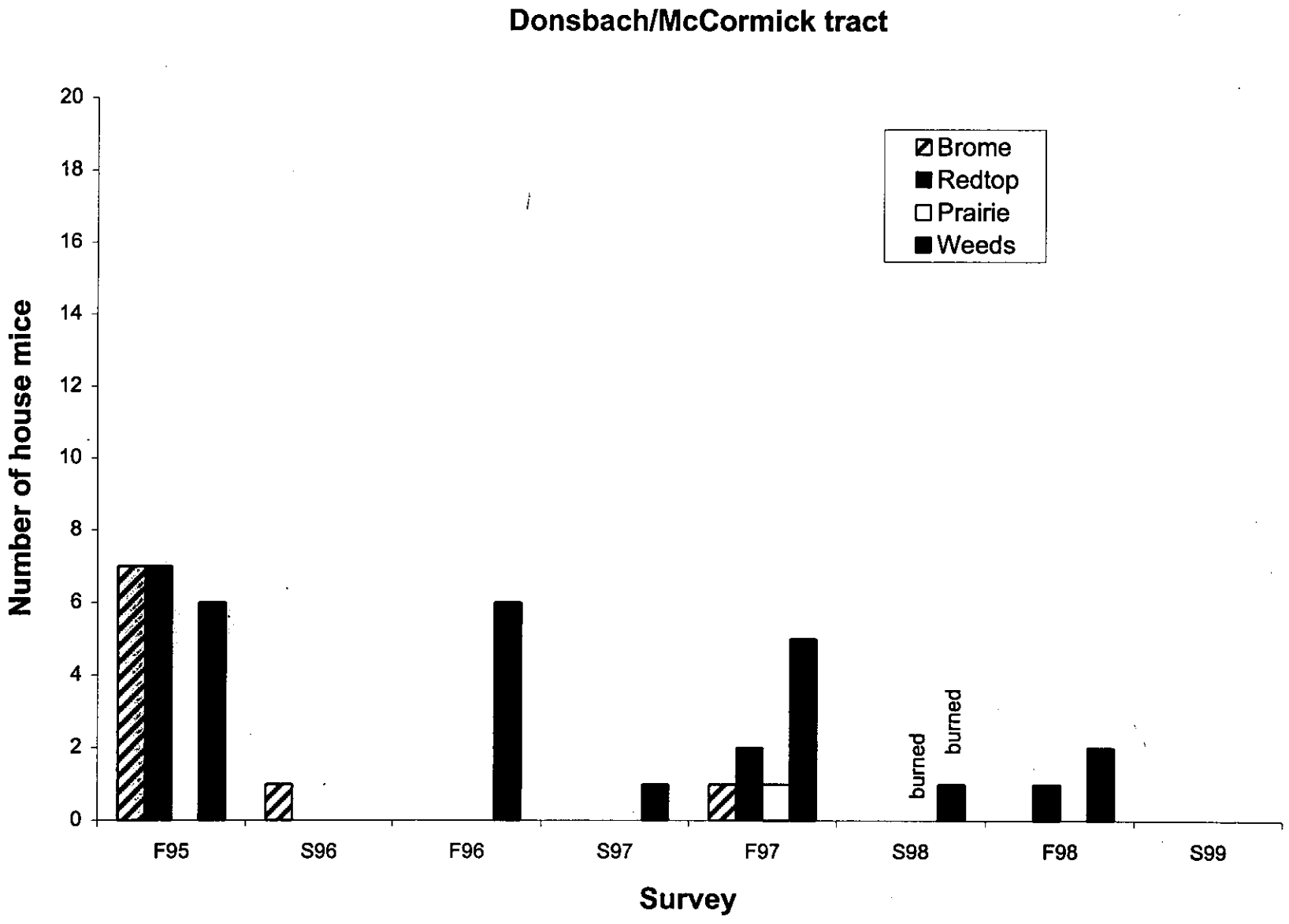

Donsbach/McCormick tract
Number of house mice
20
18
16
14
12
10
8
6
4
2
0
Brome
Redtop
Prairie
Weeds
burned
burned
F95
S96
F96
S97
F97
S98
F98
S99
Survey

Fig. 11