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Ecological Survey of M-Field, Edgewood Area Aberdeen Proving Ground, Maryland

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December 1991

**Prepared for Chemical Research,
Development and Engineering Command
U.S. Army Aberdeen Proving Ground, Maryland
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GROUND, MARYLAND

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Richland, Washington 99352

MASTER

SUMMARY

An ecological survey was conducted on M-Field, at the Edgewood Area, Aberdeen Proving Ground, Maryland. This study was conducted for the U.S. Department of the Army, Chemical Research and Development Engineering Center, by Pacific Northwest Laboratory. M-Field is used routinely to test army smokes and obscurants, including brass flakes, carbon fibers, and fog oils. The field has been used for testing purposes for the past 40 years, but little documented history is available. Under current environmental regulations, the test field must be assessed periodically to document the presence or potential use of the area by threatened and endangered species.

The M-Field area is approximately 370 acres and is part of the U.S. Army's Edgewood Area at Aberdeen Proving Ground in Harford County, Maryland. The grass-covered field is primarily lowlands with elevations from about 1.0 to 8 m above sea level, and several buildings and structures are present on the field. The ecological assessment of M-Field was conducted in three stages, beginning with a preliminary site visit in May to assess sampling requirements. Two field site visits were made June 3-7, and August 12-15, 1991, to identify the biota existing on the site. Data were gathered on vegetation, small mammals, invertebrates, birds, large mammals, amphibians, and reptiles.

In addition to the release of smokes and obscurants on M-Field, the area is subject to disturbance from mowing and heavy equipment traffic. Portions of M-Field are routinely mowed to decrease the potential for fire during obscurant testing. Comparisons of data on areas of M-Field with known exposure to smokes with data from areas believed to have no or relatively little exposure to smokes showed no significant differences between areas. Comparison of data from areas that are routinely mowed with data from areas that were not subject to mowing at the time of the surveys showed differences in mean percent cover of sedges in June and mean percent cover of grasses for the August sampling. Data from the small mammal trapping indicated differences in the use of mowed versus unmowed areas by small mammals. There were no significant

differences in mean percent cover of sedges in June and mean percent cover of grasses for the August sampling. Data from the small mammal trapping indicated differences in the use of mowed versus unmowed areas by small mammals. There were no significant differences in the average abundance of invertebrates inhabiting the mowed and unmowed areas.

The two surveys of the area documented a number of plant and animal species found on and near M-Field. The only endangered species noted on M-Field was the bald eagle (*Haliaeetus leucocephalus*), which was feeding on the field.

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INTRODUCTION

The 370-acre area designated as M-Field has been used to test smokes and obscurants for the past 40 years. Since World War II, tests of other munitions or chemicals at the field are believed to have been minimal. (The history of M-field before World War II is not documented.) These tests have resulted in the exposure of flora and fauna inhabiting M-Field to smokes and perhaps other chemicals. An ecological survey was required to meet environmental regulations and to assess whether any chronic effects to biota from these exposures or any significant ecological impacts of the testing could be detected.

The vegetation of the M-Field area is dominated by grasses and sedges, and forbs are an important component of understory and ground cover. A few scattered shrubs and vines exist on the field as well, but no large woody shrubs or trees are located on the field. Deciduous trees and shrubs do occur at the perimeters of M-Field (Figure 1). Several structures are located on the field, including a large cement pad, a scaffolding-like framework, construction trailer, and a bermed bunker-type structure.

The field is low lying with elevations of 1.0 to 8.0 m above sea level. Soils at M-Field are in the Sassafras and Elkton series. The Sassafras soils occur on the higher elevations of the field and consist of deep, well-drained soils that originated from old marine deposits containing sand with minor amounts of silts and clays. The Elkton soils occur at the lower elevations and consist of deep, poorly drained soils formed in old deposits of clay marine sediments. Areas of M-Field below 2-m elevation were visibly mesic or wet throughout the summer. The mean annual precipitation of the area is 116 cm (45.8 in.).

M-Field is subject to two types of disturbance in association with obscurant testing. The first disturbance is the introduction of contaminants to the ecosystem from the smokes or obscurants. The second level of disturbance is that resulting from

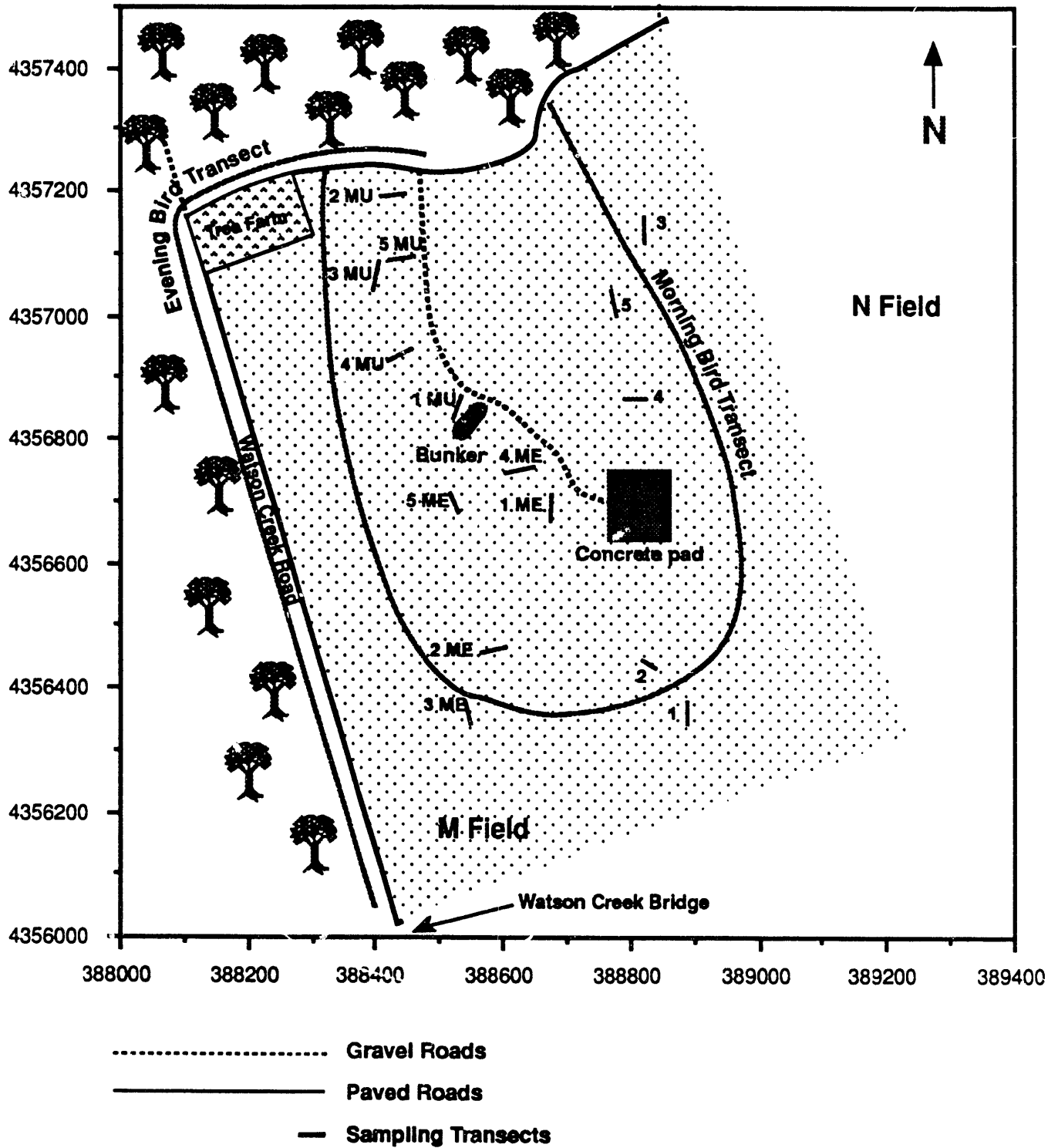


FIGURE 1. M-Field Area and Location of Transects. X and Y axes are Universal Transverse Mercator System Grid coordinates.

physical activities, that is, driving of heavy equipment across the field and routine mowing of portions of the field to alleviate fire hazard.

The primary objective of this survey was to document the flora and fauna inhabiting the field. Sampling of the area was also designed to test for differences in vegetation composition and canopy cover, invertebrate composition, and the relative abundance of small mammals in areas with different disturbance histories.

METHODS

Primary sampling transects were randomly assigned to areas of M-Field according to three designations: 1) unmowed, unexposed transects (nos. 1-5 in Figure 1), 2) mowed, unexposed transects (nos. 1MU-5MU in Figure 1), and 3) mowed, exposed transects (nos. 1ME-5ME in Figure 1). The designated areas were identified after discussions with Chemical Research and Development Engineering Center (CRDEC) staff during the preliminary visit to the field site. The southwestern quadrant of the field (that area south and west of the bunker) was determined to be used for testing and routinely mowed. The northwestern portion of M-Field was described as being routinely mowed but receiving relatively little or no exposure to smokes. The eastern half of M-Field had little to no exposure to smokes and was not mowed. Both the location and orientation of the transects are shown in Figure 1. Plastic stakes were used to mark the location of each 50-m transect, and a Geographic Positioning System (GPS) was used to determine the position of each transect and map prominent features of M-Field in Universal Transverse Mercator System Grid Coordinates (UTM) using satellite information. Appendix A lists the UTM coordinates of each of the sampling transects. These transects were used as the sampling units and thus the areas where information was gathered on vegetation, small mammals, and invertebrates on M-Field.

VEGETATION

Each 50-m transect was sampled to determine species composition and estimate canopy cover along the transect. Plant canopy cover was estimated using a modified Daubenmire plot (Daubenmire 1959). The Daubenmire plot is a rectangular plot frame, 20 cm by 50 cm (0.1 m²). The plot frame was modified by using taut string to evenly divide the frame into 10 equal boxes and aid in estimating percent cover. The canopy cover was visually estimated by holding the frame over the vegetation and looking directly down. The percentage of the plot frame, from 1 to 100%, was recorded for each species occurring within the bounds of the plot frame. All visual estimates of canopy cover were

performed by the same person to ensure consistency in the data.

Ten samples were taken on each transect at 5-m intervals. Species were identified when possible or gathered for later identification. Identifying grass species on closely mown transects was extremely difficult and often could not be accomplished with any certainty. During each field site visit, some transects had been recently mowed, and some were mowed during the sampling effort. In addition to listing species identified on transects, efforts were made to identify and list all other plant species encountered on M-Field, including species seen and collected during the preliminary site visit in the spring.

Data were analyzed by grouping species canopy cover into three categories: grasses, forbs, and sedges. The data were transformed for analysis using $\arcsin \sqrt{y}$, which is recommended by Steel and Torrie (1980) for percentages covering a wide range of values. Statistical comparisons of plant canopy cover by area (unmowed, unexposed; mowed, unexposed; mowed, exposed) were done using one-way analysis of variance techniques. If analysis of variance indicated a difference in mean values, Duncan's Multiple Range Test was applied. Significant differences were determined at the 5% level ($p = 0.05$).

SMALL MAMMAL TRAPPING

Live trapping for small mammals was done along all 15 primary sampling transects (Figure 1). Two 100-m long transects were placed parallel to and 10 m away on each side of the primary sampling transects. Sherman live traps were placed at 10-m intervals along each of the two small mammal transects for a total of 20 traps per primary sampling transect. Traps were baited with a mixture of rolled oats and peanut butter and were checked in the mornings. Species and sex of each captured

small mammal were determined, and each mammal was classified into adult or juvenile age categories. All mice were weighed to the nearest 0.5 g.

BIRD SURVEYS

A transect line was established through M-Field (Figure 1), and this path was walked by an observer on June 4, 5, and 6 and August 14 and 15, 1991. All birds observed within 100 m of either side of the transect were counted. The June 4 survey was conducted in the evening from 1830 to 1930 hours. The June 5 and 6 surveys were morning surveys, beginning at 0610 and ending at 0800 hours. The August 14 and 15 surveys of M-Field birds began at 0600 hours and ended at 0730 hours. Two evening bird transects, one in June and one in August, were also walked around the Watson Creek Road (Figure 1). These surveys included birds observed on M-field and birds associated with wooded, bay, and marsh habitats.

INVERTEBRATE SURVEYS

Invertebrate populations were sampled by using sweep nets and by collecting soil/litter samples. Insects were collected on each of the 15 sampling transects using a 12-in.-diameter insect sweep net. The net was swept side to side through vegetation in an arc approximately 1-m wide. Fifty consecutive sweeps were made in each transect. The net and contents were stuffed into an insect killing jar containing a cotton swab saturated with ethyl acetate as a killing agent. After the insects were immobilized, they were emptied into a pint jar containing 72% ethanol. They were stored in this solution for later identification.

A soil litter sample was collected at each transect: a core 4 in. in diameter by 6 in. deep was dug with a metal trowel. Each sample was placed in a plastic bag labeled, and stored. These samples were flown to our laboratory where each was placed in a berlese funnel. The amount of time lapsed between collection and

placement in the funnel was approximately 24 hours. Invertebrates were captured in glass jars filled with 72% ethanol at the bottoms of the berlese funnels and stored for identification.

Invertebrate identifications were made with the aid of a variable (0-70 power magnification) microscope. The nomenclature follows that of Borror et al. (1976) for adult specimens and Chu (1949) for immature life stages.

A Shannon information index (Shannon and Weaver 1949) was used as a measure of invertebrate diversity.

$$H' = \sum_{i=1}^s P_i \log_e P_i$$

where H' equals the diversity index, and P_i equals the proportion of the total number of individuals that belong to the i th taxa. An evenness index (J') (Pielou 1969) was also calculated:

$$J' = \frac{H' \text{ observed}}{H' \text{ maximum}}$$

J' is a measure of the distribution of the invertebrates among the various taxa present. A value of 1.0 would indicate an equal number of specimens in each taxa. Richness (S) or the number of taxa present is also documented. The Bonferroni t-test was used to test for significant differences between mean values (Miller 1966). All tests were conducted at the $\alpha 0.05$ level.

RESULTS AND DISCUSSION

VEGETATION SAMPLING

The plant species identified at M-Field during the May, June, and July visits are listed in Table 1. Mowing of the field during sampling in June and August complicated plant identification on those transects that were mowed. The mean percent cover for grasses, sedges, and forbs was calculated from the transect sampling data and is shown in Figures 2-4. Mean percent cover of sedges and forbs decreased from June to August, while the mean percent cover of grasses increased in all areas as the summer progressed.

A one-way analysis of variance of the data gathered in June showed no significant difference in the mean percent cover of grasses or forbs between any of the groupings of transects (e.g., mowed, unmowed, exposed, unexposed). Analysis of variance did indicate differences in mean percent cover of sedges on the mowed, unexposed (MU) transects compared with the unmowed unexposed transects (UU) ($F = 4.29$, $df = 2, 12$, $p = 0.03$). Comparisons of vegetation data from the August sampling showed significant differences ($F = 9.83$, $df = 2, 12$, $p = 0.003$) between mean percent cover of grasses on the MU-transects and grasses on the UU-transects and ME-transects. The significantly lower grass cover on the MU-transects seemed to reflect greater disturbance of those areas by driving and parking large equipment across portions of the area. The ground surface on transects near the gravel roadway appeared to be hard packed. Two of these transects (Transects 2MU and 5MU) also appeared to have a white crust on much of the bare ground. The appearance of the white powdery crust may indicate that this area had been used in the past as a testing ground and did not adequately represent an unexposed condition. The difference in percent cover of sedges in the June sampling may be related to the topography of M-Field. In general, sedges at M-Field are more likely to be found at wetter, lower elevations. Three of the randomly assigned transects for this area were near the

TABLE 1. Plant Species Found on M-Field

<u>Grasses</u>	<u>Common Names</u>
<i>Agrostis stolonifera</i>	Red top
<i>Andropogon virginicus</i>	Broom sedges
<i>Anthoxanthum odoratu</i>	Sweet vernal grass
<i>Aristida oligantha</i>	Three-awn
<i>Cynodon dactylon</i>	Bermuda grass
<i>Eragrostis spectabilis</i>	Purple love grass
<i>Festuca rubra</i>	Red fescue
<i>Holcus lanatus</i>	Velvet grass
<i>Panicum spp.</i>	Panic grass
<i>Paspalum pubescens</i>	
<i>Poa praetensis</i>	
<i>Phragmites sp.</i>	Reed
<i>Setaria geniculata</i>	Fox-tail
<i>Sorghastrum nutans</i>	Indian grass
<i>Tripsacum dactyloides</i>	Gama grass
<i>Unknown grasses</i>	
 <u>Sedges and Rushes</u>	
<i>Carex annectans</i>	
<i>Carex granularis</i>	Meadow sedge
<i>Carex squarrosa</i>	
<i>Carex tribuloides</i>	
<i>Eleocharis tenuis</i>	Spike rush
<i>Juncus effuses</i>	Soft rush
<i>Juncus tenuis</i>	Path rush
<i>Scirpus atrovirens</i>	Dark green bulrush

TABLE 1. (contd)

Forbs

<i>Allium vineale</i>	Field garlic
<i>Cassia fasciculata</i>	Wild senna
<i>Chrysanthemum leucanthemum</i>	Ox-eye daisy
<i>Cichorium intybus</i>	Chicory
<i>Claytonia virginica</i>	Spring beauty
<i>Duchesnea indica</i>	Indian strawberry
<i>Erigeron strigosus</i>	Daisy
<i>Liquidamber styraciflua</i>	Sweetgum
<i>Galium sp.</i>	Bedstraw
<i>Osmunda regalis</i>	Royal fern
<i>Penstemon digitalis</i>	Foxglove beardtongue
<i>Plantago lanceolata</i>	Plantain
<i>Potentilla sp.</i>	Cinquefoil
<i>Oxalis sp.</i>	Wood-sorrel
<i>Ranunculus sp.</i>	Buttercup
<i>Rudbeckia hirta</i>	Black-eyed susan
<i>Rumex acetosella</i>	Sheep sorrel
<i>Scutellaria integrifolia</i>	Hyssop skullcap
<i>Sisyrinchium arenicola</i>	Blue-eyed grass
<i>Solenum carolinense</i>	Horse nettle
<i>Trifolium sp.</i>	Cattail
<i>Typhia latifolia</i>	Clover
<i>Viola sp.</i>	Violet
Unknown forbs	

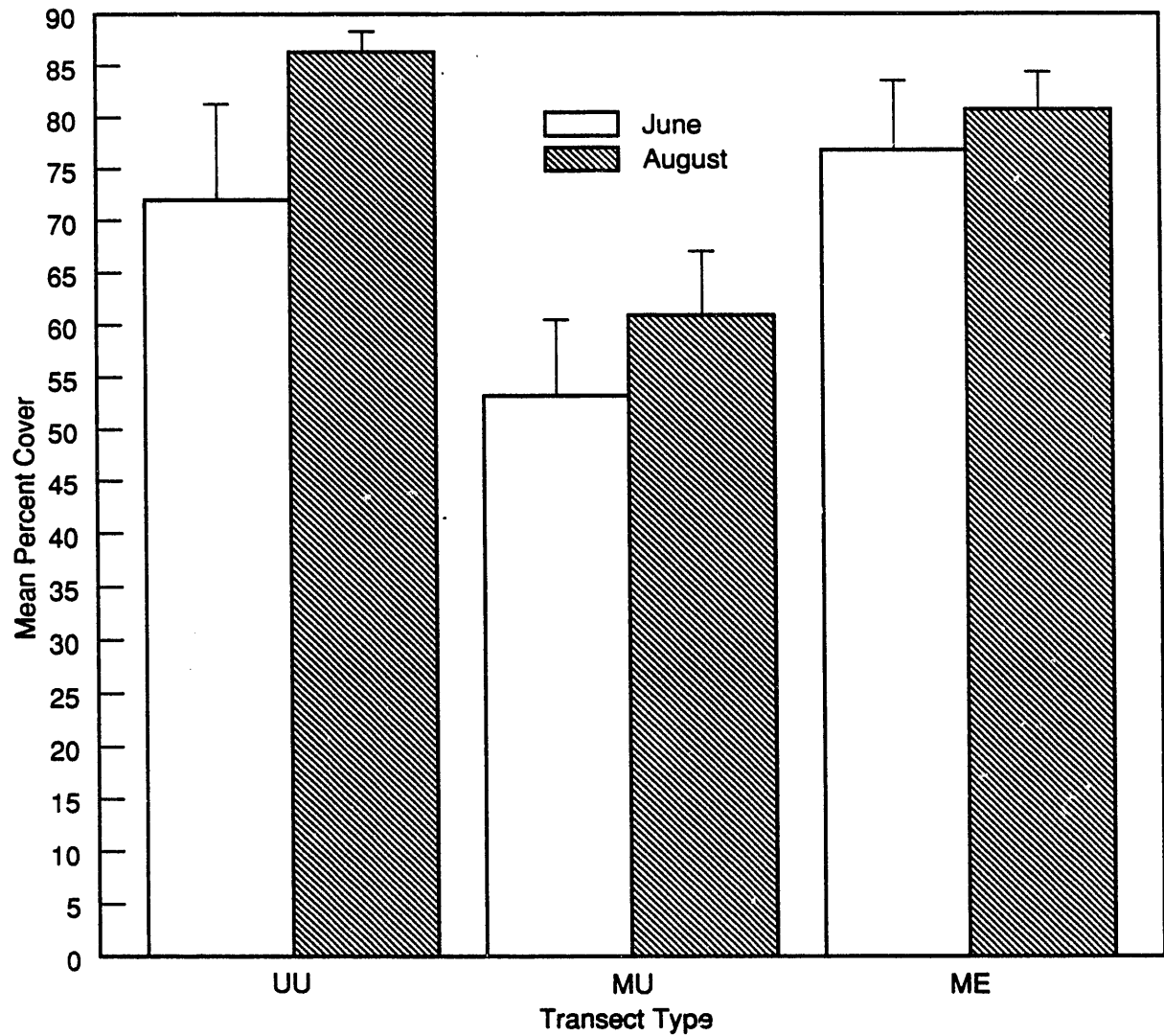


FIGURE 2. Mean Percent Canopy Cover of Grasses on M-Field in June and August 1991 (error bars are one standard error)

roadway and at higher elevation than most of the other transects. These transects visibly appeared to be under more water stress than transects at lower elevations.

SMALL MAMMAL TRAPPING

Small mammal trapping was conducted from June 4-6 and August 15-16, 1991, for a total of 1,300 trap-nights. Three species of small mammals were captured

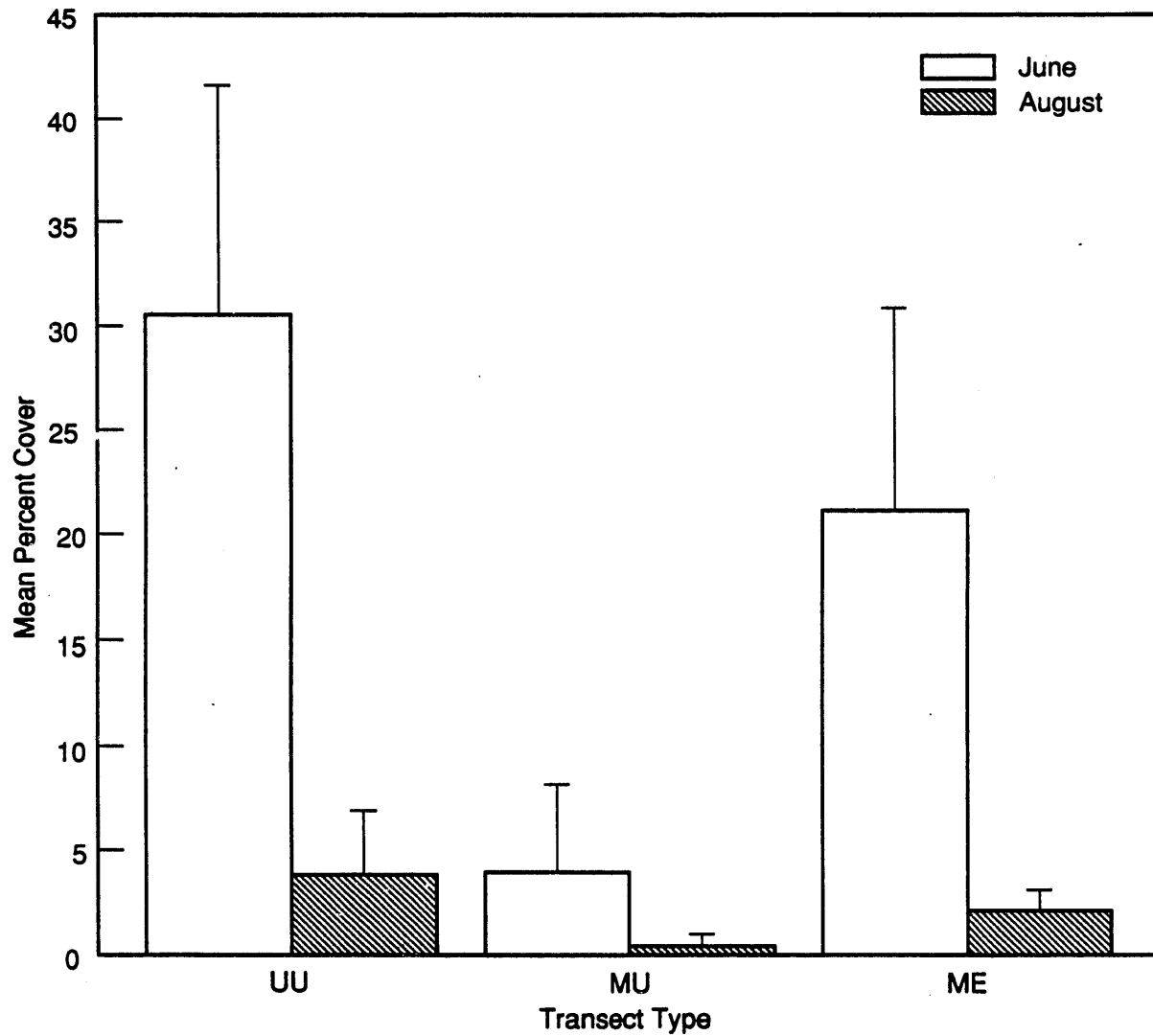


FIGURE 3. Mean Percent Canopy Cover of Sedges on M-Field in June and August 1991 (error bars are one standard error)

(Table 2). The meadow vole (*Microtus pennsylvanicus*) was by far the most common small mammal captured, with a trapping success of 0.02 captured per trap-night. The only other species captured were deer mice (*Peromyscus maniculatus*) and rice rats (*Oryzomys palustris*). The only sampling transects on which mice were captured were the four located in the southern part of M-Field (nos. 2ME, 3ME, 2, and 1) and the

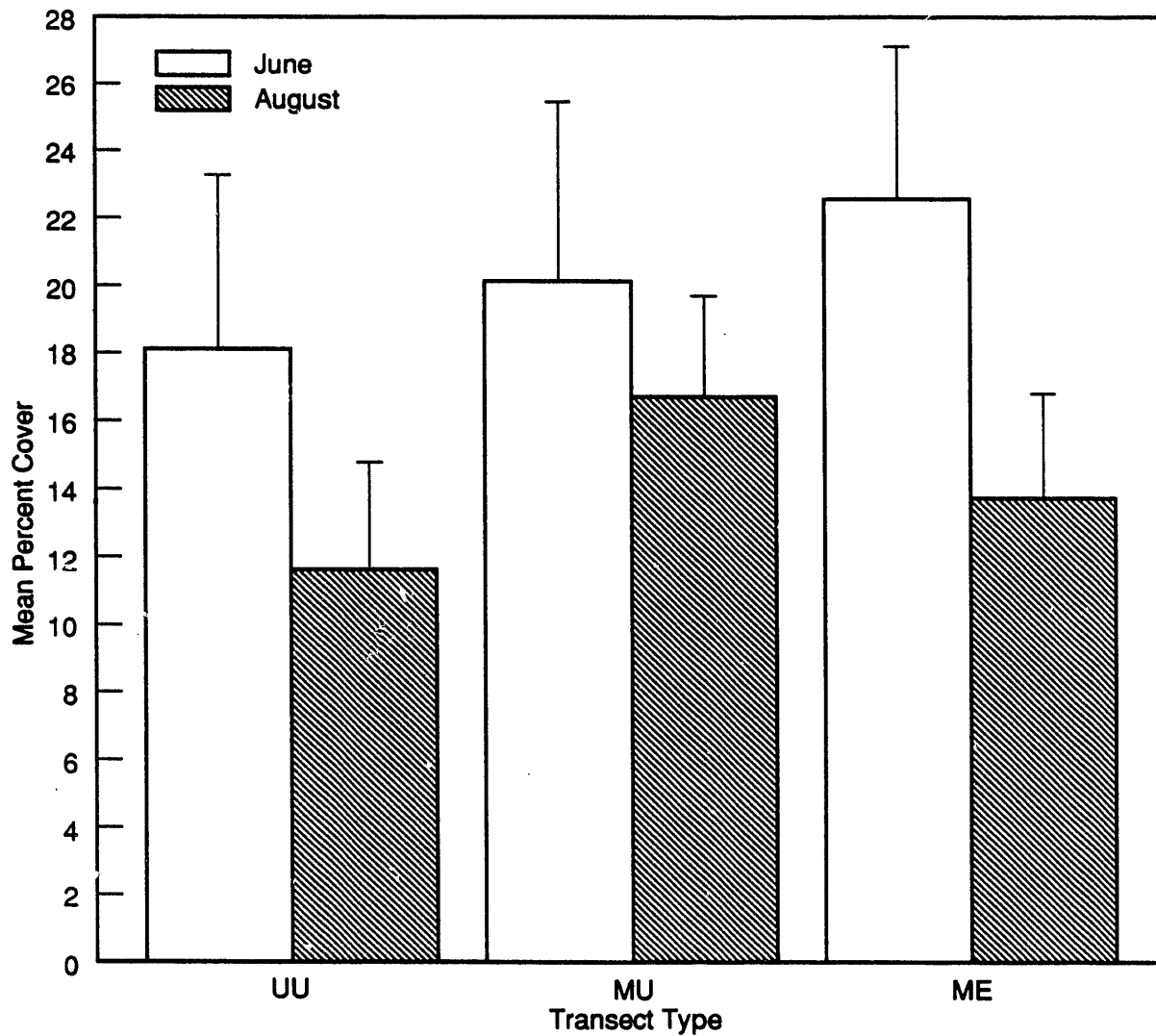


FIGURE 4. Mean Percent Canopy Cover of Forbs on M-Field in June and August 1991 (error bars are one standard error)

three located on the eastern half (nos. 3, 4, and 5) (Figure 1). Trapping success was highest on sampling transect 2ME (Figure 1). Mowing on these transects was infrequent during the study period, and the grass was tall (0.5 m) and dense. No

TABLE 2. Summary of Small Mammals Live Trapped on M-Field in June and August 1991

<u>Date</u>	<u>Plot No.</u>	<u>Species</u>	<u>Age^(a)</u>	<u>Sex</u>	<u>Weight (g)</u>
6/4/91	2ME	<i>Microtus pennsylvanicus</i>	J	F	15.0
6/5/91	2ME	<i>Microtus pennsylvanicus</i>	J	F	15.5
6/5/91	2ME	<i>Microtus pennsylvanicus</i>	J	F	15.0 ^(a)
6/5/91	2	<i>Microtus pennsylvanicus</i>	A	F	25.5
6/5/91	1	<i>Microtus pennsylvanicus</i>	A	F	43.0
6/5/91	3	<i>Oryzomys palustris</i>	A	F	60.0
6/6/91	1	<i>Microtus pennsylvanicus</i>	J	F	25.0
6/6/91	1	<i>Microtus pennsylvanicus</i>	A	F	35.0
6/6/91	5	<i>Oryzomys palustris</i>	A	F	60.0 ^(b)
6/6/91	4	<i>Microtus pennsylvanicus</i>	A	M	36.0
6/6/91	2ME	<i>Microtus pennsylvanicus</i>	J	M	18.0
6/6/91	2ME	<i>Microtus pennsylvanicus</i>	J	F	15.5
8/14/91	2ME	<i>Peromyscus maniculatus</i>	J	F	12.0
8/14/91	2ME	<i>Microtus pennsylvanicus</i>	A	F	41.0
8/14/91	3ME	<i>Microtus pennsylvanicus</i>	A	M	33.0
8/14/91	2	<i>Microtus pennsylvanicus</i>	A	M	57.0
8/14/91	1	<i>Microtus pennsylvanicus</i>	A	F	38.0
8/14/91	1	<i>Microtus pennsylvanicus</i>	A	F	55.0
8/14/91	1	<i>Microtus pennsylvanicus</i>	A	M	67.0
8/15/91	2ME	<i>Peromyscus maniculatus</i>	J	F	12.0 ^(b)
8/15/91	3ME	<i>Microtus pennsylvanicus</i>	J	M	30.0
8/15/91	1	<i>Microtus pennsylvanicus</i>	A	M	68.0
8/15/91	1	<i>Microtus pennsylvanicus</i>	A	F	40.0
8/15/91	1	<i>Microtus pennsylvanicus</i>	A	F	51.0 ^(c)
8/15/91	1	<i>Microtus pennsylvanicus</i>	A	F	45.0 ^(d)
8/15/91	3	<i>Microtus pennsylvanicus</i>	A	F	40.0

(a) J = juvenile, A = adult.

(b) Recapture.

(c) Lactating.

(d) Pregnant.

small mammals were captured on the remaining eight sampling transects. The grass on these transects was mowed very short (10 to 15 cm tall) and did not provide adequate cover for small mammals.

OTHER MAMMALS

White-tailed deer (*Odocoileus virginianus*) were very common on M-Field and could be observed every morning and evening feeding on the grasses and forbs (Table 3). Occasionally, deer were found bedded in the tall grass in the southern part of M-Field during midday. Most deer activity took place in the southern part of M-

TABLE 3. Summary of Mammals Observed on M-Field in June and August 1991

<u>Date</u>	<u>Species</u>	<u>No. Observed</u>
6/3/91	White-tailed deer (<i>Odocoileus virginianus</i>)	5
	Red fox (<i>Vulpes fulva</i>)	1
	Raccoon (<i>Procyon lotor</i>)	1
	Woodchuck (<i>Marmota monax</i>)	1
6/4/91	White-tailed deer (<i>Odocoileus virginianus</i>)	1
	Red fox (<i>Vulpes fulva</i>)	5
6/5/91	White-tailed deer (<i>Odocoileus virginianus</i>)	18
	Woodchuck (<i>Marmota monax</i>)	2
	Star-nosed mole (<i>Condylura cristata</i>)	1 ^(a)
8/13/91	White-tailed deer (<i>Odocoileus virginianus</i>)	5
	Red fox (<i>Vulpes fulva</i>)	2
	Woodchuck (<i>Marmota monax</i>)	2
8/14/91	White-tailed deer (<i>Odocoileus virginianus</i>)	3
	Red fox (<i>Vulpes fulva</i>)	2
8/15/91	White-tailed deer (<i>Odocoileus virginianus</i>)	5
	Opossum (<i>Didelphis marsupialis</i>)	1 ^(a)

(a) Found dead on road near M-Field.

Field. One fawn, approximately 1 week old, was observed in the northeast corner of M-Field in June. Woodchucks (*Marmota monax*) were also common residents on M-Field. They were observed exclusively in the closely mowed areas around the bunker (Figure 1). A family of red foxes (*Vulpes fulva*) was also present on M-Field. An adult and four pups were observed in June near the concrete pad (Figure 1) and may have been denning there. Adult and juvenile red foxes were also observed foraging in M-Field in August. A single raccoon (*Procyon lotor*) was observed in June in the northern part of M-Field. In addition, one opossum (*Didelphis marsupialis*) was observed dead on a road near M-Field.

BIRD SURVEYS

Fifty-one species of birds were observed on and adjacent to M-Field during the morning and evening surveys in June and August (Table 4). Nineteen of these species were observed exclusively in the wooded areas adjacent to M-Field (Table 4). The mute swan (*Cygnus olor*) and mallard (*Anas platyrhynchos*) were observed on the Watson Creek Wildlife Refuge at Watson Creek Bridge at the southern end of M-Field.

During the June M-Field bird surveys, 26 species were observed. The eastern meadowlark (*Sturnella magna*) and grasshopper sparrow (*Ammodrammus sarannarum*) were the most abundant birds observed. Territorial males were found singing, and the breeding season was at its height. The eastern bluebird (*Sialia sialis*), red-winged blackbird (*Agelaius phoeniceus*), and several other passerine species were singing and breeding in the area. Tree and barn swallows (*Tachycineta bicolor*, *Hirundo rustica*) were present, but not numerous over the fields. Males of the northern bobwhite (*Colinus virginianus*) and ring-necked pheasant (*Phasianus colchicus*) (gamebirds) were heard singing, indicating that the species probably nested on M-Field. Four birds of prey were observed (Table 5). The bald eagle (*Haliaeetus leucocephalus*), listed as an endangered species by the U.S. Fish and Wildlife Service, was observed on the ground at M-Field feeding on the carcass of a

TABLE 4. Birds Observed on and Adjacent to M-Field in June and August 1991

Family - Ardeidae

Green-backed heron (*Butorides striatus*)

Great egret (*Casmerodius albus*)

Great blue heron (*Ardea herodias*)

Family - Anatidae

Mute swan (*Cygnus olor*) *

Canada goose (*Branta canadensis*)

Mallard (*Anas platyrhynchos*)*

Family - Charadriidae

Killdeer (*Charadrius vociferus*)

Family - Laridae

Herring gull (*Larus argentatus*) *

Family - Cathartidae

Turkey vulture (*Cathartes aura*)

Family - Accipitridae

Bald eagle (*Haliaeetus leucocephalus*)

Red-tailed hawk (*Buteo jamaicensis*)

Osprey (*Pandion haliaetus*)

Family - Falconidae

American kestrel (*Falco sparverius*)

Family - Phasianidae

Northern bobwhite (*Colinus virginianus*)

Ring-necked pheasant (*Phasianus colchicus*)

Family - Columbidae

Mourning dove (*Zenaida macroura*)

Family - Cuculidae

Yellow-billed cuckoo (*Coccyzus americanus*) *

TABLE 4. (contd)

Family - Picidae

Northern flicker (*Colaptes auratus*)
Hairy woodpecker (*Picoides villosus*) *

Family - Tyrannidae

Eastern kingbird (*Colaptes auratus*)
Eastern wood-pewee (*Contopus virens*) *

Family - Hirundinidae

Tree swallow (*Tachycineta bicolor*)
Purple martin (*Progne subis*)
Barn swallow (*Hirundo rustica*)

Family - Corvidae

Blue jay (*Cyanocitta cristata*)
American crow (*Corvus brachyrhynchos*)

Family - Paridae

Black-capped chickadee (*Parus atricapillus*) *

Family - Troglodytidae

Carolina wren (*Thryothorus ludovicianus*) *

Family - Muscicapidae

Eastern bluebird (*Sialia sialis*)
American robin (*Turdus migratorius*) *
Hermit thrush (*Catharus guttatus*) *

Family - Mimidae

Northern mockingbird (*Mimus polyglottos*)
Brown thrasher (*Toxostoma rufum*) *
Gray catbird (*Dumatella carolinensis*) *

TABLE 4. (contd)

Family - Sturnidae

European starling (*Sturnus vulgaris*)

Family - Vireonidae

Red-eyed vireo (*Vireo olivaceus*) *

Family - Emberizidae

Yellow warbler (*Dendroica petechia*) *
Common yellowthroat (*Geothlypis trichas*)
Northern cardinal (*Cardinalis cardinalis*) *
Blue grosbeak (*Cyanocompsa parellina*)
Indigo bunting (*Passerina cyanea*) *
Rufous-sided towhee (*Pipilo erythrophthalmus*) *
Grasshopper sparrow (*Ammodramus savannarum*)
Song sparrow (*Melospiza melodia*) *
Bobolink (*Dolichonyx oryzivorus*)
Eastern meadowlark (*Sturnella magna*)
Red-winged blackbird (*Agelaius phoeniceus*)
Brown-headed cowbird (*Molothrus ater*)
Common grackle (*Quiscalus quiscula*)
Northern oriole (*Icterus galbula*) *

Family - Fringillidae

American goldfinch (*Carduelis tristis*)

* = birds observed off M-Field. Restricted to forest, forest edge, or marsh.

dead red fox. One adult eagle and four subadults were sighted feeding on the carcass. Two additional subadults were found perched on a concrete pad in the middle of M-Field.

During the August bird transects, only 22 species were recorded on M-Field (Table 6). Fewer eastern meadowlarks and grasshopper sparrows were observed, indicating that the breeding season had ended and most birds had dispersed

TABLE 5. Number and Species of Birds Observed on M-Field on June 4, 5, 6, 1991

<u>Species</u>	<u>No. Observed</u>	<u>Activity</u>
Great blue heron	2	Flying
Killdeer	1	On ground
Turkey vulture	7	Flying
Bald eagle	5	Feeding, standing
	2	Perched
Red-tailed hawk	2	Flying
Osprey	1	Flying
Northern bobwhite	3	Perched, singing
Ring-necked pheasant	1	Standing, ground
Mourning dove	2	On ground
Northern flicker	1	Flying
Tree swallow	2	Flying
Barn swallow	13	Flying
Blue jay	1	Perched
American crow	6	Flying
Eastern bluebird	2	Perched
Northern mockingbird	3	Perched, singing
European starling	10	Feeding, ground
Common yellowthroat	3	Perched, singing
Blue grosbeak	1	Perched, singing
Grasshopper sparrow	17	Perched, singing
Bobolink	2	Perched, singing
Eastern meadowlark	35	Perched, singing
	2	Flying
Red-winged blackbird	5	Perched
Brown-headed cowbird	1	Feeding, ground
	2	Flying
Common grackle	5	Flying
American goldfinch	4	Flying

elsewhere. Tree swallows and barn swallows were abundant in August. Their increase in number may be related to the presence of young hatched during the year. The purple martin (*Progne subis*) was the most numerous species recorded. No martins were observed during the June survey. The large number of martins found in August is probably related to the addition of young of the year into the population and

TABLE 6. Number and Species of Birds Observed on M-Field on August 14 and 15, 1991

<u>Species</u>	<u>No. Observed</u>	<u>Activity</u>
Green-backed heron	2	Flying
Great egret	1	Flying
Great blue heron	1	Flying
Canada goose	10	Feeding, ground
Turkey vulture	3	Flying
Bald eagle	1	Flying
Red-tailed hawk	4	Flying
Osprey	2	Flying
	1	Perched
American kestrel	2	Perched
Ring-necked pheasant	1	Standing, ground
Mourning dove	8	On ground
Eastern kingbird	2	Perched
Tree swallow	69	Flying
Purple martin	105	Flying
	20	Perched
Barn swallow	72	Flying
American crow	14	Flying
Eastern bluebird	12	Perched
Blue grosbeak	1	Perched, singing
Grasshopper sparrow	6	Perched, singing
Bobolink	1	Perched, singing
Eastern meadowlark	20	Perched, singing
	2	Flying
American goldfinch	5	Flying

perhaps a pre-migratory staging on M-Field. Twelve eastern bluebirds were also observed during August, while only two were observed in June. In June, the bluebirds were nesting and were more secretive; also, the young had not hatched or fledged. The August increase reflects the addition of young birds into the population. Bluebird houses were found in several areas around M-Field. These houses no doubt attracted the bluebirds to the area. One subadult bald eagle was observed flying over M-Field. Ten observations of Canada geese (*Branta canadensis*) were made. A small group of three birds was seen feeding on M-Field each day of the field study. Table 6

provides a list of birds observed on M-Field during the August field studies.

REPTILES AND AMPHIBIANS

During the course of conducting the small mammal trapping, bird surveys, and other field work, we kept records of all reptiles and amphibians observed. The only snake observed was the common garter snake (*Thamnophis sirtalis*). One specimen was observed near plot 5ME in August. The only other reptile observed was a road-killed wood turtle (*Clemmys insculpta*). The turtle was found during the June field trip, on the road near the tree farm (Figure 1) at the northwest corner of M-Field. Three amphibians were found on M-Field. The green frog (*Rana clamitans*), leopard frog (*Rana pipiens*), and Fowler's toad (*Bufo woodhousei fowleri*) were all observed during the June visit to M-Field. Leopard frogs were observed again during the August visit. Of interest were the captures of several green frogs in the small mammal traps. The dark cavity of the traps probably attracted the frogs during the hot, sunny days. Frogs may also have been attracted to small insects that often entered the traps to feed on the bait.

INVERTEBRATES

The average abundance of invertebrates collected from transects in the three treatment areas is shown in Table 7. The average abundance was slightly greater for the control area (66.4 ± 18.2) than for the exposed and unexposed mowed areas (60.8 ± 17.4 and 53.0 ± 11.6 , respectively), but the values were not significantly different ($\alpha = 0.05$). Nor were there any statistical differences detected for the diversity (H'), richness (S), or evenness indices (J') as shown in Table 7.

TABLE 7. Between Plot Comparisons for Invertebrates Collected at M-Field

<u>Sample Category</u>	<u>Control</u>	<u>Mowed</u>	
		<u>Exposed</u>	<u>Unexposed</u>
Sweep Net Samples	----- $\bar{x} \pm SE$ (5)-----		
Abundance	66.4 \pm 18.2	60.8 \pm 17.4	53.0 \pm 11.6
Diversity (H')	2.2 \pm 0.2	2.1 \pm 0.1	2.3 \pm 0.1
Richness (S)	18.0 \pm 1.7	14.2 \pm 2.1	11.8 \pm 2.6
Evenness (J')	0.78 \pm 0.07	0.83 \pm 0.05	0.84 \pm 0.02
Litter Samples			
Abundance	117.2 \pm 53.2	88.2 \pm 29.0	87.4 \pm 35.9
Diversity (H')	1.1 \pm 0.3	0.8 \pm 0.1	1.1 \pm 0.2
Richness (S)	9.0 \pm 1.5	7.4 \pm 2.0	7.2 \pm 1.0
Evenness (J')	0.49 \pm 0.13	0.45 \pm 0.07	0.57 \pm 0.10

() = number of samples.

Sweep Net Samples

The abundance of invertebrate taxa collected in the sweep-net samples are shown in Table 8. The insect order Diptera (flies) was well represented in the collections with a total of 21 different families collected across the three treatments. The Syrphidae and Chloropidae were consistently collected in most transects.

Leafhoppers (Cicadellidae) and aphids were also abundant and consistently collected. Orthopterans as represented by both long-horned (Tettigoniidae) and short-horned grasshoppers (Acrididae) were commonly collected with no noticeable distribution across the study transects.

Litter Samples

The average abundance of litter inhabitants collected from the three treatment areas is shown in Table 7. The average abundance for the control transects was somewhat higher than for the mowed treatments, but none of the values for the three areas were significantly different ($\alpha = 0.05$). The diversity (H'), richness (S), and

TABLE 8. Invertebrates Collected at M-Field: Seep Net Sample

Taxa	Control					Mowed									
						Exposed					Unexposed				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Diptera (Flies)															
Anthomyiidae	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-
Asilidae	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Cecidomyiidae	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2
Ceratopogonidae	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Chamaemyiidae	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Chironomidae	-	-	-	-	2	-	-	-	2	-	2	1	-	-	-
Chloropidae	-	1	1	3	1	2	1	-	7	1	6	9	-	4	11
Culicidae	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-
Dolichopodidae	-	1	-	-	1	2	-	3	-	-	3	14	3	1	-
Empididae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Heleomyzidae	-	1	-	2	-	-	-	1	-	-	1	1	1	2	3
Mycetophilidae	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phoridae	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-
Pipunculidae	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Sciaridae	-	-	1	-	-	-	-	1	-	-	-	2	-	-	-
Sepsidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Simuliidae	2	-	1	-	-	-	-	-	-	-	-	-	1	1	-
Syrphidae	2	2	2	7	27	4	37	4	16	13	32	6	2	6	20
Tabanidae	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Tephritidae	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Tipulidae	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-

TABLE 8. (cont'd)

Taxa	Control					Mowed														
						Exposed					Unexposed									
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Homoptera (Bugs)																				
Aphididae	4	3	9	5	46	-	45	5	-	8	4	1	9	3	6					
Cercopidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1					
Cicadellidae	10	3	5	1	6	4	8	2	2	16	2	4	-	7	4					
Psyllidae	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Psocoptera (Psocids)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Psocidae	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-					
Hemiptera (true bugs)																				
Anthocoridae	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-					
Lygaeidae	4	-	14	50	-	-	1	-	-	1	-	-	-	-	-					
Miridae	-	-	2	3	-	1	2	1	1	-	2	8	-	-	-					
Nabidae	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-					
Pentatomidae	-	5	1	-	1	-	4	4	4	7	1	3	-	-	-					
Reduviidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1					
Scutelleridae	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-					
Unident (Nymph)	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-					
Orthoptera (Grasshoppers, Crickets)																				
Acrididae	-	-	-	-	1	-	1	-	3	7	2	1	-	1	-					
Gryllidae	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-					
Tettigoniidae	2	-	-	-	2	-	4	3	-	-	2	4	-	-	2					

TABLE 8. (cont'd)

Taxa	Control					Exposed					Mowed				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Odonata (Dragonflies and Damselflies)															
Coenagrionidae	1	-	-	-	-	1	-	1	-	-	-	-	-	-	-
Hymenoptera (Bees, Wasps, Ants)															
Braconidae	1	-	-	13	-	-	1	1	-	-	1	-	-	-	-
Chalcidoidea	-	-	1	1	-	-	1	-	-	-	-	-	-	-	1
Eulophidae	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Formicidae	-	-	2	-	2	-	1	-	-	-	-	-	2	-	2
Halictidae	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2
Ichneumonidae	-	-	1	1	2	-	1	-	-	-	1	-	-	-	-
Mymaridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perilampidae	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphecidae	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-
Vespidae	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Coleoptera (Beetles)															
Chrysomelidae	-	1	-	-	3	-	1	1	-	4	-	-	-	-	-
Coccinellidae	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Curculionidae	-	-	-	4	-	-	-	-	-	1	1	-	-	-	-
Phalacridae	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Scarabaeidae	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Unknown (L)	-	-	-	-	-	-	2	-	-	-	-	1	-	-	-

TABLE 8. (cont'd)

Taxa	Control					Mowed														
						Exposed					Unexposed									
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Arachnida																				
Acari (Mites, Ticks)	1	2	-	7	-	-	-	2	-	2	1	1	-	-	1	-	-	-	-	-
Aranida (Spiders)	3	2	1	2	3	4	6	9	1	8	4	3	2	2	3					
Thysanoptera (Thrips)																				
Aleoarthripidae	-	-	-	-	-	-	-	1	-	5	-	-	-	-	-	-	-	-	-	-
Phloethripidae	-	2	1	-	-	-	-	1	-	4	2	-	-	-	2	-	-	-	-	2
Thripidae	-	1	3	-	-	-	-	3	2	-	7	8	-	-	1	-	-	-	-	-
Unknown	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepidoptera (Butterflies and Moths)																				
Gelechiidae	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Hesperiidae	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Noctuidae	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-
Pyralidae (Larvae)	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unident. (Larvae)	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Neuroptera (Nerve-winged insects)																				
Chrysopidae	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL SPECIMENS	34	27	51	108	112	21	122	44	44	73	82	68	24	28	64					

evenness indices are also shown in Table 7 for the litter samples. There were no significant differences between any of the values ($\alpha = .05$).

The abundance of invertebrate taxa collected from the litter layer is shown in Table 9. The Acari (mites) were collected from every transect. They were also the most abundant taxa collected. The Collembola (springtails) were collected from all but two transects and were also an abundant part of the invertebrate fauna.

TABLE 9. Invertebrates Collected at M-Field: Litter Sample

Taxa	Control										Mowed														
	1					2					3					4					5				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Coleoptera (Beetles)																									
Carabidae	2	-	1	-	1	-	-	1	-	-	-	-	1	-	-	2	-	1	-	-	-	-	-	1	2
Chrysomelidae	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Curculionidae	-	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Larvae (unidentified)	-	11	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lathridiidae	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pselaphidae	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scarabaeidae	-	-	1	-	-	-	-	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	-	1	1
Staphylinidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Thysanoptera (Thrips)																									
Phlaeothripidae	-	-	-	-	5	7	-	1	-	1	-	-	1	-	-	3	-	-	-	-	-	-	-	3	1
Thripidae	-	-	-	-	-	9	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
immatures (unident)	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Collembola (Springtails)																									
Entomobryidae	5	6	54	-	-	-	-	-	-	5	-	-	2	-	-	1	2	-	-	-	1	2	-	1	14
Isotomidae	4	3	4	-	4	2	-	22	1	3	-	-	22	1	3	8	157	-	-	-	-	-	-	2	-
Poduridae	6	1	6	-	-	1	-	-	3	-	-	-	-	3	-	-	3	-	-	-	-	3	-	3	2
Sminthuridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	-	-	-	2
Hymenoptera (Bees, Wasps, Ants)																									
Ceraphronidae	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Formicidae	9	1	5	1	1	-	-	-	44	1	-	-	-	44	1	1	13	-	-	-	-	-	-	-	-
Larvae (unidentified)	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 9. Continued

Taxa	Control					Unexposed					Mowed					Exposed					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Homoptera (Bugs)	-	1	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Cicadellidae	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fulgoridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diptera (Flies)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heleomizidae	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tabanidae (Larvae)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Larvae (unidentified)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Orthoptera (Grasshop/crickets)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Gryllidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hemiptera (true bugs)	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coreidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lygaeidae	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arachnida	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acarina (mites and sticks)	10	43	49	27	302	159	25	20	13	93	66	37	19	1	69	-	-	-	-	-	-
Araneida (spiders)	-	2	1	1	1	2	-	2	-	2	-	-	1	4	7	-	-	-	-	-	-
Symphyla (myriapods)	-	-	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilopoda (centipedes)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chelonethida (Pseudoscorpions)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CONCLUSIONS

The M-Field area supports diverse wildlife and vegetation. No significant biological effects of testing smokes and obscurants could be detected in our survey. Differences in canopy cover and small mammal abundance appeared to be related to mowing of the field and disturbance from vehicle traffic rather than chronic exposure to smokes. The use of the M-Field area by the bald eagle, an endangered species, is of interest; however, bald eagles are unlikely to use M-Field during testing of smokes and obscurants because of the number of people and the activities associated with testing. Bald eagles were present on M-Field to take advantage of a food source (red fox carcass) and are not expected to use the area under most circumstances.

Mowed areas were attractive to swallows and other aerial feeders. Fewer bird species were observed in August than in June, but the total number of birds using the area was higher. The increase in number of birds is probably related to the addition of young of the year into the population.

A total of 76 families of invertebrates were collected from the M-Field sampling areas. There were no significant differences in invertebrate abundance between mowed and unmowed areas. Although the average abundance was slightly higher on the unmowed unexposed transects, the difference was not significant.

Detection of any chronic biological effects as a result of testing activities would require regular monitoring of the flora and fauna over several seasons.

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APPENDIX A

COORDINATES OF SAMPLING TRANSECTS ON M-FIELD

TABLE A.1. Locations of Sampling Transects on M Field (given in Universal Transverse Mercator System Grid Coordinates)

<u>Transect Location</u>	<u>Starting Location</u>		<u>Ending Location</u>	
	<u>Easting</u>	<u>Northing</u>	<u>Easting</u>	<u>Northing</u>
1MU	388539	4356872	388523	4356825
2MU	388398	4357190	388450	4357189
3MU	388403	4357087	388394	4357035
4MU	388420	4356934	388466	4356948
5MU	388460	4357091	388412	4357086
1ME	388516	4356718	388532	4356672
2ME	388558	4356458	388610	4356463
3ME	388541	4356385	388547	4356330
4ME	388653	4356751	388599	4356744
5ME	388592	4356668	388589	4356719
1	388885	4356383	388893	4356334
2	388846	4356433	388814	4356443
3	388815	4357160	388823	4357112
4	388782	4356862	388831	4356869
5	388768	4357049	388782	4356987

APPENDIX B

MEASUREMENT OF PERCENT COVER VEGETATION
ON M-FIELD TRANSECTS

TABLE B.1. Estimates of Vegetation Canopy Cover on Unmowed, Unexposed Transects (1-5) in June

Transect 1

PASP	0	25	5	0	15	0	0	45	35	15
GRUN	100	40	45	60	50	50	75	10	25	30
CAGR	0	0	0	0	0	0	5	0	0	0
ELTE	0	0	55	45	50	35	75	40	40	50
JUTE	25	50	35	35	0	30	20	60	30	50
FOUN	0	0	0	0	10	0	0	0	5	0
Grasses	100	65	50	60	65	50	75	55	60	45
Sedges	25	50	90	80	50	65	50	100	70	100
Forbs	0	0	0	0	10	0	0	0	5	0

Transect 2

ANAR	3	20	0	10	0	0	0	0	0	0
HOLA	0	8	0	0	0	0	0	0	0	5
PASP	5	40	5	6	5	0	0	0	0	0
GRUN	100	40	45	60	50	50	75	10	25	30
ELTE	0	0	15	0	0	0	0	0	30	60
JUTE	0	10	25	35	20	25	0	5	40	5
POSP	0	0	0	0	3	0	0	0	0	0
SCIN	0	0	0	10	13	0	0	0	0	0
PAQU	0	0	0	0	3	0	0	0	0	0
CAFA	0	0	0	0	0	0	0	45	0	0
FOUN	7	5	0	3	0	3	8	5	7	12
Grasses	108	108	50	76	55	50	75	10	25	35
Sedges	0	10	40	35	20	25	0	5	70	65
Forbs	7	5	0	13	19	3	8	50	7	12

Transect 3

ANAR	5	5	0	25	40	20	30	15	5	50
PASP	17	10	7	20	0	40	0	5	10	12
GRUN	10	50	60	50	45	50	60	80	65	60
ELTE	30	10	10	0	0	0	10	0	0	10
JUSP	15	15	10	0	0	0	0	0	0	0
JUTE	0	0	0	0	0	2	10	10	5	0
LASP	5	0	12	0	12	0	0	5	0	0
POSP	0	5	0	7	8	3	10	10	3	0
SCIN	0	0	3	0	0	0	0	0	0	0
VISP	0	3	0	0	0	0	0	0	0	0
FOUN	0	20	25	20	30	5	5	0	3	40
Grasses	42	65	67	95	85	110	90	100	80	122
Sedges	45	25	20	0	0	2	20	10	5	10
Forbs	5	28	40	27	50	8	15	15	6	40

Transect 4

ANAR	1	0	0	0	0	10	0	5	0	0
HOLA	20	0	0	0	10	12	0	0	0	0
PASP	8	7	0	6	3	0	20	0	0	0
GRUN	25	85	0	40	35	78	5	70	45	35

TABLE B.1. cont.

CAAN	0	8	3	10	3	0	25	0	18	0
ELTE	0	7	80	0	0	0	40	0	0	0
JUTE	10	12	0	60	16	8	10	30	0	55
PEDI	50	5	30	0	10	0	0	0	0	0
POSP	40	15	0	0	0	0	0	0	5	0
SCIN	0	0	0	0	12	0	0	0	0	0
SIAR	4	0	20	5	0	0	0	3	0	0
FOUN	12	18	0	0	0	25	5	8	8	0
Grasses	54	92	0	46	48	100	25	75	45	45
Sedges	10	27	83	70	19	8	75	30	18	55
Forbs	56	38	50	5	22	25	5	11	13	0
Transect 5										
ANAR	45	25	6	12	5	10	10	20	6	33
HOLA	0	0	0	0	0	0	0	10	30	7
PASP	0	0	12	5	3	0	5	0	0	0
GRUN	50	50	65	90	90	100	95	80	80	70
CAGR	0	0	0	0	0	5	1	5	0	0
CASQ	0	0	0	0	1	0	0	0	0	0
JUTE	0	0	3	3	8	1	3	15	0	0
PAQU	0	0	0	0	0	0	0	0	0	5
DACA	4	0	0	0	0	0	0	0	0	0
LASP	0	0	0	0	0	0	5	0	0	0
OXSP	0	0	0	0	3	0	0	3	0	5
PEDI	0	7	0	0	0	0	0	0	0	0
PLLA	7	13	0	0	0	0	0	0	0	0
POSP	0	0	15	0	3	10	0	10	0	0
SCIN	5	0	0	0	0	0	0	0	0	0
CAFA	25	0	0	0	0	0	0	10	0	0
FOUN	15	28	20	18	20	0	10	12	20	38
Grasses	95	75	83	107	98	110	110	110	116	110
Sedges	0	0	3	3	9	6	4	20	0	0
Forbs	56	46	35	18	26	10	15	35	20	48

TABLE B.2. Estimates of Vegetation Canopy Cover on Mowed, Exposed Transects (IME-5ME) in June

Transect 1-ME										
ANAR	10		5	0	5	0	5	0	0	0
HOLA	0	10	0	10	0	0	0	0	10	0
PASP	10	0	5	0	0	0	0	0	0	0
ANO	0	0	0	0	0					
JUTE	30	0	20	10	3	0	10	30	15	25
GRUN	65	15	50	75	50	60	5	0	70	50
OXSP	0	0	2	0	0	0	0	0	15	0
PLLA	0	50	0	45	30	0	0	10	0	40
POSp	25	40	30	0	0	0	0	3	5	0
SCIN	0	0	5	0	0	0	0	0	0	0
PAQU	3	0	2	0	0	0	0	0	0	0
TRSP	0	4	0	0	0	0	0	0	10	0
FOUN	0	0	0	3	0	0	0	0	1	5
Transect 2-ME MOWED RECENTLY										
ANAR	10	10	10	0	0	0	0	0	0	10
ELTE	0	4	0	0	0	0	0	0	0	0
JUTE	15	0	0	0	10	0	0	0	0	0
PASP	20	15	15	15	40	15	15	30	0	0
HOLA	5	10	0	0	0	0	0	0	0	15
GUNK	55	65	80	55	75	60	75	50	55	65
OXSP	3	3	3	0	0	0	0	0	0	0
POSP	20	3	0	0	0	12	15	15	20	10
SIAR	1	0	0	0	0	0	0	0	0	0
FOUN	30	50	8	48	17	5	3	22	14	40
Totals										
Grasses	90	100	105	70	115	75	90	80	55	75
Sedge	15	4	0	0	10	0	0	0	0	0
Forbs	54	56	11	48	17	17	18	37	34	50
Transect 3-ME										
ANAR	10	0	20	20	10	40	5	65	5	0
HOLA	10	20	40	30	30	0	10	5	0	0
JUTE	0	10	0	15	20	5	65	10	0	20
PASP	0	0	0	0	0	10	0	0	0	0
ELTE	0	0	0	25	58	0	50	0	0	0
SONU	5	0	0	0	0	0	0	0	0	0
GUNK	80	70	60	25	30	70	60	65	95	100
DACA	0	0	0	0	0	10	0	0	0	0
POSP	15	5	10	0	20	25	0	0	10	0
FOUN	12	5	10	35	15	0	0	12	5	1
Totals										
Grasses	105	90	120	75	70	120	75	135	100	100
Sedges	0	10	0	40	78	5	115	10	0	20
Forbs	27	10	20	35	35	35	0	12	15	1
Transect 4-ME										
HOLA	3	0	0	0	0	0	0	0	0	0
JUTE	0	15	0	0	0	15	0	20	50	60
PASP	0	0	0	0	0	0	13	15	5	10
GUNK	40	35	85	85	80	75	80	85	55	35
DACA	3	0	0	0	0	4	0	0	0	0
OXSP	0	0	5	0	0	0	0	0	0	0

TABLE B.2. cont.

SIAR	0	3	0	0	0	0	0	0	0	0
TRSP	60	75	0	0	0	0	0	0	0	0
Totals										
Grasses	43	35	85	85	80	75	93	100	60	45
Sedges	0	15	0	0	0	15	0	20	50	60
Forbs	63	78	5	0	0	4	0	0	0	0
Transect 5-ME										
ANAR	2	40	0	2	10	90	60	30	25	45
CAAN	0	0	0	0	0	0	0	0	3	0
HOLA	0	0	0	0	0	0	0	0	40	30
JUTE	20	25	20	10	10	15	10	50	5	20
PASP	15	20	0	3	30	2	40	12	10	15
ELTE	0	0	0	85	90	20	0	0	10	25
GUNK	60	50	50	70	25	30	20	30	0	30
POSP	0	0	0	0	0	0	0	0	30	0
SCIN	0	0	0	0	0	0	0	0	3	20
SIAR	0	0	0	0	0	0	3	40	0	0
FOUN	0	0	0	0	0	0	0	0	30	0
Totals										
Grasses	75	70	50	74	55	50	60	42	51	75
Sedges	80	75	70	80	35	45	30	80	8	50
Forbs	0	0	0	0	0	0	3	40	63	20

TABLE B.3. Estimates of Vegetation Canopy Cover on Mowed Unexposed Transects (IMU-5MU) in June

Transect 1-MU										
HOLA	4	10	17	0	0	0	0	0	0	0
PASP	0	0	15	5	0	20	0	0	0	15
SEGE	0	5	0	0	0	0	0	0	0	0
GRUN	65	20	45	75	60	50	70	55	95	75
Totals										
Grasses	75	42	60	80	60	70	70	55	95	90
Sedge										
Forb	20	37	20	23	55	85	58	40	11	15
Transect 4-MU										
PASP	25	0	10	15	0	0	3	35	0	5
ANAR	0	0	0	0	25	0	0	10	5	40
GRUN	5	70	25	40	15	90	90	50	3	7
POSP	0	0	0	0	3	0	0	0	1	0
SOCA	0	0	0	0	0	3	0	0	0	0
FOUN	10	15	4	4	27	10	8	3	1	30
Totals										
Grasses	30	70	35	55	40	90	93	95	8	52
Sedges										
Forbs	10	15	4	4	30	13	8	3	2	30

TABLE B.3. cont.

Transect 2-MU																								
HOLA	40	7	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10	10	0	0	0	0		
PASP	0	0	0	0	0	0	0	0	0	0	0	0	0	15	27	3	15	2	45	10	2	5	30	0
GRUN	30	77	60	80	10	55	95	10	0	0	0	0	0	70	40	75	25	20	10	60	20	5	25	0
OXSP	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0
PLLA	20	5	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POSP	0	10	4	4	0	0	0	0	0	5	8	0	0	0	0	0	0	5	1	10	5	3	0	0
SOSP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAFA	5	5	5	17	0	4	0	0	0	10	0	0	0	5	10	0	0	15	0	4	15	0	0	0
FOUN	17	8	20	0	0	3	0	0	0	40	10	0	0	0	0	0	0	0	0	5	0	0	0	0
Totals	70	77	70	92	106	88	0	85	67	78	50	55	70	32	20	55	70	32	70	55	32	20	55	0
Grasses	0	10	10	15	13	0	55	10	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedges	42	28	37	21	3	7	15	55	18	18	0	1	19	20	3	0	19	20	1	19	20	3	0	0
Forbs	0	10	0	0	0	40	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Transect 3-MU																								
CASQ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CATR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	50	0	0
ELTR	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	10	0	0
JUTE	0	0	0	5	10	10	10	10	20	0	0	0	0	0	0	0	0	0	0	0	0	0	30	15
JUEF	15	10	30	25	20	45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PASP	0	0	0	0	0	0	0	0	0	60	10	0	0	0	0	60	25	10	10	0	10	15	0	40
POCO	0	0	0	0	0	0	0	0	30	5	0	0	0	40	0	0	0	0	0	30	0	0	0	0
Totals	15	10	30	25	20	45	0	0	3	0	10	30	10	40	0	0	10	15	10	30	0	0	0	0
Grasses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedges	42	28	37	21	3	7	15	55	18	18	0	1	19	20	3	0	19	20	1	19	20	3	0	0
Forbs	0	10	0	0	0	40	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0

TABLE B.3. cont.

	70	65	20	20	10	20	30	45	55	80	60	25	70	45	30	20
GRUN	60	50	50	40	45	40	100	95	20	0	10	0	0	0	0	0
DACA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LOSP	0	0	0	0	0	0	0	0	0	0	20	20	0	0	0	0
OXSP	0	0	0	0	0	0	0	0	0	5	0	0	0	7	0	0
PEDI	0	0	0	8	5	0	7	7	0	0	0	0	5	0	5	0
PCSP	0	12	5	3	10	0	0	0	0	10	20	25	20	5	10	0
PLLA	10	0	15	10	5	0	5	5	0	0	0	0	0	0	0	0
SCIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PAQU	0	0	0	0	10	0	0	0	0	20	0	10	5	10	0	0
FOUN	5	12	5	0	30	10	15	18	25	10	5	5	15	5	10	0
Totals	5	10	40	5	10	80	90	70	55	60	30	60	80	60	30	60
Grasses	75	70	72	82	45	45	125	25	80	70	70	55	80	60	30	60
Sedges	75	50	40	100	45	40	0	3	25	0	0	0	1	43	90	15
Forbs	15	70	55	10	30	55	10	21	10	45	55	60	45	27	25	0
	5	12	38	63	60	57	10	60	60	45	55	60	45	27	25	0
	20	10	53	5	15	53	5	10	0	0	0	0	0	0	0	0

Transect 5-MU

PASP	10	1	0	2	5	0	0	10	0	10	0	0	0	0	0	0
GRUN	80	85	80	55	65	55	55	65	30	80	0	0	0	0	0	0
PCSP	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
PAQU	0	0	0	0	10	15	15	0	20	10	0	0	0	0	0	0
FOUN	5	0	10	0	0	0	0	15	10	15	0	0	0	0	0	0
Grasses	30	86	80	57	70	57	55	75	30	90	0	0	0	0	0	0
Sedges	10	0	15	20	20	20	55	25	55	45	0	0	0	0	0	0
Forbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE B.4. Estimates of Vegetation Canopy Cover on Unmowed, Unexposed Transects (1-5) in August

Transect 1										
PASP	15									
GRUN		40	100	100	90	35	90	85	65	
PAPU	90	20				20	10		25	
AGST		50				20				40
CATR										
FOUN									50	
									10	15
Grasses										
	105	110	100	100	90	75	100	85	90	40
Sedges										
									10	50
Forbs										
										15
Transect 2										
PASP		10							25	5
PAPU										
TRDA										
AGST		25	75	80	70	65			60	
POSP				10						
SEGE		50								
GRUN	80	20			30		50	75	20	75
TRSP						3		35		10
FOUN	30		30	15	10	10	35	10	10	5
Grasses										
	80	105	75	90	100	65	50	75	105	80
Sedges										
Forbs										
	30		30	15	10	13	35	45	10	15
Transect 3										
HOLA							20			
PASP	10		5	20				5	15	5
PAPU			5	5						
GRUN	70	65	100	85	90	60	100	80	80	100
CATR	25	5	5	40			5		10	40
JUTE									20	
POSP	10		10		20	10	15			
LOSP								10		
FOUN	10	5	10	5	15	20	10	15		
Grasses										
	80	65	110	110	90	80	100	85	95	105
Sedges										
	25	5	5	40			5		30	40
Forbs										
	20	5	20	5	35	30	25	25		
Transect 4										
PASP				5		20	5			5
SEGE	75	20			10	25	30	20	50	
PAPU						10		65	25	10
GRUN	10	20	80	100	70	40	75		40	50
POSP	5							3		
SOCA					7					3
FOUN	10		25	10	10					
Grasses										
	85	40	85	100	100	80	105	90	115	60
Sedges										
Forbs										
	15		25	10	17			3	3	

TABLE B.4. cont.

Transect 5										
PASP			3		10					
PAPU					5					
TRDA			35	30		100	90			
GRUN	95	70	75	45	50		20	75	40	90
OXSP										3
POSP		5						10		
TRSP	10									
FOUN	10	15	10	5	10			7	15	15
Grasses	95	73	110	85	55	100	110	75	40	90
Sedges										
Forbs	20	20	10	5	10			17	15	18

TABLE B.5. Estimates of Vegetation Canopy Cover on Mowed, Unexposed Transects (IMU-5MU) in August

Transect 1ME										
HOLA	30	35	15							
PASP	5	8	10							
SEGE	15		10	15	35	40	50			
PAPU	30								80	
CY					35	20	100	20		
ERSP										10
GRUN	25	55	10	40	5				15	50
CATR									10	10
SEUN				20	5					
PLLA		10	20	20	15					30
POSP	5	15	8							
CAFA									5	
FOUN	5	5	10						5	15
Grasses	75	93	65	70	75	60	150	20	95	60
Sedges				20	5				10	10
Forbs	10	30	38	20	15				10	45
Transect 2ME										
PASP	5	10	45	30	30	25	15	40	15	5
PAPU				50	5				25	
TRDA	100								40	70
GRUN	20	80	55	30	40	55	75	45		
POSP	5		5			3	5		10	20
FOUN		40	25	15	20	15	20	25	10	5
Grasses	125	90	100	110	75	80	90	85	80	75
Sedges										
Forbs	5	40	30	15	20	18	25	25	20	25
Transect 3ME										
HOLA				35					20	25
PASP		15				55		5	30	
PAPU					80	40	40			
TRDA								30		
AGST										50
POPR		5								
SEGE		40			5			20		
GRUN	90		90	15		25	5	10	5	30
CAAN				10						
CATR		15								
JUTE					20					
POSP			10				10			
FOUN	10	5	5		5		5		10	15
Grasses	90	60	90	50	85	120	45	85	60	80
Sedges		15		10	20					
Forbs	10	5	15		5		15		10	15
Transect 4ME										
HOLA						45		30	30	
PASP		5								
SEGE		25	20	10			10			5
PAPU								20		
CY				50			5			10
GRUN	85	60	70		85	30	80		10	40

TABLE B.5. cont.

PLLA				5					5	
TRSP						25	25	20	35	60
Grasses	85	90	90	60	85	75	95	50	40	55
Sedges										
Forbs				5		25	25	20	40	60
Transect 5ME										
HOLA							30			20
PASP	5	5		3	30	15	3	35	20	30
POPR					10					
SEGE		50	90	40	50	10				
PAPU	60	10		40				30		
CY						10	5			
TRDA									5	
GRUN	10	60		10		50	20	30	80	30
CATR			5							20
SEUN							5			
POSP									15	10
FOUN	5	5		5			5		10	
Grasses	75	125	90	93	90	85	58	95	105	80
Sedges			5				5			20
Forbs	5	5		5			5		25	10

TABLE B.6. Estimates of Vegetation Canopy Cover on Mowed, Unexposed Transects (1MU-5MU) in August

Transect 1MU										
HOLA					30	5		10	10	20
PASP		3			3	3			8	25
POPR	15		3				40			30
PAPU					5			25		
CY	5					5			35	10
SEGE		5								
GRUN	40	60	75	90	45	35	10	10	35	15
DACA										
OXSP					3					
PLLA	2		2	1						
POSP		10	10	15	3	20	30			
SOCA	12	5								
CAFA	5				5					
TRSP					30	5	25		10	
FOUN			1		5	1		2		5
Grasses	60	65	78	93	83	48	50	45	88	100
Sedges										
Forbs	19	15	13	16	46	26	55	2	10	5
Transect 2MU										
PASP		15				5	5	15		7
PAPU				20	10	50	50		35	10
SEGE									10	10
GRUN	5	25	25	15	20	30	25	55		15
PLLA										
POSP	40								35	10
GASP	20							10		
CASP						2			10	
OXSP						2				
LOSP							2			
FOUN		3		10	35	7	10	5	10	20
Grasses	5	40	25	35	30	85	80	70	45	42
Sedges										
Forbs	60	3		10	35	11	32	5	55	30
Transect 3MU										
HOLA					7					55
PASP			10	15		5			50	
SEGE	30	10		10	20					
PAPU		60	35	15		80			25	
TRDA							50	100		
GRUN	20	20	20	70	20	5	10			10
CATR										
										30
PLLA										
POSP	5	10	15	5		10				
SOCA							10			
TRSP	10									
FOUN	20	15	15	10		5		10		45
Grasses	50	90	65	110	47	90	60	100	75	65
Sedges										30
Forbs	35	25	40	15		15	10	10		45
Transect 4MU										
PASP		5	5		12	12	5	3		10
SEGE			40							

TABLE B.6. cont.

GRUN	10	85	25	85	25	5	50	50		50
PLLA					10					
GASP					10	10				
CAFA									10	
FOUN			5	10	12	20	10	2		5
Grasses	10	90	70	85	37	17	55	53		60
Sedges										
Forbs	5	10	32	30	10	2	10	5		
Transect 5MU										
PASP			3			15	10	12	5	15
SEGE		10		10	15					
PAPU	40								10	
POPR									10	
GRUN	60	50	95	50	35	55	50	40	45	35
POSP	10	17					5	2		
GASP			5							
LOSP	3	2								
XASP		2								
FOUN		5	12	10	5		3	5	5	
Grasses	100	60	98	60	50	70	60	52	70	50
Sedges										
Forbs	13	26	17	10	5		8	7	5	

APPENDIX C

LIST OF RARE, THREATENED, AND ENDANGERED VERTEBRATES
THAT COULD OCCUR AT M-FIELD

APPENDIX C

LIST OF RARE, THREATENED, AND ENDANGERED VERTEBRATES THAT COULD OCCUR AT M-FIELD

<u>Scientific Name</u>	<u>Common Name</u>	<u>State</u>
AMPHIBIANS		
<i>Ambystoma tigrinum</i>	Eastern tiger salamander	Endangered
<i>Aneides aeneus</i>	Green salamander	Endangered
<i>Cryptobranchus alleganiensis</i>	Hellbender	Endangered
<i>Gastrophryne carolinensis</i>	Eastern narrow-mouthed toad	Endangered
REPTILES		
<i>Dermochelys coriacea</i>	Atlantic leatherback turtle	Endangered
<i>Eretmochelys imbricata</i>	Atlantic hawksbill turtle	Endangered
<i>Eumeces anthracinus</i>	Northern coal skink	Endangered
<i>Farancia erythrogramma</i>	Rainbow snake	Endangered Extirpated
<i>Lepidochelys kempii</i>	Atlantic ridley turtle	Endangered
<i>Virginia valeriae pulchra</i>	Mountain earth snake	Endangered
<i>Falco peregrinus</i>	Peregrine falcon	Endangered
<i>Haliaeetus leucocephalus</i>	Bald eagle	Endangered
<i>Numenius borealis</i>	Eskima curlew	Endangered Extirpated
<i>Picoides borealis</i>	Red-cockaded woodpecker	Endangered Extirpated
MAMMALS		
<i>Erethizon dorsatum</i>	Porcupine	In Need of Conservation
<i>Lynx rufus</i>	Bobcat	In Need of Conservation
<i>Mustela nivalis</i>	Least weasel	In Need of Conservation
<i>Myotis sodalis</i>	Indiana bat	Endangered
<i>Ursus americanus</i>	Black bear	Rare

APPENDIX D

TERRESTRIAL VERTEBRATES OF MARYLAND FOUND AT ABERDEEN
THAT COULD OCCUR AT M-FIELD

APPENDIX D

TERRESTRIAL VERTEBRATES OF MARYLAND FOUND AT ABERDEEN THAT COULD OCCUR AT M-FIELD

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>
MAMMALS		
<i>Didelphis marsupialis virginians</i>	Opossum	Common
<i>Sorex cinereus fontinalis</i>	Masked shrew	Uncommon
<i>Cryptotis parva parva</i>	Least shrew	Least shrew Rare
<i>Blarina brevicauda kirtlandi</i>	Short-tailed shrew	Common
<i>Condylure cristata cristata</i>	Star-nosed mole	Rare
<i>Scalopus aquaticus aquaticus</i>	Eastern mole	Rare
<i>Various species</i>	Bats	Uncommon
<i>Procyon lotor</i>	Raccoon	Common
<i>Mustela erminea cicognanii</i>	Short-tailed weasel or ermine	Rare
<i>Lutra canadensis lataxina</i>	River otter	Rare
<i>Mephitis mephitis nigra</i>	Striped skunk	Common
<i>Vulpes vulpes fulva</i>	Red fox	Common
<i>Urocyon cinereoargenteus cinereoargenteus</i>	Grey fox	Rare
<i>Marmota monax monax</i>	Woodchuck	Common
<i>Tamias striatus fisheri</i>	Eastern chipmunk	Common
<i>Sciurus niger vulpinus</i>	Eastern fox squirrel	Common
<i>Sciurus carolinensis pennsylvanicus</i>	Eastern gray squirrel	Common
<i>Glaucomys volans volans</i>	Southern flying squirrel	Uncommon
<i>Castor canadensis</i>	Beaver	Uncommon
<i>Peromyscus leucopus noveboracensis</i>	White-footed mouse	Abundant
<i>Neotoma floridana magister</i>	Eastern woodrat	Rare
<i>Oryzomys palustris palustris</i>	Rice rat	Uncommon
<i>Microtus pennsylvanicus pennsylvanicus</i>	Meadow vole	Abundant
<i>Microtus pinetorum scalopsoides</i>	Pine vole	Uncommon
<i>Ondatra zibethicus macrodon</i>	Muskrat	Abundant
<i>Zapus hudsonicus americanus</i>	Meadow jumping mouse	Common
<i>Rattus norvegicus</i>	Norway rat	Rare
<i>Mus musculus</i>	House mouse	Uncommon
<i>Sylvilagus floridanus mallurus</i>	Eastern cottontail	Abundant
<i>Odocoileus virginianaborealis</i>	White-tailed deer	Abundant
BIRDS		
<i>Gavia immer</i>	Common loon	
<i>Podiceps auritus</i>	Horned grebe	
<i>Podilymbus podiceps</i>	Pied-billed grebe	
<i>Phalacrocorax auritus</i>	Double-crested cormorant	
<i>Ardea herodias</i>	Great blue heron	

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>
<i>Florida caerulea</i>	Little blue heron	
<i>Bubulcus ibis</i>	Cattle egret	
<i>Casmerodius albus</i>	Common egret	
<i>Leucophoyx thula</i>	Snowy egret	
<i>Butorides virescens</i>	Green heron	
<i>Ixobrychus exilis</i>	Least bittern	
<i>Botaurus lentiginosus</i>	American bittern	
<i>Fiegadus faicinelius</i>	Glossy ibis	
<i>Fiegadus albus</i>	White ibis	
<i>Olor cobumbianus</i>	Whistling swan	
<i>Brania canadensis</i>	Canada goose	
<i>Anas platyrhynchos</i>	Mallard	
<i>Anas rubripes</i>	Black duck	
<i>Anas strepera</i>	Gadwall	
<i>Anas acuta</i>	Pintail	
<i>Anas carolinensis</i>	Green-winged teal	
<i>Anas discors</i>	Blue-winged teal	
<i>Mareca americana</i>	American widgeon	
<i>Spatula clypeata</i>	Shoveler	
<i>Aix sponsa</i>	Wood duck	
<i>Aythya americana</i>	Redhead	
<i>Aythya collaris</i>	Ring-necked duck	
<i>Aythya valisineria</i>	Canvasback	
<i>Aythya marila</i>	Greater scaup	
<i>Bucephala clangula</i>	Common goldeneye	
<i>Bucephala albeola</i>	Bufflehead	
<i>Oxyura jamaicensis</i>	Ruddy duck	
<i>Lophodytes cucullatus</i>	Hooded merganser	
<i>Mergus merganser</i>	Common merganser	
<i>Mergus serrator</i>	Red-breasted merganser	
<i>Cathartes aura</i>	Turkey vulture	
<i>Coragyps atratus</i>	Black vulture	
<i>Accipiter striatus</i>	Sharp-shinned hawk	
<i>Accipiter cooperii</i>	Cooper's hawk	
<i>Buteo lagopus</i>	Rough-legged hawk	
<i>Buteo jamaicensis</i>	Red-tailed hawk	
<i>Buteo lineatus</i>	Red-shouldered hawk	
<i>Buteo platypterus</i>	Broad-winged hawk	
<i>Aquila chrysaetos</i>	Golden eagle	
<i>Haliaeetus leucocephalus</i>	Bald eagle	
<i>Circus cyaneus</i>	Marsh hawk	
<i>Pandion haliaetus</i>	Osprey	
<i>Falco columbarius</i>	Pigeon hawk	
<i>Falco sparverius</i>	Sparrow hawk	
<i>Meleagris gallopavo</i>	Turkey	
<i>Colinus virginianus</i>	Bobwhite	
<i>Phasianus colchicus</i>	Ring-necked pheasant	
<i>Rallus elegans</i>	King rail	
<i>Rallus limicola</i>	Virginia rail	
<i>Gallinule chloropus</i>	Common gallinule	
<i>Porzana carolina</i>	Sora	
<i>Laterallus jamaicensis</i>	Black rail	
<i>Fulica americana</i>	American coot	
<i>Charadrius wilsonia</i>	Wilson's plover	
<i>Charadrius vociferus</i>	Killdeer	
<i>Squatarola squatarola</i>	Black-bellied plover	

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>
<i>Philohela minor</i>	American woodcock	
<i>Capella gallinago</i>	Common snipe	
<i>Actitis macularia</i>	Spotted sandpiper	
<i>Tringa solitaria</i>	Solitary sandpiper	
<i>Catoptrophorus semipolmanus</i>	Willet	
<i>Totanus melanoleucus</i>	Greatest yellowlegs	
<i>Totanus flavipes</i>	Lesser yellowlegs	
<i>Erolia melanotos</i>	Pectoral sandpiper	
<i>Erolia minutilla</i>	Least sandpiper	
<i>Erolia alpina</i>	Dunlin	
<i>Limnodromus griseus</i>	Short-billed dowitcher	
<i>Ereunetes pusillus</i>	Semipalmated sandpiper	
<i>Larus marinus</i>	Great black-backed gull	
<i>Larus argentatus</i>	Herring gull	
<i>Larus delawarensis</i>	Ring-billed gull	
<i>Larus atricilla</i>	Laughing gull	
<i>Larus philadelphia</i>	Bonaparte's gull	
<i>Sterna albifrons</i>	Least tern	
<i>Hydroprogne caspia</i>	Caspian tern	
<i>Columba livia</i>	Rock dove	
<i>Zenaidura macroura</i>	Mourning dove	
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	
<i>Bubo virginianus</i>	Great horned owl	
<i>Asio flammeus</i>	Short-eared owl	
<i>Tyto alba</i>	Barn owl	
<i>Strix varia</i>	Barred owl	
<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	
<i>Caprimulgus vociferus</i>	Whip-poor-will	
<i>Chaetura pelagica</i>	Chimney swift	
<i>Archilochus colubris</i>	Ruby-throated hummingbird	
<i>Megaceryle alcyon</i>	Belted kingfisher	
<i>Colaptes auratus</i>	Yellow-shafted flicker	
<i>Sphyrapicus varius</i>	Yellow-bellied sapsucker	
<i>Centurus carolinus</i>	Red-bellied woodpecker	
<i>Dendrocopos villosus</i>	Hairy woodpecker	
<i>Dendrocopos pubescens</i>	Downy woodpecker	
<i>Tyrannus tyrannus</i>	Eastern kingbird	
<i>Myiarchus crinitus</i>	Great crested flycatcher	
<i>Sayornis phoebe</i>	Eastern phoebe	
<i>Empidonax vireescens</i>	Acadian flycatcher	
<i>Contopus virens</i>	Eastern wood pewee	
<i>Nuttallornis borealis</i>	Olive-sided flycatcher	
<i>Eremophila alpestris</i>	Horned lark	
<i>Iridoprocne bicolor</i>	Tree swallow	
<i>Riparia riparia</i>	Bank swallow	
<i>Stelgidopteryx ruficollis</i>	Rough-winged swallow	
<i>Hirundo rustica</i>	Barn swallow	
<i>Progne subis</i>	Purple martin	
<i>Cyanocitta cristata</i>	Blue jay	
<i>Corvus brachyrhynchos</i>	Common crow	
<i>Corvus ossifragus</i>	Fish crow	
<i>Parus carolinensis</i>	Carolina chickadee	
<i>Parus bicolor</i>	Titmouse	
<i>Sitta carolinensis</i>	White-breasted nuthatch	
<i>Certhia familiaris</i>	Brown creeper	

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>
<i>Troglodytes troglodytes</i>	Winter wren	
<i>Thryothorus ludovicianus</i>	Carolina wren	
<i>Telmatactodytes palustris</i>	Long-billed marsh wren	
<i>Mimus polyglottos</i>	Mockingbird	
<i>Dumetella carolinensis</i>	Catbird	
<i>Toxostoma rufum</i>	Brown thrasher	
<i>Turdus migratorius</i>	Robin	
<i>Hylocichla mustelina</i>	Wood thrush	
<i>Hylocichla guttata</i>	Hermit thrush	
<i>Hylocichla ustulata</i>	Swainson's thrush	
<i>Hylocichla fuscescens</i>	Veery	
<i>Sialia sialis</i>	Eastern bluebird	
<i>Polioptila caerulea</i>	Blue-gray gnatcatcher	
<i>Regulus satrapa</i>	Golden-crowned kinglet	
<i>Regulus calendula</i>	Ruby-crowned kinglet	
<i>Bombycillus cedrorum</i>	Cedar waxwing	
<i>Sturnus vulgaris</i>	Starling	
<i>Vireo griseus</i>	White-eyed vireo	
<i>Vireo olivaceus</i>	Red-eyed vireo	
<i>Mniotilta varia</i>	Black-and-white warbler	
<i>Vermivora pinus</i>	Blue-winged warbler	
<i>Vermivora peregrina</i>	Tennessee warbler	
<i>Parula americana</i>	Parula warbler	
<i>Dendroica petechia</i>	Yellow warbler	
<i>Dendroica magnolia</i>	Magnolia warbler	
<i>Dendroica tigrina</i>	Cap May warbler	
<i>Dendroica caerulescens</i>	Black-throated blue warbler	
<i>Dendroica coronata</i>	Myrtle warbler	
<i>Dendroica virens</i>	Black-throated green warbler	
<i>Dendroica fusca</i>	Blackburnian warbler	
<i>Dendroica pensylvanica</i>	Chestnut-sided warbler	
<i>Dendroica castanea</i>	Bay-breasted warbler	
<i>Dendroica straita</i>	Blackpoll warbler	
<i>Dendroica pinus</i>	Pine warbler	
<i>Dendroica discolor</i>	Prairie warbler	
<i>Dendroica palmarum</i>	Palm warbler	
<i>Seiurus aurocapillus</i>	Ovenbird	
<i>Seiurus noveboracensis</i>	Northern waterthrush	
<i>Seiurus motacilla</i>	Louisiana waterthrush	
<i>Geothlypis trichas</i>	Yellowthroat	
<i>Icteria virens</i>	Yellow-breasted chat	
<i>Wilsonia pusilla</i>	Wilson's warbler	
<i>Wilsonia canadensi</i>	Canada warbler	
<i>Setophaga ruticilla</i>	American redstart	
<i>Passer domesticus</i>	House sparrow	
<i>Dolichonyx oryzivorus</i>	Bobolink	
<i>Sturnella magna</i>	Eastern meadowlark	
<i>Agelaius phoeniceus</i>	Red-winged blackbird	
<i>Icterus spurius</i>	Orchard oriole	
<i>Icterus galbula</i>	Baltimore oriole	
<i>Euphagus carolinus</i>	Rusty blackbird	
<i>Quiscalus quiscula</i>	Common grackle	
<i>Molothrus ater</i>	Brown-headed cowbird	
<i>Piranga olivacea</i>	Scarlet tanager	
<i>Piranga rubra</i>	Summer tanager	
<i>Richmondia cardinalis</i>	Cardinal	

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>
<i>Pheucticus ludovicianus</i>	Rose-breasted grosbeak	
<i>Guiraca caerulea</i>	Blue grosbeak	
<i>Passerina cyanea</i>	Indigo bunting	
<i>Spinus tristis</i>	American goldfinch	
<i>Pipilo erythrophthalmus</i>	Rufous-sided towhee	
<i>Passerculus sandwichensis</i>	Savannah sparrow	
<i>Ammodramus savannarum</i>	Grasshopper sparrow	
<i>Poocetes gramineus</i>	Vesper sparrow	
<i>Junco hyemalis</i>	State-colored junco	
<i>Spizella arborea</i>	Tree sparrow	
<i>Spizella passerina</i>	Chipping sparrow	
<i>Spizella pusilla</i>	Field sparrow	
<i>Zonotrichia leucophrys</i>	White-crowned sparrow	
<i>Zonotrichia albicollis</i>	White-throated sparrow	
<i>Passerella iliaca</i>	Fox sparrow	
<i>Melospiza georgiana</i>	Swamp sparrow	
<i>Melospiza melodia</i>	Song sparrow	
<i>Plectrophenax nivalis</i>	Snow bunting	

AMPHIBIANS AND REPTILES

<i>Ambystoma maculatum</i>	Spotted salamander	Common
<i>Ambystoma opacum</i>	Marbled salamander	Uncommon
<i>Plethodon c. cinereus</i>	Red-backed salamander	Common
<i>Bufo a. americanus</i>	American toad	Common
<i>Bufo woodhousei fowleri</i>	Fowler's toad	Abundant
<i>Acris crepitans crepitans</i>	Northern cricket frog	Abundant
<i>Hyla cinerea</i>	Green treefrog	Uncommon
<i>Hyla c. crucifer</i>	Northern spring peeper	Abundant
<i>Hyla v. versicolor</i>	Eastern gray treefrog	Abundant
<i>Pseudacris triseriata feriarum</i>	Upland chorus frog	Common

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