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THE VERTEBRATE LIFE OF CERTAIN PRAIRIE AND FOREST REGIONS NEAR CHARLESTON, ILLINOIS

BY

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ERRATA AND ADDENDA.

Page 50, second column, line 13 from bottom, for *Danais archippus* read *Anosia plexippus;* line 8 from bottom, for *mellifica* read *mellifera.*

Page 51, line 11 from bottom, for *Danais* read *Anosia.*

Page 159, at right of diagram, for *Bracon agrilli* read *Bracon agrili.*

Page 289, second column, last line but one, for *Scalops* real *Scalopus.*

Page 294, line 3, for *catcsbeana* read *catesbiana.*

Pages 327 and 330, line 12, for *orcus* read *oreas.*

Page 347, line 4, for Cecidomyidæ read Cecidomyiidæ.

Page 356, line 7, for Anthomyidæ read Anthomyiidæ.

Page 368, line 18, dele second word.

Page 373, after line 10 insert as follows: 53a, *subpruinosa* Casey, 1884, p. 38.

Page 375, after *submucida* Le Conte, 48, insert *subpruinosa* Casey, 53a.

Page 377, after line 7, insert as follows:—

1884. Casey, Thomas L.
Contributions to the Descriptive and Systematic Coleopterology of North America. Part I.

Page 379, line 11 from bottom, for *sensu lata* read *sensu lato.*

Page 382, line 12, for VII read VIII.

Page 408, line 2, for *the next article in* read *Article VIII of.*

Page 410, line 6 from bottom, for $=4$ read *'11.*

Page 412, line 7, for 31 read 30.

Page 421, line 17 from bottom, insert *it* before *grows.*

CONTENTS

ARTICLE III.—*The Vertebrate Life of certain Prairie and Forest Regions near Charleston, Illinois.* BY T. L. HANKINSON.

INTRODUCTION

During August, 1910, a study was made of the biological conditions of a piece of prairie and a piece of woodland near Charleston, Coles County, Illinois, by Mr. Charles C. Adams, of the University of Illinois, who studied the invertebrates; by Mr. E. N. Transeau, of the Eastern Illinois State Normal School, at Charleston, who studied the plants; and by the writer, who gave particular attention to the vertebrate life. Embodied in this paper are the notes taken at this time on the vertebrates, together with other notes on vertebrates taken during occasional visits to the places since then.

The two areas chosen for the work here reported are located as follows. The prairie, in section 35, township 13 N., range 9 E., is a bit of right-of-way of the Toledo, St. Louis and Western Railroad, about two miles north of the center of the city of Charleston, extending some sixteen hundred feet along the east side of the track, just north of the east and west wagon-road which here crosses the railroad. This place will be frequently referred to in this paper as Station I. The woodland, chiefly in section 5, township 12 N., range 10 E., is about three and a half miles northeast of the center of Charleston and covers about one hundred and sixty acres of the farm owned by Mr. J. I. Bates. We called this Bates woods—Station II of this paper. These two areas are shown on the map, Plate LXIV.

In selecting areas for special study, an attempt was made to get those as little disturbed by man as possible and representing at the same time the two prevailing types of country about Charleston, namely, *forest* and *prairie*. Such conditions are hard to find in a region so extensively cultivated as Coles County. In a part of the country of this character the most extensive representations of original prairie features are usually along railway rights-of-way. This fact governed us in the selection of Station I as representative prairie. As representative forest, Bates woods (Station II) was chosen, because it seemed less disturbed than any other piece of forest available for study.

To one or the other of these stations almost daily visits were made during August, 1910. The writer's data were obtained chiefly by watching animals. It was possible to identify most of the birds positively without shooting them. Binocular field-glasses constituted the most useful instrument for the work. For small mammals, furthermore, considerable trapping was done. The results of the efforts to find vertebrates, made by the writer and by his co-workers (incidentally—while doing their special parts of the field work), were on the whole disappointing. Yet the methods seemed little at fault, for they were of a well-tested kind. It is very evident that vertebrates were not present in any considerable numbers, either as individuals or species, in either of the regions. Hence this contribution on the vertebrate life of the two areas is unimportant as compared with the other parts of the report on the life of this region.

The writer is under considerable obligation to Mr. C. B. Cory for naming a few birds and mammals for him; to Mr. A. G. Ruthven for naming amphibians and reptiles; and to his collaborators in the field, Mr. E. N. Transeau and Mr. C. C. Adams, both of whom gave him information and other help in doing the work on vertebrates.

The Prairie Area, Station I

The prairie region studied, lies, as before stated, along the Toledo, St. Louis and Western Railroad (known as the Clover Leaf Road). It is approximately sixteen hundred feet long by forty feet in width. A line of telegraph poles, placed two hundred feet apart and supporting five wires, runs the length of it. Plates LXV, LXVI, and LXVII, Fig. 1, will give one a general idea of the place.

The surface of the area is uneven. Near its middle is a marked depression, a few hundred feet in length and with a bottom five or six feet below the railroad-track bed. This is a west extension of a large piece of low ground comprising eight or nine acres of the field just east of the area studied. Commonly the ground here is wet, and it may be covered with water, forming a pool with its west margin at Station I. Marsh conditions may also develop here, which probably resemble those that were prevalent in the large prairie marshes or sloughs that existed in much of the region north of Charleston before the days of ditching and tile drains. This low, commonly wet area will be referred to in this paper as Substation *d*. The main part of the low region in the field east of the station is sometimes a large mud flat with black soil, which on drying becomes much cracked. Plate LXV, Fig. 2; Plate LXVI, Fig. 1; Plate LXVII, Fig. 2; Plate LXVIII; Plate LXIX, Fig. 1; and Plate LXXI,

Fig. 1,—all show parts of this low-ground area under different conditions and from different points of view.

On both north and south sides of Substation *d*, the ground is high and level, but at the north end of Station I the ground is low but without conspicuous marsh conditions. Early in the spring, however, there are shallow pools here. Plate LXVI, Fig. 2, and Plate LXVII, Fig. 1 show the south portion of the station, and Fig. 1, Plate LXXII, shows the north part.

The whole area has a black, stiff, clay soil, except for a narrow, artificial ridge of gravel near the track in places; indeed, the natural topography appears to have been little disturbed by the railway construction work, which began about 1880. The ground of the station is almost entirely covered with vegetation, chiefly herbaceous in character. There is a large willow *(Salix)* patch at Substation *d* and a smaller one near the north end of the station. Saplings of cottonwood *(Populus deltoides)* are scattered over parts of the region, and small cherry-trees are numerous about the south end. In August, 1910, conspicuous herbs on the high ground were goldenrod *(Solidago)*, rosin-weed *(Silphium)*, cone-flower *(Lepachys pinnata)*, mountain mint *(Pycnanthemum virginianum)*, and flowering spurge *(Euphorbia corollata)*; and there were also a number of grasses and sedges, that in some cases formed tall, thick growths. On the low ground, swamp milkweed *(Asclepias incarnata)*, rushes *(Scirpus)*, flags *(Iris)*, and the tall reed grass were prominent.

The fields adjoining Station I are cultivated. They were planted with Indian corn during the period of observation, but in 1913 a large piece of broom-corn lay adjacent to the north half of the station. Figure 1, Plate LXX, shows a part of this. Because attempts to grow Indian corn on the piece of low ground where there is often much water have been almost failures, this has been a nearly open area with a few sickly corn plants here and there and with many weeds. (See Plate LXVIII, Fig. 2.) Along the road just south of the station and running at right angles to it is a row of cherry trees and a few Osage orange trees. (See Plate LXVI, Fig. 2, and Plate LXX, Fig. 2.) The field some six hundred feet east of the north part of the station surrounds a piece of uncultivated land covering between two and three acres. It is a small swamp with standing water a good part of the time—one of the few bits of undrained prairie lowland left in the region about Charleston, and undoubtedly a remnant of a much larger prairie slough. Vegetation is so abundant here that the swamp looks like a compact bush patch with a few cottonwood trees at its middle, and with a broad zone of grass, sedge, and other low herbs forming its border. Figure 1, Plate LXX,

shows this bit of swamp; it can also be seen in the far background just to the right of the foremost telegraph pole in Figure 1, Plate LXXI. A short distance south of this little swamp, out in the field, is a large, isolated, naked, and burnt dead stub of a tree, forming a conspicuous landmark (Plate LXXI, Fig. 2).

Vertebrates were not numerous at Station I, and at few times were there so many as to constitute a conspicuous feature of the area, the kinds present being usually represented by merely a few individuals. Only thirty-five species were found at the station or in its immediate vicinity. A list of these, with brief notes of their occurrence, follows.

AMPHIBIANS AND REPTILES

Chorophilus nigritus (Le Conte). Swamp Tree-frog.

Conspicuous by its call in early spring about the temporary pond at Substation *d* and about the small shallow pools at the north end of the station (Pl. LXXII, Fig. 1). Eggs of the species were found at this place April 23, 1911.

Rana pipiens Shreber. Common Frog.

A few specimens were seen in early spring about the low ground at Substation *d*, and in the pools here in early spring where they undoubtedly breed. Eggs were found in the temporary pools at the north end of the station (Pl. LXXII, Fig. 1). A large example of this species was found in the stomach of a garter snake (see below) November 24, 1913. The frog, its hind legs included, was about eight inches long.

Thamnophis sirtalis (Linn.). Garter Snake.

Two of these snakes were taken by the writer; one of them small (March 30, 1913), and one large, measuring twenty-nine inches in length (November 24, 1913). This large snake is the one that ate the leopard frog spoken of above. It is shown in Figure 2, Plate LXXII, as it appeared before it was captured.

BIRDS

Butorides virescens virescens (Linn.). Little Green Heron.

One was seen, resting on the fence between the right-of-way and the corn field, July 31, 1912.

Rallus elegans Aud. King Rail.

One was flushed from the high grass of the low ground of Substation *d* on August 1, 1912, and another on May 18, 1913.

Porzana carolina (Linn.). Sora Rail.

Frequently flushed during the field work in August, 1910, from the grass-covered low ground of Substation *d*.

Totanus flavipes (Gmel.)? Lesser Yellowlegs.

One was seen at the mud flat in the field east of the station in August, 1910. It is possible that this may have been the greater yellowlegs, *Totanus melanoleucus* (Gmel.).

Helodromas solitarius solitarius (Wils.). Solitary Sandpiper.

Common about the mud flat of the field east of the station in August, 1910.

Oxyechus vociferus vociferus (Linn.). Killdeer.

Common about the pools and mud flats whenever these existed.

Colinus virginianus virginianus (Linn.). Bob-white.

Two of these birds were flushed from the right of way July 3, 1911. A small covey flew up from the broom-corn stubble just east of the station on November 4, 1913.

Zenaidura macroura carolinensis (Linn.). Mourning Dove.

Frequently seen resting on the telegraph wire over the station and occasionally seen on the ground.

Circus hudsonius (Linn.). Marsh Hawk.

One was seen flying over the fields near the station in August, 1910. It is common in the prairie region north of Charleston.

Falco sparverius sparverius Linn. Sparrow Hawk.

One was seen resting on a telegraph pole at the station, July 3, 1911. They are common along the Clover Leaf right-of-way.

Melanerpes erythrocephalus (Linn.). Red-headed Woodpecker.

One was seen about the telegraph poles of the station August 8, 1910. Also seen about the cottonwoods of the small swamp east of the station.

Colaptes auratus luteus Bangs. Flicker.

Common about corn fields, and frequently seen on fences bordering those in the vicinity of the station. A nest was found in the small swamp east of the station in May, 1914.

Tyrannus tyrannus (Linn.). Kingbird.

Frequently seen on the wires. On August 8, 1910, one was seen chasing a marsh hawk near the station. Kingbirds were noted in the small swamp east of the station.

Cyanocitta cristata cristata (Linn.). Blue Jay.

A few were seen about the wild cherry-trees along the road just south of the station.

Corvus brachyrhynchos brachyrhynchos Brehm. American Crow.

Often seen flying over the station and in the adjacent corn fields. A few were noted on the railroad track at the station in July, 1911.

Agelaius phœniceus phœniceus (Linn.). Red-winged Blackbird.

The most often seen bird at the station and the only one actually found nesting there. On May 18, 1913, a nest with three eggs was found about two feet above the marshy ground of substation *d*, in some rushes *(Scirpus robustus)* to which the nest was attached (Pl. LXIX, Fig. 2). Seven red-winged blackbirds' nests were located by the writer on May 21, 1914, in the thick willows of the willow zone of the small swamp east of the station (Pl. LXX, Fig. 1). They were placed five to eight feet up in the willows, and five that were examined internally contained eggs, one to four in number.

Quiscalus quiscula æneus Ridgw. Bronzed Grackle or Crow Blackbird.

Abundant; often in large flocks about the corn fields in the region around the station in late summer and early fall. A number were seen feeding on the ground at the station April 23, 1911, and July 31, 1912. On May 21, 1914, a dozen or more of these blackbirds were seen following a harrow in the field east of the station—undoubtedly after grubworms that were being turned up here in large numbers; the writer, in fact, saw a bird pick one up.

Sturnella magna magna (Linn.). Meadowlark.

Not common at the station or in its immediate vicinity, though a few were seen resting on the wires. Meadowlarks are most common in the Charleston region in grassy meadows, and comparatively few are seen about cultivated fields like those in the neighborhood of Station I. They seem to avoid railway rights-of-way. The writer, however, found a nest of the species with four eggs within a dozen feet of the Clover Leaf track on a grassy part of the right-of-way, some ten miles north of Charleston, on May 1, 1914.

Passer domesticus domesticus (Linn.). English Sparrow.

Common at the south end of Station I, about the fences, trees, shrubs, and overhead wires.

Astragalinus tristis tristis (Linn.). Goldfinch.

Common at the station and its vicinity in the fall when weed seeds were common; they were not seen here at other seasons.

Spizella monticola monticola (Gmel.). Tree Sparrow.

Common about the broom-corn near the station and in the small swamp east of it, during the fall of 1913 and winter of 1913–14. They probably visited the station at times where conditions were favorable for them.

Melospiza melodia melodia (Wils.). Song Sparrow.

A few of these birds were seen at the station and sometimes they were heard singing there.

Passerina cyanea (Linn.). Indigo Bunting.

Seen at the station August 11, 1910; a male was on a telegraph wire.

Hirundo erythrogaster (Bodd.). Barn Swallow.

Seen flying about the station in August, 1910.

Lanius ludovicianus migrans Palmer. Migrant Shrike.

Shrikes were frequently seen at the station, resting on the wires or tops of telegraph poles, where they appeared to be watching for prey below. One was seen to drop down from the wire and capture a monarch butterfly. In the winter shrikes are sometimes seen at other places along the Clover Leaf Railroad; and in all probability they visited the station then. One specimen obtained in August, 1910, was *L. ludovicianus migrans*. The writer is not certain that all the shrikes seen belonged to the subspecies *migrans;* some may have been loggerhead shrikes, *Lanius ludovicianus hudsonius* Linn.

Dendroica coronata (Linn.). Myrtle Warbler.

Occasionally seen in fall about the bushy and weedy roadside near the south end of the station.

Geothlypis trichas trichas (Linn.). Maryland Yellow-throat.

A male yellow-throat was seen, and heard singing about the willow patch of the low ground in the summer of 1911 and in May, 1913. A nest was probably present, although the writer was unable to find it.

Toxostoma rufum (Linn.). Brown Thrasher.

Not a regular inhabitant of the station; only one seen (April 23, 1911), and this was on the fence.

Planesticus migratorius migratorius (Linn.). Robin.

Common at the south end of the station; many seen at times resting on the wires. Probably attracted by the wild cherries near this place.

Mus musculus (Linn.). House Mouse.

One was caught in a trap set on the low ground (Substation *d*), in a patch of swamp milkweed.

Peromyscus maniculatus bairdi (Hoy and Kennicott). White-footed Prairie Mouse.

Caught on the high ground in a patch of wild sunflowers, in a mouse trap baited with apple.

Sylvilagus floridanus mearnsi (Allen). Common Rabbit.

Rabbits were very common here during the spring and summer of 1913. They would frequently jump up from their resting places in the herbage of the low ground. Many were present in the fields about the station. The animal is abundant in the prairie region north of Charleston.

Blarina parva (Say). Small Short-tailed Shrew.

One was found drowned in an old well at the edge of the small piece of swamp just east of the station, on March 16, 1914.

Besides the vertebrates just listed, a number of others certainly inhabit the piece of right-of-way, and the above record probably includes only a small fraction of those actually present. Some species of birds that were probably overlooked are the Wilson's snipe, and one or more kinds of wild ducks. The former has been flushed in places about Charleston similar to Substation *d;* and on October 30, 1911, the writer saw, from a train, a wild duck fly up from the pool which has its west margin at this station. Hunters say that ducks visit this place in spring and autumn whenever water is present there.

Little was learned concerning the kinds of mammals at Station I. A number of burrows on the high ground of the station appeared to be gopher burrows. From Mr. F. E. Wood's published notes on the mammals of Champaign County*—a county less than twenty miles north of Coles County—and from data on these forms obtained from the writer's observations about Charleston, it appears that the following belong to the fauna of the piece of prairie under consideration, either as occasional visitors or as permanent inhabitants.

*A Study of the Mammals of Champaign County, Illinois. Bull. Ill. State Lab. Nat. Hist., Vol. VIII, Article V (1910), pages 501–613.

Common Names	Scientific Names
Striped Gopher	*Citellus tridecemlineatus* (Mitchill)
Gray Gopher	*Citellus franklini* (Sabine)
Prairie Meadow-mouse	*Microtus austerus* (Le Conte)
Skunk	*Mephitis mesomelas avia* (Bangs)
Weasel	*Putorius noveboracensis* Emmons
Short-tailed Shrew	*Blarina brevicauda* Say
Common Mole	*Scalops aquaticus machrinus* (Rafinesque)

RELATION OF THE PRAIRIE VERTEBRATES TO THEIR ENVIRONMENT

The influences that seemed to be the most important in determining the character of the vertebrate fauna of Station I were its size, its topography, its climatic conditions, its vegetation, its invertebrates, the interactions of the vertebrates themselves, and certain features in the country surrounding the station.

The small size of the area studied was undoubtedly an important factor in giving the place a small vertebrate fauna. Any favorable feature for a particular species in the way of food, shelter, nesting place, and so on, could not be extensive enough to attract many individuals of the species.

The topography was of such a character that a diversity of conditions, chiefly hydrographic and vegetal, were brought about. A varied fauna was thus produced, with some animals that were strictly aquatic and others that were entirely terrestrial.

The weather has a marked effect on the vertebrate life. In winter little activity is manifest, though a few roving winter birds may search about the dead but standing herbs for seeds; shrikes and sparrow-hawks may rest on the wires; and a few rabbits may hide in the dead, ground vegetation. In spring the wet weather, that usually comes, causes the forming of pools where amphibians breed. In different summers the amount and frequency of rainfall differs greatly. In 1910 and in 1912, small pools or areas of wet ground were present most of the time, and aquatic or partly aquatic animals were prominent through the season; but in the summers of 1911 and 1913, dry weather prevailed, and water animals, except crawfish in burrows, seemed to be entirely absent. The appearance and slow disappearance of the pools, especially of the large pool, bring about a succession of animal habitats—pond changing to mud flat and the latter to low, dry, cracked ground with scant vegetation. Each of these has

its characteristic animal community. Figure 2, Plate LXVII and Plate LXVIII show conditions in this series. Autumn weather has been very diverse in character since the observations began. In November, 1913, very unusual conditions, like those of early spring, prevailed. The air was warm and balmy; the fields were green; and flying insects were much in evidence, At this time, November 24, 1913, a garter snake was captured on the high ground at the station. It was very active, and it had just swallowed a large leopard frog.

The plant life of this prairie area is probably the most important factor in determining its vertebrates, since it not only furnishes them food, in the shape of seeds, fruits, roots, leaves, and insects, but also affords them shelter, seclusion, and concealment while they are resting, feeding, and nesting. A few instances of these latter uses of plants to vertebrates were observed: rabbits were found hiding among the plants; a king rail concealed itself so effectively in a small patch of rushes that much searching did not reveal it; a red-winged blackbird's nest was attached to rush leaves, which not only supported the nest but concealed it (Pl. LXIX, Fig. 2).

Vertebrates were in all probability attracted to the station by insects and other invertebrates which furnish them food, yet meager data on this point was obtained, for few were seen feeding. A shrike caught a monarch butterfly while being watched by the writer, and a shrike which was killed contained many insect fragments, chiefly of grasshoppers and other *Orthoptera*. Bronzed grackles were seen searching for grubworms behind a harrow that was being used in the field just east of Station I, May 21, 1914. In fact, most of the birds seen at the station were well-known insect eaters.

Vertebrates have a marked influence on each other, and their interactions have much to do with the character of the vertebrate fauna at Station I. Few facts concerning these interrelations could be obtained, however, because of the meagerness of the field work done. A kingbird was seen chasing a marsh hawk over the fields near the station; a red-winged blackbird appeared to be trying to drive away a sparrow-hawk that was about the telegraph poles at the station; and, as previously stated, a garter snake was found, which had swallowed a large frog. Shrikes and sparrow-hawks seen along the railroad here and elsewhere in winter are in all probability hunting for mice. Man produces at this station a marked effect on the vertebrates of a lower order than himself. During the hunting season, hunters were often seen at the station or near it looking for rabbits, bob-whites, or ducks; and judging from the many empty shot-shells found lying on the ground, some game is found by gun-

ners here. Railway workmen cut the weeds and shrubbery and sometimes burn over the region in the fall. Trains passing also disturb the animal life. On the other hand, the telegraph line constitutes a very attractive feature for birds. Eight of the twenty-nine species of birds that were seen at or near the station were noted only on the wires and poles, which appeared to be the one feature of the place to bring them there, and a majority of all the individual birds noted were upon the poles or wires.

The vertebrate life of Station I is influenced considerably by the nature of the region about it. From neighboring corn fields, where they fed, blackbirds would come and gather in large numbers on the telegraph wires; and birds attracted to roadside cherry-trees near the south end of the station also used wires near by as a resting place. Beneath the wires and along fences in the neighborhood of this row of trees many small cherry-trees had sprung up, in all probability from cherry-stones dropped by the birds (Pl. LXVII, Fig. 1, and Pl. LXX, Fig. 2). In the former figure there are no trees visible under the wire, those formerly there having been cut away by railroad employees, but there are cherry-trees visible along the fence. Were it not for the destructive activities of man, the south part of the station would soon develop into a small cherry thicket, having its origin in cherry-stones dropped there by the birds. A tall naked stub in the field a few hundred feet east of the middle of the station was a kind of headquarters for woodpeckers, ten nesting-holes being counted in it (Pl. LXXI, Fig. 2).

The small piece of swamp a short distance east of the station may have been responsible for the presence, at the station, of red-winged blackbirds, the green heron, and the rails. All of these birds frequent such places in the Charleston region, and red-winged blackbirds nest there in considerable numbers. A green heron's nest was found in a little swamp similar to this one but some two miles northwest of it. A flicker's nest was found in this swamp May 21, 1914.

The Forest Area, Station II

As stated above, the piece of woods studied is about three and a half miles northeast of Charleston, perhaps a quarter of a mile north of the Big Four railroad and a few rods west of the Embarras River.

The topography of the woods is much varied. A part of the woods is on the west slope of the Embarras valley, and other portions are on the high ground and on the low ground adjacent to this slope; besides, two rather complex ravine systems cut up the woods considerably. There are, then, four rather distinct kinds of region in

the woods: (1) high, comparatively level ground; (2) low, river-bottom woods; (3) slopes; and (4) ravine bottoms. A small, temporary stream is in the south ravine. At the time that our field work was started, trees covered the region quite evenly except in a few small glades and about the west margin, where, over a few acres, considerable wood-cutting had been done. There was much diversity in the height of trees, and a number of kinds were present.

On the upland were chiefly oaks *(Quercus)* and hickories *(Carya)*, but walnut *(Juglans)*, mulberry *(Morus rubra)*, and sumac *(Rhus glabra)* were also present, as well as other species. On the river bottom were maples *(Acer)*, elms *(Ulmus)*, red oak *(Quercus rubra)*, wild cherry *(Prunus serotina)*, coffee-tree *(Gymnocladus dioica)*, walnut, mulberry, bitternut hickory *(Carya cordiformis)*, and redbud *(Cercis canadensis)*. Climbing plants, notably wild grape *(Vitis cinerea)*, were common, especially in the low woods. Undergrowth was unequally developed; in the upland woods in some places the ground had little else than dead leaves and fallen twigs upon it (see Pl. LXXIII), while in other places, there were many bushes (Pl. LXXIV). Herbage was scant on the forest floor in the upland woods but formed an abundant growth in the bottom woods (see Pl. LXXV).

The little stream, which runs in an easterly direction, taking a tortuous course through the south part of the woods, is an important animal habitat; and it brings to the station a number of aquatic vertebrates. For a good part of its course in the woods, it flows through a ravine (Pl. LXXVI). In the southeast corner of the woods, however, it passes through a piece of low and level ground where it is less shaded, and its banks have rank herbage. Farther up stream, in the thicker woods, the banks have little low vegetation on them and are covered chiefly with dead leaves, brush or other forest debris. Figure 1, Plate LXXVII, shows a part of the stream in the lower, southeast corner of Bates woods. Throughout its course, the stream is a series of clear, shallow pools connected by narrow rills trickling over deposits of sand and gravel in the stream bed. In the lower part of its course, east of Bates woods and on the river flood-plain, the bed of the stream is ordinarily dry. Aquatic plants, except some algæ (chiefly *Spirogyra*, *Oscillatoria*, and diatoms) were absent. Water-striders *(Gerris)* and small crawfish *(Cambarus)* were the only invertebrates noted in conspicuous numbers by the writer.

The country about Bates woods, which was an important factor in determining the nature of its fauna, is rough and hilly. It was, for the most part, originally forested, but now it is largely cleared

and cultivated. Corn is the prevailing crop grown upon it. Plate LXXVII, Figure 2, and Plate LXXIX show features of the country about the woods.

Birds were the most conspicuous of the vertebrates of Bates woods, but they appeared to have a decided preference for the margin of the upland woods at the time (August, 1910) when most of the field work was done. Plate LXXVIII is typical of the upland woodland margin where most of the birds were found.

Many vertebrates besides birds were undoubtedly present in the woods, but few notes were obtained on them. Two species of fish, represented by only a few individuals, were in the stream, and some amphibians were found at this place. Only one species of reptile was found, the box-turtle. Mammals seemed scarce, and much trapping brought scanty results. The almost complete absence of squirrels in woods which have food and shelter in abundance for them, is due, as I was told, to certain gunners.

An annotated list of the vertebrates found by the writer in Bates woods follows.

FISH, AMPHIBIANS AND REPTILES

Campostoma anomalum (Rafinesque). Stone-roller.

A small example, two and a half inches long, was caught in the ravine stream in August, 1910.

Semotilus atromaculatus (Mitchill). Horned Dace.

Small specimens, one to nearly two inches long, were present in small numbers in a few of the shallow pools in the lower part of the south ravine woods during August, 1910. They were in the deepest of the few shallow pools here. When disturbed they would hide under stones or under the bank. Freshets following hard rains in August, 1910, seemed to clean these and other fish out of the stream, for none have been found in it since.

An examination of the intestinal contents of a few of these little dace, revealed various objects, but chiefly insect fragments, including parts of beetles, gnat larvæ, and ants. Copepods and green alga filaments were also present. These dace were seen trying to capture grasshoppers and other insects that had fallen on the water surface.

Desmognathus fusca Rafinesque. Dusky Salamander.

Larvæ of this species were frequently found in the shallow, stony-bottomed pools of the stream, where it flowed through the deeper and well-shaded part of the ravine in the woods.

Bufo americanus Le Conte. Common Toad.

A few small toads were noted along the bank of the lower, less-shaded part of the creek in the woods.

Hyla versicolor Le Conte. Common Tree-toad.

One specimen was taken in Bates woods by Mr. Adams.

Rana catesbeana (Shaw). Bullfrog.

A large specimen was taken in the pool close to the fence in the lower part of the stream in the woods. The pool is shown in Figure 1, Plate LXXVII. In the stomach of this frog were remains of grasshoppers, ground-beetles, snails, and crawfish *(Cambarus diogenes)*.

Terrapene carolina (Linn.). Box-turtle.

Two box-turtles were found on the north slope of the south ravine by Mr. Adams. One was too small to be identified with certainty, but the other was undoubtedly this species.

BIRDS

Butorides virescens virescens (Linn.). Little Green Heron.

Common along the Embarras River near Bates woods; also frequently seen about some small ponds in a piece of woods continuous with Bates woods.

Cathartes aura septentrionalis Wied. Turkey Vulture.

Birds of this species were seen flying low over the woods in August, 1910. They are common in the Charleston region, especially along the Embarras bottoms.

Accipiter cooperi (Bonap.)? Cooper's Hawk.

A hawk that resembled this species flew from the trees in the south ravine on April 4, 1914.

Coccyzus americanus americanus (Linn.). Yellow-billed Cuckoo.

Common about the upland woods; none seen in the low, bottom woods.

Ceryle alcyon (Linn.). Belted Kingfisher.

Common about the "Big Four ponds" just south of Bates woods, which are in a piece of woods similar to Bates woods.

Dryobates villosus villosus (Linn.). Hairy Woodpecker.

One specimen was seen in the upland woods April 4, 1914.

Dryobates pubescens medianus (Swains.). Downy Woodpecker.

Common in both high and low woods but most often seen in the latter.

Centurus carolinus (Linn.). Red-bellied Woodpecker.

Often seen in the upland woods in August, where it was frequently noisy.

Sphyrapicus varius varius (Linn.). Yellow-bellied Sapsucker.
This species was noted in April, 1914, about the few trees which remain of the upland woods.

Colaptes auratus luteus Bangs. Northern Flicker.
Common about the margins of the upland woods in August, 1910. It appeared to limit itself strictly to regions of this character and to avoid the thick interior woods.

Archilochus colubris (Linn.). Ruby-throated Hummingbird.
Seen resting in the foliage region of the upland woods in August, 1910.

Myiarchus crinitus (Linn.). Crested Flycatcher.
Common in the woods on both high and low ground, confining itself mostly to the "upper story" of the woods, that is, the foliage region.

Myiochanes virens (Linn.). Wood Pewee.
Common; frequently heard; chiefly in the upland woods.

Empidonax virescens (Vieill.). Acadian Flycatcher.
Common in the upland woods.

Cyanocitta cristata cristata (Linn.). Blue Jay.
Very common; busy feeding on acorns. Few calls were uttered, and the presence of the bird was usually revealed by the oft-repeated noise of dropping acorns in some particular part of the woods.

Corvus brachyrhynchos brachyrhynchos Brehm. American Crow.
Uncommon, though a few were noted.

Astragalinus tristis tristis (Linn.). Goldfinch.
Very common and singing about the tops of the high trees along the south edge of the woods in August, 1910.

Zonotrichia albicollis (Gmel.). White-throated Sparrow.
Common in Bates woods in late spring and early fall during migrations.

Spizella pusilla pusilla (Wils.). Field Sparrow.
Abundant in the bushy growth near the upland woods, to the edge of which it frequently went. Plate LXXVIII shows a typical habitat.

Junco hyemalis hyemalis (Linn.). Slate-colored Junco.
Seen in August, 1910, along the east edge of the low woods. Abundant and singing on April 4, 1914, in the remnant of the upland woods.

Melospiza melodia melodia (Wils.). Song Sparrow.
A few individuals were noted. Uncommon.

Pipilo erythrophthalmus erythrophthalmus (Linn.). Towhee.
A few specimens were seen in the low woods.

Cardinalis cardinalis cardinalis (Linn.). Cardinal.
Often heard in various parts of the woods both low and high; a few were seen.

Zamelodia ludoviciana (Linn.). Rose-breasted Grosbeak.
One specimen was noted in the low woods in August, 1910. Probably more common than it seemed to be, on account of its silence at this time of year.

Passerina cyanea (Linn.). Indigo Bunting.
Common and singing almost constantly during the August days in the shrubby growth on the upland near the woods. None seen or heard in the woods.

Piranga erythromelas Vieill. Scarlet Tanager.
A few individuals were noted in the interior of the woods.

Piranga rubra rubra (Linn.). Summer Tanager.
A few specimens were seen and heard about the edges of the woods.

Seiurus sp. Water-thrush.
A water-thrush was seen in the south ravine on May 24, 1911. A good enough view could not be obtained to determine the species.

Icteria virens virens (Linn.). Yellow-breasted Chat.
A few individuals were noted in the woods.

Mniotilta varia (Linn.). Black and White Warbler.
Several birds of this species were seen in the upland woods during August, 1910.

Setophaga ruticilla (Linn.). Redstart.
A few individuals were seen; probably common.

Thryothorus ludovicianus ludovicianus (Lath.). Carolina Wren.
One specimen was found in the low forest.

Bæolophus bicolor (Linn.) Tufted Titmouse.
Common in the woods at all seasons. Lives chiefly in the foliage region, but comes frequently to the undergrowth, and is often seen on the ground.

Penthestes atricapillus atricapillus (Linn.). Chickadee.
Common in the woods; seen chiefly in the upland woods.

Polioptila cærulea cærulea (Linn.). Blue-grey Gnatcatcher.
A few specimens were noted in August, 1910.

Planesticus migratorius migratorius (Linn.). Robin.
A few robins were seen in the woods. They did not appear to be common.

Sialia sialis sialis (Linn.). Bluebird.
Common in April, 1914, about the few trees left standing after the removal of most of the upland woods.

MAMMALS

Tamias striatus (Linn.)? Chipmunk.
One chipmunk was seen in the remnant of the upland woods in June, 1914. Since Wood records the subspecies *hysteri* in Champaign County, it is possible that this may be *T. striatus hysteri* (Richardson).

Sciurus niger rufiventer (Geoffroy)? Fox Squirrel.
A squirrel that was in all probability this species, but which may possibly have been a gray squirrel, was seen in the upland woods in August, 1910.

The foregoing list includes all the vertebrates seen by the writer in Bates woods during the field trips made to the region. It certainly comes far from including all those that were in the woods since the field studies were started in August, 1910. Most of the writer's observations were made in late summer, when birds are seen with difficulty because of their comparative silence. Poor success was obtained in making mammal collections, although methods were used that the writer has employed with considerable success in places similar to Bates woods. It is very probable that mammals are actually scarce there.

It is remarkable that no examples of the common rabbit *(Sylvilagus floridanus mearnsi)* were found, for the species is very abundantly represented about Charleston in both wooded and prairie regions. Another notable fact is that no snakes were observed, for they are frequently though not commonly found in other woodlands about Charleston.

Other vertebrates that in all probability belong to the Bates woods' fauna, according to the writer's observations in similar woodlands about Charleston and according to reliable testimony, are given in the list below. Still other species may live in the woods or visit it oc-

casionally, but their occurrence can not be so clearly vouched for as those in the following list.

SUPPLEMENTARY LIST OF BIRDS

Common Names	Scientific Names
Black-crowned Night Heron	*Nycticorax nycticorax nævius* (Bodd.)
Bob-white	*Colinus virginianus virginianus* (Linn.)
Sharp-shinned Hawk	*Accipiter velox* (Wils.)
Red-tailed Hawk	*Buteo borealis borealis* (Gmel.)
Red-shouldered Hawk	*Buteo lineatus lineatus* (Gmel.)
Sparrow Hawk	*Falco sparverius sparverius* Linn.
Barred Owl	*Strix varia varia* Barton.
Screech Owl	*Otus asio asio* (Linn.)
Great Horned Owl	*Bubo virginianus virginianus* (Gmel.)
Black-billed Cuckoo	*Coccyzus erythrophthalmus* (Wils.)
Red-headed Woodpecker	*Melanerpes erythrocephalus* (Linn.)
Whippoorwill	*Antrostomus vociferus vociferus* (Wils.)
Kingbird	*Tyrannus tyrannus* (Linn.)
Cowbird	*Molothrus ater ater* (Bodd.)
Baltimore Oriole	*Icterus galbula* (Linn.)
Bronzed Grackle	*Quiscalus quiscula æneus* Ridgw.
Purple Finch	*Carpodacus purpureus purpureus* (Gmel.)
Lark Sparrow	*Chondestes grammacus grammacus* (Say)
White-crowned Sparrow	*Zonotrichia leucophrys leucophrys* (Forst.)
Tree Sparrow	*Spizella monticola monticola* (Gmel.)
Fox Sparrow	*Passerella iliaca iliaca* (Merr.)
Cedar Waxwing	*Bombycilla cedrorum* Vieill.
Myrtle Warbler	*Dendroica coronata* (Linn.)
Catbird	*Dumetella carolinensis* (Linn.)
Brown Thrasher	*Toxostoma rufum* (Linn.)
Brown Creeper	*Certhia familiaris americana* (Bonap.)

Golden-crowned Kinglet	*Regulus satrapa satrapa* Licht.
Ruby-crowned Kinglet	*Regulus calendula calendula* (Linn.)
Wood Thrush	*Hylocichla mustelina* (Gmel.)
Hermit Thrush	*Hylocichla guttata pallasi* (Cab.)

SUPPLEMENTARY LIST OF MAMMALS

Opossum	*Didelphys virginiana* Kerr.
Fox Squirrel	*Sciurus niger rufiventer* (Geoffroy)
Gray Squirrel	*Sciurus carolinensis* Gmel.
Chipmunk	*Tamias striatus hysteri* (Richardson)
Flying Squirrel	*Sciuropterus volans* (Linn.)
House Mouse	*Mus musculus* Linn.
Mole Mouse	*Microtus pinetorum scalopsoides* (Aud. and Bach.)
Muskrat	*Fiber zibethicus* (Linn.)
Common Rabbit	*Sylvilagus floridanus mearnsi* (Allen)
Raccoon	*Procyon lotor* (Linn.)
Skunk	*Mephitis mesomelas avia* (Bangs)
Weasel	*Putorius noveboracensis* Emmons
Smaller Shrew	*Blarina parva* (Say)
Common Mole	*Scalopus aquaticus machrinus* (Rafinesque)

RELATION OF THE WOODLAND VERTEBRATES TO THEIR ENVIRONMENT

The principal factors that influence the vertebrates of Bates woods are similar to those which are influential in determining the character of the vertebrates of the prairie area (Station I): vegetation, topography of the region, climatic conditions, invertebrates, the vertebrates themselves, and the surrounding region.

The vegetation of the woods affects vertebrates directly by giving them places of concealment from their enemies and shelter from the elements, and also by furnishing them with food to a certain extent. The food thus provided by the plants of Bates woods is chiefly fruit. There are many plants there that bear fruits known to be acceptable to birds, important among which are the following: mulberry, sassafras, poison-ivy, smilax, blackberry, sumac, wild grape, wild cherry, June-berry, pokeberry, woodbine, flowering dogwood, bayberry, and

oaks of various kinds. Meager data were obtained on the feeding of birds upon fruit, for it was very difficult to see them eating on account of the foliage and their wariness; furthermore, fruit-eating birds were not present in numbers proportionate to the amount of fruit there for them. This illustrates a condition very conspicuous in the Charleston region generally—plenty of bird food but few birds to avail themselves of it. The marked decrease in numbers of wild native birds about Charleston during some ten years of the writer's observations in the region, is undoubtedly due to other causes than to a scarcity of food. Blue jays and tufted titmice were seen in Bates woods pecking acorns or carrying them.

The environmental conditions in the woods were diversified by the character of the topography. There were marked differences in the fauna of the upland and lowland woods; some birds preferred one to the other. The ravine with the small stream also had certain vertebrates not found elsewhere in the woods.

Some observations were made on the effect of climatic conditions on the vertebrates of the woods. The temperature of the air and water in the woods, and the amount of moisture in the air are features that undoubtedly affect the vertebrate life, directly or indirectly, by determining the character of food, shelter, and other environmental features present. These factors are the chief ones in bringing about the marked seasonal differences in faunal conditions and in giving rise to a variety of animal habitats and hence to a variety of forms ranging from strictly aquatic animals to those living in arid situations. Some animals were found that live continually in the shade; others were found that are attracted by bright sunlight. A dynamic climatic feature was noticed in August, 1910, when a hard rain produced such a torrent in the creek that the few fish in it were seemingly all carried out of it, not again to return. Thus in a few hours a rain produced a marked and apparently permanent faunal change.

The invertebrates had a powerful effect on the vertebrate life of Bates woods, being food for the majority of the vertebrates found there. Some insectivorous birds common in Bates woods are the yellow-billed cuckoo, downy woodpecker, red-bellied woodpecker, crested flycatcher, wood pewee, Acadian flycatcher, red-eyed vireo, and tufted titmouse. The large bullfrog captured in the stream had been eating small crawfish. Grasshopper fragments were found in the stomach of a small toad caught along the stream.

Little information was obtained concerning the influence of the species of vertebrates on each other. A few hawks were noted, which undoubtedly prey upon other vertebrates in the woods, yet none were seen hunting there. Vertebrates may also affect each other through

competition for food, yet so much food was present in the form of insects and fruit, that this was probably an unimportant factor. Man has done much to change the character of the vertebrate life of the woods. Hunters frequently visit the place with the result that game (squirrels, rabbits, bob-whites) has become very scarce there. During the last two years, furthermore, man has almost destroyed this as a habitat for wood-loving animals by timber-cutting. A little of the upland woods is left and most of that on the Embarras slope; practically all of the lowland woods is removed. Plate LXXIX shows some of the conditions as they now (1914) are. The timber in the lower part of the south ravine has not been much disturbed. Here, in the spring of 1914, many maples *(Acer saccharum)* were tapped for sap.

Insufficient data were obtained concerning the effect of the surrounding region upon the vertebrate life of Bates woods. All the species found there live normally in woodland regions. Though birds undoubtedly carry fruits and seeds of the plants in the woods to the more open region about it, thus tending to extend the wooded area, neverthless the counteracting operations of man prevent their doing much in this way.

Summary and Conclusions

When a careful search in a very typical part of central Illinois for regions with features like those of the original prairies and forests reveals no better places than the piece of Clover Leaf right-of-way (Station I) and the small piece of woods (Station II), and when we note that both of these have become so modified since our work began in 1910 that they are no longer of special interest, biologically, we are once more made aware of the importance of studying any remnants of wild uncultivated Illinois land, or any areas having conditions similar to these, in order that we may have a few facts, at least, concerning the history of our interesting fauna.

Station I, although it appeared to have more primitive conditions than any other piece of ground near Charleston, had a vertebrate fauna very different from that of the old, uncultivated prairies, according to the little information available concerning the life of the latter. Some idea of this prairie life is given by C. E. Wilson, who, in writing of the prairies of Coles County,* tells of the buffalo that used to live there and the great number of prairie wolves that did much damage during the period of the early settlement of the county.

*History of Coles County, Illinois, in Historical Encyclopedia of Illinois. Munsell Publishing Co., Chicago. 1906.

He writes of the wild fowl coming each spring to the prairie ponds "in countless thousands", a number of them remaining to breed. Prairie chickens were numerous, as well as some other prairie vertebrates that are now very scarce. Snakes, including rattlesnakes, were very prevalent. In all probability the latter are now exterminated on the prairies in the part of Illinois which includes Charleston.

Robert Ridgway gives an interesting account of the bird life of a piece of prairie near Olney, some forty miles south of Charleston.* Ninety-five species were observed by him. Some of these not now existing about Charleston, unless in very small numbers, are Henslow's bunting, black terns, marsh wrens (both species), ravens, swallow-tailed kites, and blue kites. His description makes it very evident that no bit of uncultivated prairie-land like the one of this study can at present have a bird fauna of the same aspect as that of the prairies as they used to be in this part of the country.

The vertebrate fauna of Station I was of a composite nature in that it was made up of aquatic, semi-aquatic, woodland, and prairie forms. It was somewhat surprising to find the prairie forms comparatively scarce. For example, the prairie birds (those that feed and breed in the open field) were for the most part absent at Station I. Examples of these, scarce or absent at Station I but common in the Charleston region, are the meadowlark, horned lark, grasshopper sparrow, savanna sparrow, dickcissel, bobolink, upland plover, and pectoral sandpiper.

The piece of right-of-way appeared to be visited by birds somewhat incidentally in going to and from places more attractive to them in the neighborhood,—the corn fields, the bit of swamp, and the row of cherry trees. The feature of the right-of-way that brought most of the birds there seemed to be the telegraph wires, for these formed perches and convenient lookouts. Furthermore, whenever standing water, another attractive feature, appeared at the station, aquatic forms were quick to visit it.

The abundance of varied herbage, with its edible fruits, seeds, and many insect associates, did not appear to be an important factor in determining the character of the vertebrate life of Station I. This was probably due to disturbing features at the place, to its small area, and to better feeding-grounds near by.

Bates woods (Station II) was a very desirable piece of woods for our study because of its primitive state and the fact that it presented three kinds of forest conditions, each with a rather distinct fauna.

*Prairie Birds of Southern Illinois, American Naturalist, 1873, pages 197-203.

These were (1) wooded upland, (2) low, wooded, bottom-land, and (3) a wooded ravine with a small stream.

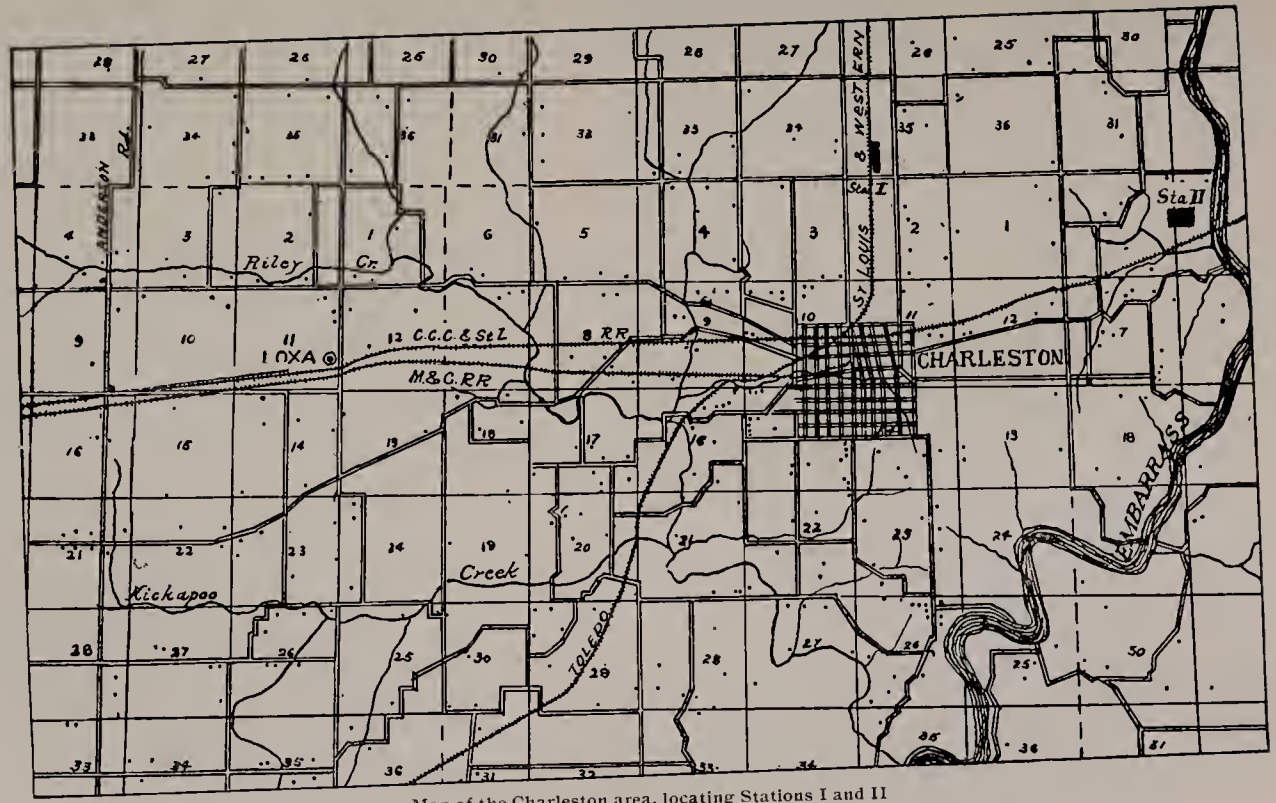
There was an apparent scarcity here of reptile and mammal life that could not be fully accounted for.

Birds, at least in late summer, preferred the upland to the low-land woods, and the margins, especially when bushy, to the interior.

Food for birds and squirrels was abundant in Bates woods, enough to support many more of these creatures than were present. Competition for food, thus, was in all probability, an unimportant factor in determining the character of the vertebrate fauna.

Game animals were scarce in the woods, undoubtedly because of excessive hunting.

The vertebrate fauna of Bates woods has undergone decided changes, due to environmental transformations brought about chiefly by man. Wilson in his "History of Coles County", mentions the following vertebrates, now absent, which used to be in the wooded part of the county: panther, wildcat, black timber wolf, large gray wolf, bear, deer, badger, wild turkey, wild pigeon, Carolina parokeet, and ruffed grouse.



Map of the Charleston area, locating Stations I and II

PLATE LXIV

Fig. 1. Station I. Looking northeast over the north portion of the station.

Fig. 2. Station I. Looking northeast over most of the station from the south end of it.

Fig. 1. Station I. Looking south, showing in the foreground the low-ground region, substation *d*, in November, 1913.

Fig. 2. Station I. Looking south over the high-ground region south of substation *d*. November, 1913.

Fig. 1. Station I. Looking northeast over the south portion, showing wild cherry-trees along the fence. January, 1914.

Fig. 2. Station I. Looking northeast over most of the station, showing flooded condition of the low-ground region in March, 1913.

Fig. 1. Station I. Looking east from the railway track across the flooded field adjacent to the station on the east. March, 1913.

Fig. 2. Border of a recent mud flat at the edge of the piece of right-of-way, Station I. August, 1913.

Fig. 1. Station I. Looking southeast over the milkweed patch of the low ground, substation *d*, August, 1910.

Fig. 2. Station I Looking west toward the railway-track bed, showing willows, rushes, and other plants forming nesting habitat of the red-winged blackbird (nest close to the handkerchief). May, 1913.

Fig. 1 Small swamp east of Station I, a short distance in the field. Broom-corn stubble in the foreground. January, 1914.

Fig. 2. Row of wild cherry-trees (some Osage orange trees intermixed) along the road just south of Station I. January, 1914.

Fig. 1. Station I, substation *d*, looking northeast, November, 1913. Small swamp shown to the right, on the horizon line.

Fig. 2. Dead tree, east of Station I, in field. January, 1914.

Fig. 1. Station I. Small temporary pool at the north end of the station in April, 1911. Looking northeast.

Fig. 2. Garter snake, *Thamnophis sirtalis*, at Station I. November 24, 1913.

Station II. Interior of upland woods, showing *type* of forest with scant undergrowth. August, 1910.

Station II. Interior of portion of upland woods, typical of that with shrubby undergrowth. August, 1910.

Plate LXXV

Station II. Interior of lowland woods.

Fig 1. Station II. South ravine of woods. Looking northwest, up the ravine. April, 1914.

Fig. 2. Station II. Lower part of south ravine of woods. Looking west, up the ravine. August, 1912.

Fig. 1. Station II. Lower part of woodland stream just below the ravine. Looking southwest, up stream. August, 1910.

Fig. 2. Station II. Bates woods, looking north from the Big Four railroad track.

Station II. West margin of upland Bates woods. August, 1910 Typical of region of most abundant bird life.

Fig. 1. Station II. Bates woods, looking southeast, showing remnant of upland woods and stump-field with a few scattered trees where the lowland woods stood. Taken June, 1914.

Fig. 2. Station II. River region northeast of Bates woods, and corn field and potato patch (in foreground) where the lowland woods stood. Taken September, 1913.