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Successional Patterns in Diverted Croplands of Crawford County, Illinois

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SUCCESSIONAL PATTERNS IN DIVERTED CROPLANDS OF CRAWFORD COUNTY, ILLINOIS

(TITLE)

BY

NORMAN TRACY

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THESIS

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TABLE OF CONTENTS

INTRODUCTION

When croplands are abandoned or diverted from cultivation for any length of time, wild species begin to invade. Extensive studies have been made on the subject of secondary succession in other parts of the country such as the Piedmont region of eastern North America (Bard, 1952; Keever, 1950; McCormick and Murray, 1956 and 1957) and in extreme southern Illinois (Bazzaz, 1963). However, no information is available on secondary succession for east-central Illinois. It is the purpose of this paper to provide information on early stages of successional patterns in abandoned or diverted croplands for this region.

The study involves four small fields which are a part of the Arthur Vaughn farm located 5 miles south, 1¼ miles east of Oblong, Illinois, in Crawford County. The fields range in size from 2.7 acres to 5.2 acres. Three of the fields had been diverted from cultivation under the Soil Bank Program since the fall of 1967. The remaining field had been in the Soil Bank Program since the fall of 1966.

DESCRIPTION OF AREA

The fields studied are a part of the Arthur Vaughn farm, which is located 5 miles south, 1¼ miles east of the village of Oblong, Illinois. Four small fields were involved in the study. Three fields, hereafter referred to as fields 1A, 1B, and 1C, are legally described as a part of the NW¼ of the NW¼ of the NW¼ of Section 29, T6N, R13W. The other field, hereafter

referred to as field 2A, is legally described as a part of the NE¼ of the NE¼ of the NW¼ of Section 29, T6N, R13W (Figure 1).

Fields 1A, 1B, and 1C had not been cropped or mowed since the fall of 1967 when a corn crop was harvested from them. Fields 1A, 1B, and 1C will be referred to as one-year-old fields throughout this paper. They are fairly level, upland fields, and are poorly drained. Field 2A had not been disturbed since the fall of 1966 when a corn crop was harvested from it. Field 2A will be referred to as a two-year-old field in this paper. It is a bottom land field, which is frequently flooded by Big Creek, which forms its east and south borders. All four fields are between 440 and 460 feet above sea level and would be classified as Class 3 land according to standards used by the Soil Conservation Service. Although there are several conservation practices needed to successfully cultivate much Class 3 land, the main limitation that makes fields 1A, B, and C Class 3 land is that they drain poorly (Crawford County Soil Conservation District Soils Handbook, 1962).

The soil in most of fields 1A, B, and C is a Cisne silt loam. Cisne silt loam is a moderately dark-colored soil occurring on level, upland areas. This soil developed under grass vegetation in wind-deposited, silty material (loess) over Illinoisan glacial till. It has a claypan subsoil beginning at a depth of 18 to 24 inches below the surface; and, if it is not drained, the water table is too high during the wet season for the soil to be cultivated. Air and water movement in this type

soil is very slow, and the soil is medium in productivity and water-holding capacity. When used as cropland, drainage is almost always essential to success. When untreated, this soil is acid, low to very low in phosphate, and low to medium in potash. Surface crusting is also a problem (Crawford County Soil Conservation District Soils Handbook, 1962).

The extreme southern tip of field 1A contains a different type of soil, namely Blueford silt loam. Bluford is a moderately deep, light-colored, forested soil occurring on nearly level to moderate slopes. It is somewhat poorly drained. Water and air move slowly through this soil, and available water-holding capacity is slightly inadequate for best plant growth. Natural fertility is medium. Bluford silt loam is developed from thin, wind-deposited materials (loess) over glacial till (Crawford County Soil Conservation District Soils Handbook, 1962).

The soil type found in field 2A is Bonnie silt loam. Bonnie silt loam is a deep, light-colored, acid, bottom land soil, derived from medium-textured, alluvial sediments. It is naturally poorly drained, and the water table is usually high during much of the year. Water moves slowly through this type of soil, and the available moisture-supplying capacity is high. Productivity is usually low due to extreme wetness. This soil is naturally acid and low in potash, phosphate, and organic matter (Crawford County Soil Conservation District Soils Handbook, 1962).

All fields were measured to determine the acreage that was to be surveyed. Field 1A contains 2.7 acres; 1B, 3.2 acres; and

1C, 3.8 acres. The south border of field 1C was made to coincide with the south borders of fields 1A, 1B, and 1C. Field 2A contains 5.2 acres.

METHODS OF STUDY

Surveys were taken on August 3 and 4, 1968; September 28 and 29, 1968; and June 10 and 11, 1969. In each field studied three east-west lines were located (Figure 2). These lines were established equidistant from the ends of the fields and from each other. Along each line four sample points were established. The sample points were also equidistant from each other and from each end of the field. Since each field had a heavily wooded fence row around it, this method of locating lines and sample points was planned to eliminate the influence of the fence rows. At each point on the lines four 90-degree quadrants were made, and rigid metal hoops were thrown at random into each quadrant. For the one-year fields, the hoops used enclosed an area of 0.1 square meter, while in the two-year-old field the hoops used enclosed an area of 0.25 square meter. The 0.1 square meter hoop would sometimes hang up on the larger vegetation in the two-year-old field and fail to hit the ground. This would detract from the random sampling technique somewhat, so the larger hoop was used in the two-year-old field. All hoops were made of one-half inch wide, steel banding tape.

From the data obtained, the Importance Value (IV) was then calculated from the actual data to provide a better basis of

comparison of the various species and fields. As used here, the determination of the IV follows the procedure outlined by Phillips (1959), in which the IV is a sum of the relative frequency

$$\frac{\text{Number of points of occurrence of the species}}{\text{Number of points of occurrence of all species}} \times 100$$

and the relative density

$$\frac{\text{Number of individuals of the species}}{\text{Number of individuals of all species}} \times 100.$$

Voucher specimens of all species were collected and deposited in the E. L. Stover Herbarium of Eastern Illinois University. The taxonomic nomenclature in this paper follows that of Jones (1963).

RESULTS AND DISCUSSION

A total of 104 different plant species was collected and identified in the fields studied. The species encountered are shown in Appendices. The leading dominants of each field are shown in Tables 1 through 12, which rank the plants according to their Importance Value. The tables also show the relative frequency and relative density, from which the IV was computed.

In a study of this type it is interesting to note how both the aspect dominance (referring to situations in which a species or group of species appear to be dominant for a period of time, usually due to conspicuous floral characters) (Oosting, 1956) and the actual floristic composition of the fields change.

During the August, 1968, survey, the most evident plants (aspect dominance) in the one-year fields were: Ambrosia

artemisiifolia, Erigeron annuus, Hypericum mutilum, Polygonum pensylvanicum, Trifolium pratense, Trifolium hybridum, Rumex crispus, Setaria lutescens, and Digitaria sanguinalis (Figure 3).

The floristic composition of fields 1A and 1B was very similar as shown by the results from the August survey (Tables 1 and 2). The most important species in both fields were: Setaria lutescens, Juncus tenuis, Ambrosia artemisiifolia, and Hypericum mutilum, which together make up slightly over half of the Importance Value in both cases. Only slight variations in IV occur among other species in the two fields. The flora of field 1C differs considerably from that of 1A and 1B. The most important species in field 1C during the August survey were: Digitaria sanguinalis, Setaria lutescens, Juncus tenuis, and Ambrosia artemisiifolia. In fields 1A and 1B Digitaria ranks seventh or lower in IV. Hypericum mutilum ranks fourth or higher in fields 1A and 1B, but twelfth in field 1C. With grasses and rushes being common in field 1C, it was thought that this might be due to herbicide carry over. A careful check with the landowner showed that no herbicide had been used in the past, so it remains unexplained.

When the most important species (IV) in all the one-year fields for the August survey (Tables 1, 2, and 3) are compared to the species making up the aspect dominance for the same date, variations between the two lists are evident. Ambrosia artemisiifolia and Hypericum mutilum are important in each case; but Juncus tenuis, which is an important plant in all three fields,

does not make up a part of the aspect dominance. On the other hand, Erigeron annuus, Polygonum pensylvanicum, Rumex crispus, Trifolium pratense, and Trifolium hybridum are very evident plants in each one-year field, but are not as important as some species previously mentioned.

In field 2A, which had been diverted from cultivation for nearly two years prior to study, the most evident (aspect dominance) plants were: Bidens aristosa, Eupatorium serotinum, Rumex crispus, Ambrosia artemisiifolia, Ambrosia trifida, Ipomea pandurata, Aster pilosus, Erigeron annuus, Echinochloa crusgalli, and Trifolium hybridum (Figure 4). During the August survey, the vegetation in field 2A was much more varied than in any of the one-year fields. Fifty-six different plant species were found during the August survey in the two-year field, as compared to from 33 to 36 species for the one-year fields (Table 13). When the most evident species were compared to the most important (Table 4), certain differences were evident. Five species, Juncus tenuis, Ambrosia artemisiifolia, Eleocharis obtusa, Eupatorium serotinum, and Bidens aristosa, made up over half of the IV for field 2A during the August survey. The first three of the five most important species did not seem to make up any portion of the aspect dominance.

Both the aspect and floristic composition of the one-year fields changed noticeably between the first (August 3 and 4) survey and the second (September 28 and 29) survey. The grasses, Panicum capillare, Setaria lutescens, and Digitaria sanguinalis,

along with such broadleaf species as Ambrosia artemisiifolia, Aster pilosus, Solidago hirtella, Erigeron annuus, and Hypericum mutilum, were the most obvious plants (aspect dominance) during the second survey (Figure 5).

When the plants making up the aspect dominance of the one-year fields were compared to the most important species in the fields during the second survey (Tables 5, 6, and 7), certain similarities were evident. Panicum capillare, Setaria lutescens, and Digitaria sanguinalis were important species in both cases, as were Ambrosia artemisiifolia, and Hypericum mutilum. However, Erigeron annuus, Aster pilosus, and Solidago hirtella were not ranked high in IV though they were an important part of the aspect of the fields. Juncus tenuis was an important species in each field although it did not seem to be so as far as aspect dominance goes.

More uniformity in actual species composition of the three one-year-old fields was evident in the second survey. The five most important species in all three fields were: Juncus tenuis, Panicum capillare, Setaria lutescens, Digitaria sanguinalis, Ambrosia artemisiifolia, and Hypericum mutilum (Tables 5, 6, and 7). There were, however, minor variations in the rank of other species in the fields. The most noticeable change which occurred between the first and second surveys was the marked increase in the importance of grass species; four of the six most important plants in all of the three one-year fields were grasses.

At the time of the second survey, the aspect and floristic composition of field 2A had not changed as noticeably as it had in the one-year fields. The most obvious plants in the two-year field during the second (September) survey were still: Eupatorium serotinum, Bidens aristosa, Aster pilosus, Ambrosia artemisiifolia, Ambrosia trifida, and Echinochloe crusgalli. Eupatorium and Bidens were by far the most obvious species in the fields (Figure 6). Many specimens of Ambrosia artemisiifolia, Xanthium spinosum, and, in some cases, Ambrosia trifida found during the second survey were severely stunted, possibly due to the shading and competition from the larger and faster-growing Eupatorium and Bidens.

The five most important species found in field 2A during the second survey were: Juncus tenuis, Ambrosia artemisiifolia, Eupatorium serotinum, Bidens aristosa, and Aster pilosus (Table 8). When the most important species were compared with the species making up the aspect dominance for the field, few variations were found. Juncus tenuis was again an important plant in the field but did not make up a part of the aspect dominance of the field. Aster pilosus was a very obvious plant during the second survey and did rank high (fifth) in Importance Value (Table 8).

In comparing the Importance Values of the species found during the two (August and September) surveys in the two-year-old field, the results showed Eupatorium serotinum and Bidens aristosa had increased from a fourth- and fifth-place ranking, respectively, in August to a third- and fourth-place ranking, respectively,

in September (Tables 4 and 8). Juncus tenuis and Ambrosia artemisiifolia remained as the top two species. The greatest changes in Importance Value occurred in the following species: Eleocharis obtusa dropped from a third-place ranking in August to seventh place in September; Ipomoea pandurata dropped from a sixth-place ranking in August to a ranking of eighteenth in September; Aster pilosus increased in IV from eleventh in August to fifth in September; and Xanthium spinosum increased from ninth place in August to sixth place in September. Other minor changes occurred in rankings also; for example, Diodia teres and Sida spinosa were not among the 20 most important species in August, but were ranked fourteenth and fifteenth, respectively, in the September survey.

Due to the date of the third survey (June 10 and 11, 1969), several plants that dominated the one-year fields the fall before were not yet in bloom. By far the most evident (aspect dominance) species found in fields 1A, 1B, and 1C during the June survey were: Allium canadense and Erigeron annuus. Other species present, but not as obvious as Allium and Erigeron, were: Ambrosia artemisiifolia, Bidens aristosa, Eupatorium serotinum, Boltonia recognita, and Hypericum mutilum (Figure 7).

Agrostis hyemalis which was in bloom at the time of the June survey, and Digitaria sanguinalis, not yet in bloom, were both important species in the one-year fields, but were far more important in field 1C than in 1A or 1B (Tables 9, 10, and 11). Again, as in the August, 1968, survey, there was a noticeable

similarity between the vegetation in fields 1A and 1B. The top three species in fields 1A and 1B for the June survey were Juncus tenuis, Allium canadense, and Ambrosia artemisiifolia (Tables 9, 10, and 11). Although other similarities do exist, fields 1A and 1B were not as similar in floristic composition at the time of the third survey as they were during the second survey.

The Importance Value of grasses in field 1C was again higher than in 1A or 1B (Tables 9, 10, and 11). The same situation was noted during the August, 1968, survey. During the June survey, the most important species were Agrostis hyemalis and Digitaria sanguinalis. Allium canadense, which was a dominant plant in fields 1A and 1B during the June survey, ranked tenth in field 1C.

Only a few large plants were in bloom in field 2A during the June survey. The most evident plants (aspect dominance) in bloom were: Allium canadense, Rumex crispus, Erigeron annuus, Trifolium hybridum, and Oenothera biennis. Plants present in greater numbers than those blooming and which made up a major part of the flora of field 2A were: Bidens aristosa, Eupatorium serotinum, Solidago hirtella, and Ambrosia artemisiifolia (Figure 8). The floristic composition of field 2A changed very little during the entire survey (Tables 4, 8, and 12). The main changes were that there was a gradual increase in the IV of Solidago and a decrease in the importance of Eleocharis obtusa. The dominant species throughout the entire study were: Juncus tenuis, Ambrosia artemisiifolia, Eupatorium serotinum, and Bidens aristosa.

The number of plant species found during each survey and the total number of individuals of all species found during each survey are listed in Table 13. From the results of the three surveys (Table 13), it appears that the number of plant species and the total number of plants are on the increase in all the one-year fields. During the August survey an average of 34 species per field was found, during the September survey an average of 43 species, while during the June survey an average of 39 species. The total number of plants per field also increased in the one-year fields. The average number of plants found per field for each survey was: August, 1515; September, 3855; and June, 2327. From this data and the fact that there were 48 samples taken in each field, the average number of plants per square meter was calculated. For the August survey there were 315.62 plants per square meter; for September, 803.12 plants per square meter; and for June, 484.79 plants per square meter. In the two-year-old field (2A) the number of species remained nearly constant throughout the survey period, but there was a slight decrease in the total number of individuals (Table 13). The average number of plants per square meter in this field was: August, 468.50; September, 300.58; and June, 306.08.

One noticeable difference between the one-year and two-year fields was in the number of woody species present. In field 1A only one woody species, Robinia pseudoacacia (IV 0.42), occurred, while in field 1B only Acer saccharinum (IV 3.30) was found. In field 1C no tree seedlings were found. In field 2A five woody

species were found. These were Fraxinus americana (IV 2.67), Acer saccharinum (IV 2.04), Populus deltoides (IV 0.64), Robinia pseudoacacia (IV 0.24), and Salix sp. (IV 0.24).

There is a tendency for the flora of the one-year fields to resemble the dominant species found in the two-year field. Eupatorium serotinum and Bidens aristosa, which are dominant plants in the two-year field, are on the increase in the one-year fields, as can be seen by comparing Tables 9, 10, 11, and 12 to Tables 1, 2, 3, and 4.

Bazzaz (1963), in a study of secondary succession in abandoned fields in southern Illinois, ranked plants according to a modified Importance Value in which IV was the summation of relative frequency and relative cover for each species. Major plants in one-year fields in his study were: Digitaria sanguinalis, Juncus tenuis, Ambrosia artemisiifolia, Diodia teres, Solanum carolinense, Crotonopsis elliptica, and species of Lespedeza and Erigeron. With the exception of Crotonopsis and Lespedeza, the same species were found to be the important plants in the one-year fields in this study. Bazzaz also reported that major plants in two-year-old fields were: Aster pilosus, Ambrosia artemisiifolia, Diodia teres, Panicum dichotomum, and Solidago nemoralis. Table 8 shows Ambrosia artemisiifolia and Aster pilosus to be among the top five in IV in this study, with Diodia teres and species of Panicum and Solidago among the top 15 species in the field.

One important difference between the two studies is that Bazzaz reported Andropogon virginicus begins to invade during the second year and becomes well established in later years. No Andropogon at all was found in the fields in this study, although it is found in the general area. There are several possible explanations for the lack of Andropogon in the fields covered by this paper as compared to the study made by Bazzaz. Probably the one important factor would be that of topography. Most of the fields studied by Bazzaz were truly upland fields in the hilly area of southern Illinois. The fields studied in this paper were all poorly drained, and one field (2A) was a bottom land field which is frequently flooded. Soil types and erosion problems would also tend to cause differences in vegetation and successional patterns.

One other important difference between the two studies was the tree species which began to invade the fields. Bazzaz found Diospyros virginiana, Sassafras albidum, and Robinia pseudoacacia begun to invade in the two-year fields. Robinia was found in this study too; but, instead of Diospyros and Sassafras, Acer saccharinum, Fraxinus americana, Populus deltoides, and Salix sp. were found in the two-year field of this study. Both Diospyros and Sassafras are found in the general area of field 2A, but in better-drained, drier areas. Due to the poor drainage and high soil moisture content in field 2A, they have not invaded it.

CONCLUSIONS

The results of the last survey (June) indicate that the vegetation in the one-year fields is becoming more and more like the vegetation in the two-year field. Both Bidens aristosa and Eupatorium serotinum increased noticeably in the one-year fields during the survey period. Both are important species in the two-year field (Tables 4, 8, and 12). Solidago hirtella (1A) and Diodia teres (1B) also increased in importance in some of the one-year fields (Tables 9 and 10). Both species are important in the two-year field (Tables 8 and 12). Bazzaz also found Diodia teres to be an important plant in two-year fields, as well as Solidago. A different species of Solidago was found in the two studies, however, as Bazzaz found Solidago nemoralis and this study reported Solidago hirtella.

Although there were only two woody species (tree seedlings) found in the one-year fields, both species (Acer saccharinum and Robinia pseudoacacia) were found in the two-year field. These two species along with Fraxinus americana, Populus deltoides, and Salix increased in importance through the duration of the survey in the two-year field. Although not one of the 21 species named in Table 12, the woody vine Campsis radicans (trumpet creeper) was also found in several plots in the two-year field. Bazzaz also found that woody species began to invade the second year and to increase in importance in later years. Only one species, Robinia pseudoacacia, was reported in both studies. Bazzaz found Diospyros virginiana and Sassafras albidum to be

the most common woody species, while the results of this study show *Fraxinus americana*, *Acer saccharinum*, *Populus deltoides*, and *Salix* to be the most common woody species.

The study, although not long in duration, does point out the fact that small areas undisturbed for even short periods of time can yield information on early stages of succession in any part of the country.

Checklist of All Plant Species Found in All Fields During the Study

During the entire study, a total of 104 plant species were found, representing 35 different families. One species was the moss Physcomitrium turbinatum (Hx.) Brid. of the family Funariaceae. Of the other 103 species, 81 were dicots and 22 were monocots. The largest family represented in the study was the Compositae with 21 species, followed by the Graminae with 13.

In the following list the nomenclature is that of Jones (1963).

ACERACEAE

Acer saccharinum L.

ASCLEPIADACEAE

Asclepias incarnata L.

Asclepias syriaca L.

BIGNONIACEAE

Campsis radicans (L.) Seem.

BORAGINACEAE

Myosotis virginica (L.) BSP.

CARYOPHYLLACEAE

Dianthus armeria L.

COMPOSITAE

Achillea millefolium L.

Ambrosia artemisiifolia L.

Ambrosia bidentata Michx.

Ambrosia trifida L.

Aster pilosus Willd.

Bidens aristosa (Michx.) Britt.

Boltonia recognita (Fern. & Grisc.) G. N. Jones

Erechtites hieracifolia (L.) Raf.

Erigeron annuus (L.) Pers.

Erigeron canadense L.

Erigeron sp. (rosettes)

Eupatorium serotinum Michx.

Lactuca sp. (rosettes)

Rudbeckia hirta L.

Senecio aureus L.

Solidago hirtella (Greene) Bush.

Solidago sp. (immature)

Taraxacum officinale Wiggers

Vernonia altissimum L.

Xanthium spinosum L.

CONVOLVULACEAE

Ipomea pandurata (L.) G. W. F. Mey.

Ipomea purpurea (L.) Roth.

CRUCIFERAE

Arabis laevigata (Muhl.) Poir.

Lepidium virginicum L.

CYPERACEAE

Carex cristatella Britt.

Cyperus acuminatus Torr. & Hook.

Cyperus strigosis L.

Eleocharis obtusa (Willd.) Schult.

EUPHORBIACEAE

Acalypha gracilens A. Gray

Chamaesyce supina (Raf.) Moldenke

Euphorbia corollata L.

GENTIACEAE

Gentiana andrewsii Griseb.

GRAMINAE

Agrostis hyemalis (Walt.) BSP.

Alopecurus carolinianus Walt.

Bromus commutatus Schrad.

Digitaria sanguinalis (L.) Scop.

Echinochloa crusgalli (L.) Beauv.

Elymus virginicus L.

Eragrostis capillaris (L.) Nees.

Hordeum pusillum Nutt.

Panicum capillare L.

Panicum huachucae Ashe

Setaria faberii Herm.

Setaria lutescens (Wiegel) F. T. Hubb.

Zea mays L.

HYPERICACEAE

Hypericus drummondii (Grer. & Hook.) T. & G.

Hypericum mutilum L.

JUNCACEAE

Juncus acuminatus Michx.

Juncus brachycarpus Engelm.

Juncus tenuis Willd.

LABIATAE

Lycopus americana Muhl.

Prunella vulgaris L.

LEGUMINOSAE

Cassia fasciculata Michx.

Lespedeza stipulacea Maxim

Strophostyles leiosperma (T. & G.) Piper

Trifolium hybridum L.

Trifolium pratense L.

Robinia pseudoacacia L.

LILIACEAE

Allium canadense L.

Allium sativum L.

LOBELIACEAE

Lobelia cardinalis L.

Lobelia inflata L.

Specularia perfoliata (L.) A DC.

MALVACEAE

Sida spinosa L.

OLEACEAE

Fraxinus americana L.

ONAGRACEAE

Ludwigia alternifolia L.

Oenothera biennis L.

OXALIDACEAE

Oxalis dillenii Jacq.

PENTHORACEAE

Penthorum sedoides L.

PLANTAGINACEAE

Plantago aristata Michx.

Plantago rugelli Dec.

Plantago virginica L.

POLYGALACEAE

Polygala sanguinea L.

POLYGONACEAE

Polygonum pecsylvanicum L.

Polygonum ramosissimum Michx.

Rumex acetocella L.

Rumex altissimus Wood

Rumex crispus L.

PRIMULACEAE

Centunculus minimus L.

Samolus parviflorus Raf.

RANUNCULACEAE

Ranunculus abortivus L.

ROSACEAE

Geum laciniatum Murr.

Potentilla monspeliensis L.

Prunus serotina Ehrh.

Rubus hispidus L.

RUBIACEAE

Diodia teres Walt.

Galium triflorum Michx.

SALICACEAE

Populus deltoides Marsh.

Salix sp.

SCROPHULARIACEAE

Gerardia tenuifolia Vahl.

Gratiola neglecta Torr.

Lindernia dubia (L.) Pennell

Mimulus alatus Ait.

Penstemon pallidus Small.

SOLANACEAE

Solanum carolinense L.

VERBENACEAE

Verbena hastata L.

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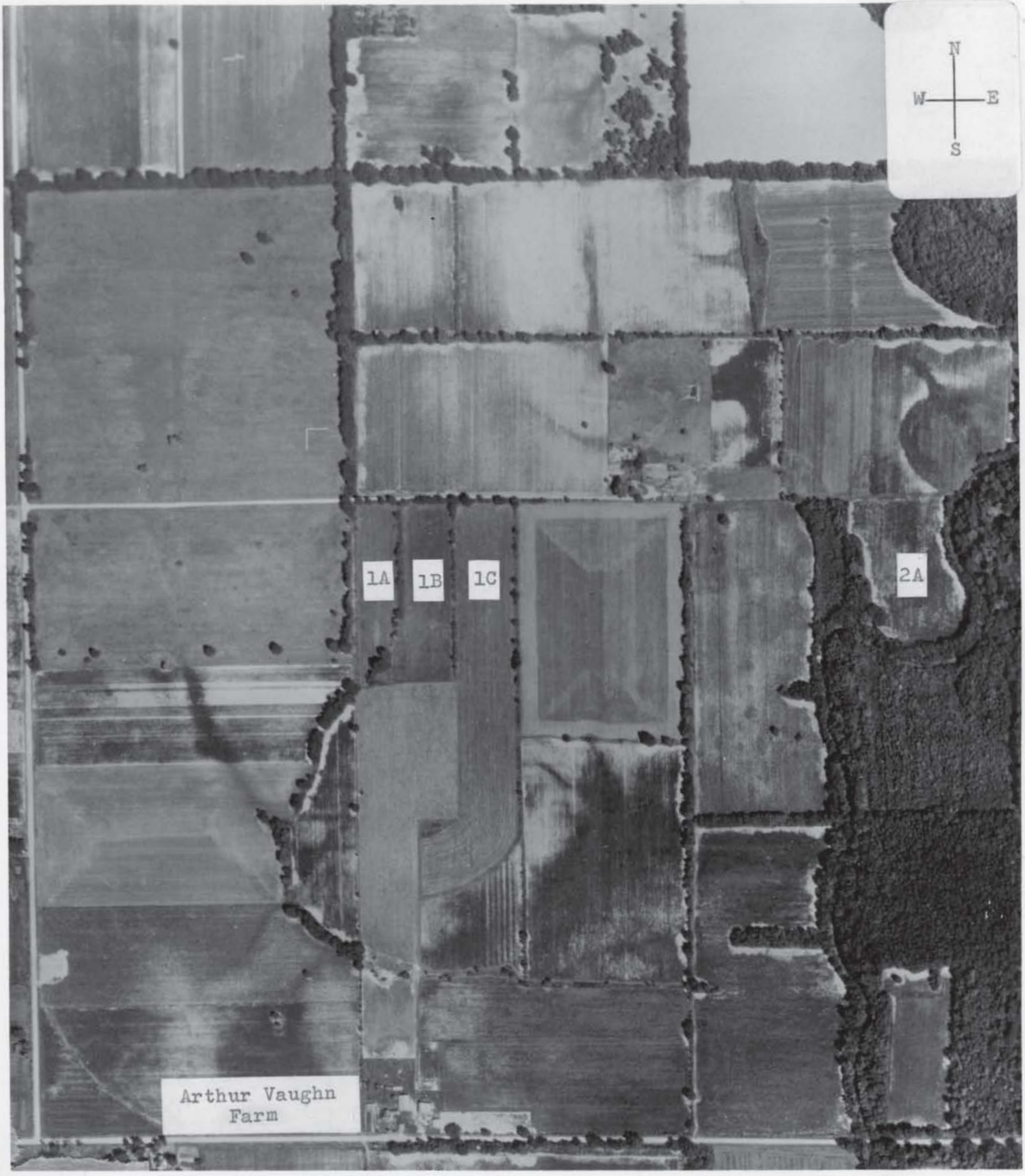

Figure 1. Aerial photograph showing locations of fields studied.

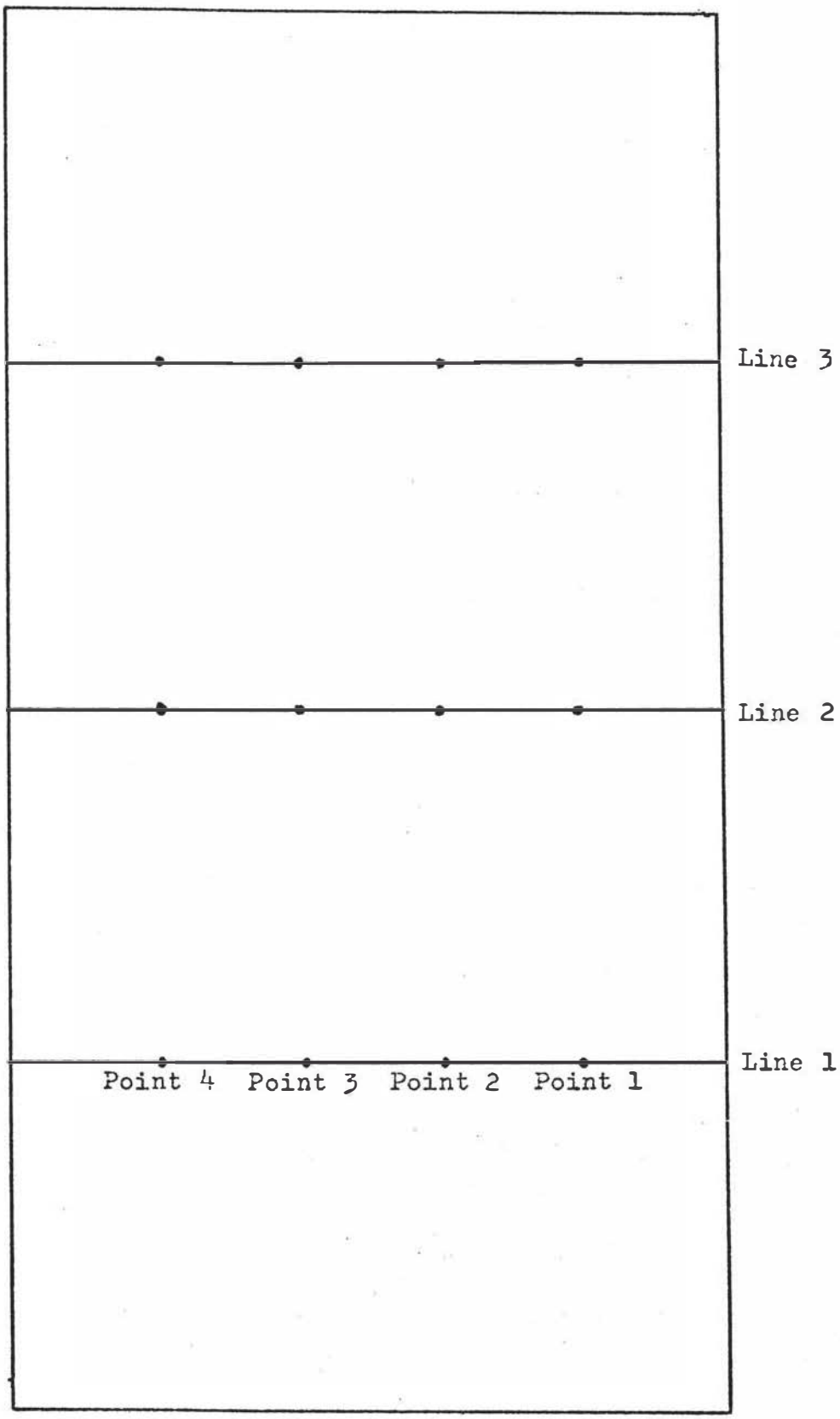

Figure 2. Method Used to Establish Lines and Sample Points

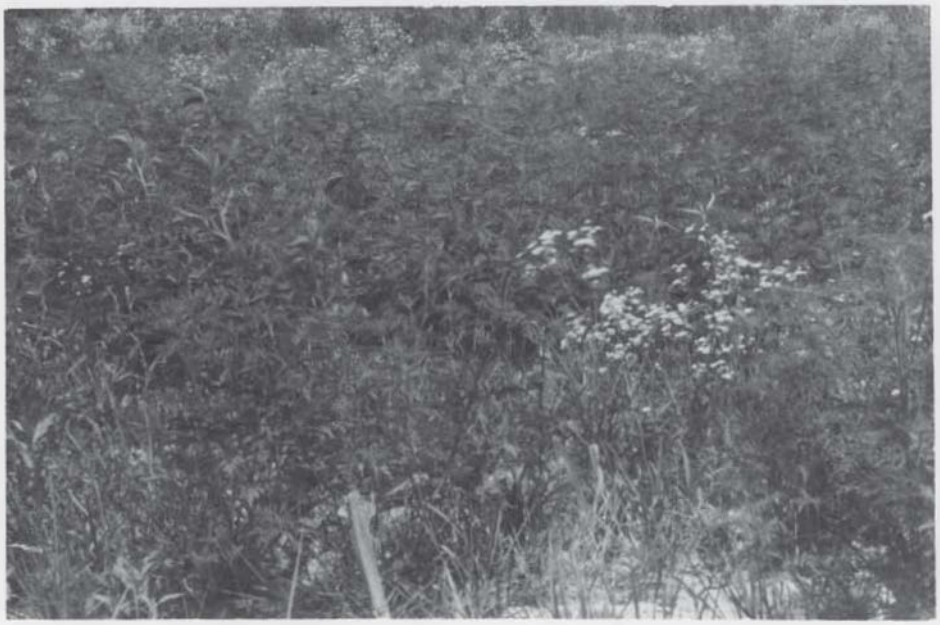

Figure 3. One-year field, August survey.

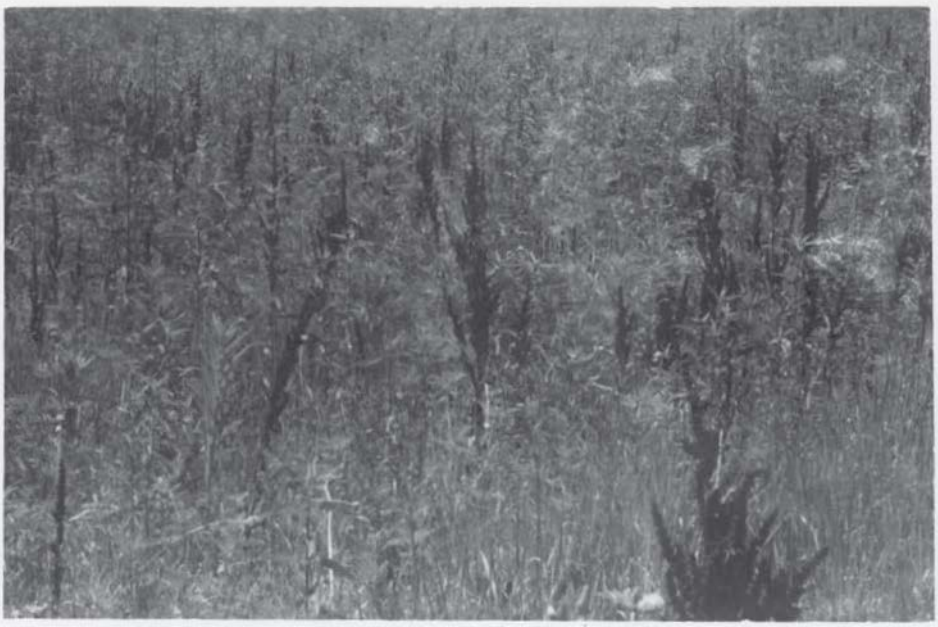

Figure 4. Two-year field, August survey.

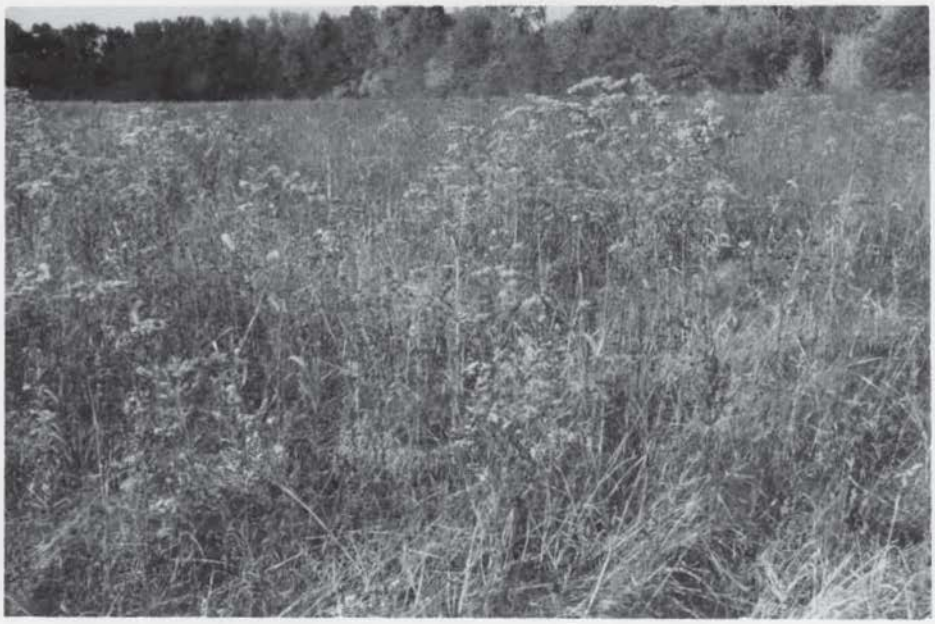

Figure 5. One-year field, September survey.

Figure 6. Two-year field, September survey.

Figure 7. One-year field, June survey.

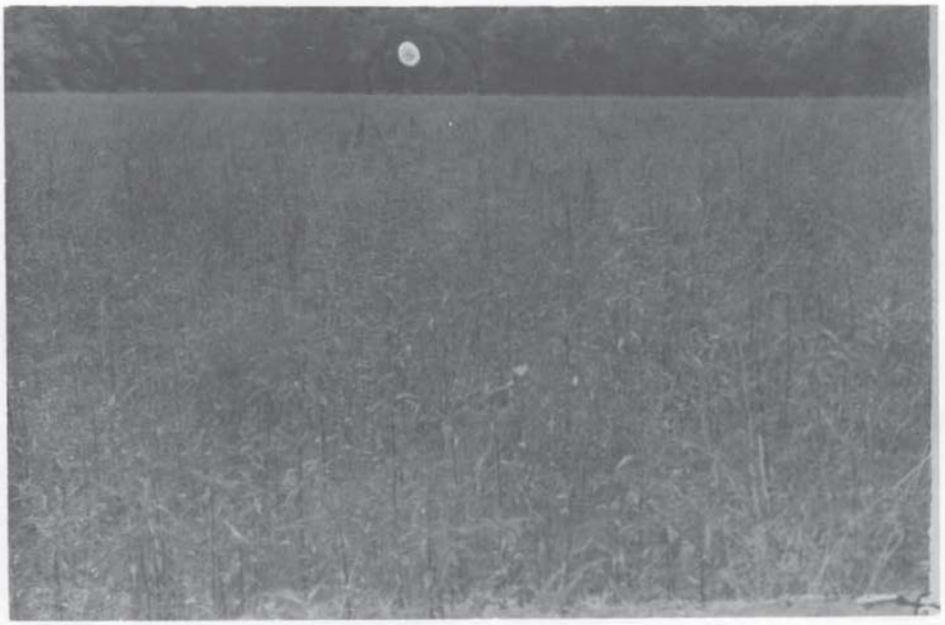

Figure 8. Two-year field, June survey.

Table 1.--Relative values and importance value for the dominant plants in field 1A on August 3, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Setaria lutescens	13.66	32.60	46.26
Juncus tenuis	14.77	23.39	38.16
Ambrosia artemisiifolia	11.66	11.67	23.33
Hypericum mutilum	8.33	7.27	15.60
Polygonum pensylvanicum	6.33	4.04	10.37
Echinochloa crusgalli	3.33	3.46	6.79
Trifolium hybridum	4.33	1.81	6.14
Allium canadense	4.00	1.05	5.05
Eupatorium serotinum	3.33	1.23	4.56
Erigeron annuus	3.33	0.99	4.32
Solidago hirtella	2.33	1.46	3.79
Polygala sanguinea	3.00	0.70	3.70
Ipomea pandurata	2.33	0.82	3.15
Eleocharis obtusa	1.00	1.58	2.58
Aster pilosus	2.00	0.41	2.41
Bidens aristosa	1.33	1.05	2.38
Digitaria sanguinalis	1.00	1.29	2.29
Lactuca canadensis	1.66	0.46	2.12
16 lesser species	12.28	4.72	17.00
TOTAL	100.00	100.00	200.00

Table 2.--Relative values and importance value for the dominant plants in field 1B on August 3, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Setaria lutescens	11.47	29.47	40.94
Juncus tenuis	14.96	23.38	38.34
Hypericum mutilum	9.83	4.97	14.80
Ambrosia artemisiifolia	8.52	5.89	14.41
Erigeron annuus	7.86	5.56	13.42
Eleocharis obtusa	1.63	7.15	8.78
Digitaria sanguinalis	2.95	4.11	7.06
Trifolium pratense	5.24	1.72	6.96
Allium canadense	4.91	1.79	6.70
Echinochloa crusgalli	2.62	2.85	5.47
Cyperus acuminatus	1.63	2.78	4.41
Strophostyles leiosperma	2.62	0.86	3.48
Aster pilosus	2.62	0.66	3.28
Diodia teres	1.31	1.59	2.90
Panicum huachucae	1.96	0.86	2.82
Polygala sanguinea	1.96	0.60	2.56
Polygonum pensylvanicum	1.63	0.86	2.49
Trifolium hybridum	1.63	0.53	2.16
Rumex crispus	1.63	0.46	2.09
Hypericum drummondii	1.63	0.40	2.03
16 lesser species	3.31	14.90	11.39
TOTAL	100.00	100.00	200.00

Table 3.--Relative values and importance value for the dominant plants in field 1C on August 4, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Digitaria sanguinalis	14.28	37.31	51.59
Setaria lutescens	11.42	22.24	33.66
Juncus tenuis	15.52	14.22	29.74
Ambrosia artemisiifolia	11.42	4.74	16.16
Cyperus acuminatus	4.64	3.76	8.40
Erigeron annuus	5.35	1.73	7.08
Polygonum pensylvanicum	4.64	2.10	6.74
Trifolium pratense	5.00	1.05	6.05
Ipomea pandurata	4.28	1.42	5.70
Echinochloa crusgalli	2.14	2.63	4.77
Ipomea purpurea	3.21	1.20	4.41
Hypericum mutilum	2.14	1.05	3.19
Eleocharis obtusa	0.35	2.10	2.45
Rumex crispus	1.78	0.45	2.23
Solidago hirtella	1.42	0.75	2.17
Solanum carolinense	1.42	0.37	1.79
Zea mays	1.07	0.30	1.37
Strophostyles leiosperma	1.07	0.22	1.29
Eupatorium serotinum	1.07	0.22	1.29
Hypericum drummondii	1.07	0.22	1.29
13 lesser species	6.71	1.92	8.63
TOTAL	100.00	100.00	200.00

Table 4.--Relative values and importance value for the dominant plants in field 2A on August 4, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	7.85	34.30	42.15
Ambrosia artemisiifolia	8.54	12.96	21.50
Eleocharis obtusa	1.84	18.76	20.60
Eupatorium serotinum	9.21	6.10	15.31
Bidens aristosa	4.84	8.28	13.12
Ipomea pandurata	6.69	0.97	7.66
Echinochloa crusgalli	3.23	3.59	6.82
Ambrosia trifida	3.69	3.00	6.69
Xanthium spinosum	4.38	2.29	6.67
Cyperus strigosus	4.15	0.83	4.98
Aster pilosus	3.92	0.81	4.73
Allium canadense	3.92	0.74	4.66
Hypericum mutilum	3.00	0.80	3.80
Hypericum drummondii	2.07	0.85	2.92
Rumex crispus	2.54	0.28	2.82
Allium sativum	2.07	0.23	2.30
Setaria lutescens	1.38	0.90	2.28
Potentilla monspeliensis	2.07	0.19	2.26
Panicum huachucae	1.84	0.28	2.12
Ipomea purpurea	1.84	0.23	2.07
36 lesser species	20.93	3.61	24.54
TOTAL	100.00	100.00	200.00

Table 5.--Relative values and importance value for the dominant plants in field 1A on September 29, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	7.52	34.48	42.00
Setaria lutescens	9.81	12.57	22.38
Panicum capillare	6.36	15.61	21.97
Digitaria sanguinalis	4.77	10.79	15.56
Ambrosia artemisiifolia	7.52	3.90	11.42
Hypericum mutilum	6.10	2.24	8.34
Eleocharis obtusa	1.32	6.27	7.59
Polygonum pensylvanicum	4.77	1.60	6.37
Echinochloa crusgalli	3.18	2.24	5.42
Erigeron sp. (rosettes)	3.97	1.34	5.31
Acalypha gracilens	3.44	0.72	4.16
Hypericum drummondii	3.44	0.58	4.02
Panicum huachucae	3.44	0.43	3.87
Aster pilosus	3.44	0.40	3.84
Trifolium hybridum	2.91	0.49	3.40
Allium canadense	2.65	0.40	3.05
Strophostyles leiosperma	2.65	0.37	3.02
Setaria faberii	1.32	1.63	2.95
Cyperus strigosus	2.12	0.49	2.61
Bidens aristosa	1.85	0.35	2.20
25 lesser species	17.42	3.10	20.52
TOTAL	100.00	100.00	200.00

Table 6.--Relative values and importance value for the dominant plants in field 1B on September 29, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	9.01	35.82	44.83
Panicum capillare	7.30	18.62	25.92
Setaria lutescens	9.01	16.38	25.39
Digitaria sanguinalis	7.65	15.38	23.23
Ambrosia artemisiifolia	6.55	1.64	8.19
Hypericum mutilum	5.19	1.60	6.79
Echinochloa crusgalli	3.82	2.07	5.89
Strophostyles leiosperma	5.19	0.56	5.75
Aster pilosus	4.37	0.47	4.84
Erigeron sp. (rosettes)	3.55	0.40	3.95
Hypericum drummondii	3.00	0.56	3.56
Panicum huachucae	3.00	0.44	3.44
Acalypha gracilens	2.73	0.32	3.05
Polygonum pensylvanicum	2.45	0.42	2.87
Eleocharis obtusa	0.81	1.76	2.57
Trifolium pratense	2.18	0.25	2.43
Ipomea purpurea	2.18	0.21	2.39
Diodia teres	1.91	0.42	2.33
Eupatorium serotinum	1.91	0.25	2.16
Allium canadense	1.91	0.18	2.09
Physcomitrium turbinatum	1.91	0.16	2.07
23 lesser species	14.37	1.89	16.26
TOTAL	100.00	100.00	200.00

Table 7.--Relative values and importance value for the dominant plants in field 1C on September 29, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	12.92	41.43	54.35
Digitaria sanguinalis	13.44	25.89	39.33
Panicum capillare	11.38	17.97	29.35
Ambrosia artemisiifolia	10.46	2.08	12.54
Setaria lutescens	4.61	4.91	9.52
Hypericum mutilum	4.92	0.54	5.46
Cyperus acuminatus	3.38	1.31	4.69
Polygonum pensylvanicum	3.69	0.56	4.25
Aster pilosus	3.38	0.30	3.68
Trifolium pratense	3.07	0.30	3.37
Chamaesyce supina	3.07	0.30	3.37
Echinochloa crusgalli	1.84	1.33	3.17
Diodia teres	2.46	0.25	2.71
Physcomitrium turbinatum	2.15	0.28	2.43
Sida spinosa	1.53	0.36	1.89
Eupatorium serotinum	1.53	0.20	1.73
Hypericum drummondii	1.53	0.12	1.65
Erigeron sp. (rosettes)	1.53	0.12	1.65
Strophostyles leiosperma	1.23	0.15	1.38
Bidens aristosa	1.23	0.15	1.38
20 lesser species	10.65	1.45	12.10
TOTAL	100.00	100.00	200.00

Table 8.--Relative values and importance value for the dominant plants in field 2A on September 28, 1968.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	7.67	29.04	36.71
Ambrosia artemisiifolia	5.75	14.33	20.08
Eupatorium serotinum	10.75	8.42	19.17
Bidens aristosa	5.03	12.69	17.72
Aster pilosus	7.91	2.99	10.90
Xanthium spinosum	5.51	2.27	7.78
Eleocharis obtusa	0.47	6.93	7.40
Cyperus strigosus	5.03	1.80	6.83
Ambrosia trifida	3.59	3.07	6.66
Echinochloa crusgalli	1.91	2.71	4.62
Rumex crispus	3.83	0.72	4.55
Panicum capillare	3.35	0.85	4.20
Setaria lutescens	1.67	2.32	3.99
Diodia teres	2.87	0.94	3.81
Sida spinosa	2.15	1.10	3.25
Allium sativum	2.63	0.55	3.18
Geum laciniatum	2.63	0.36	2.99
Ipomea pandurata	2.39	0.41	2.80
Hypericum mutilum	1.67	0.77	2.44
Ipomea purpurea	1.91	0.47	2.38
32 lesser species	21.28	7.64	28.54
TOTAL	100.00	100.00	200.00

Table 9.--Relative values and importance value for the dominant plants in field 1A on June 10, 1969.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	7.66	23.09	30.75
Allium canadense	14.38	7.52	21.90
Ambrosia artemisiifolia	10.72	9.17	19.89
Eleocharis obtusa	1.53	16.34	17.87
Bidens aristosa	8.04	7.42	15.46
Agrostis hyemalis	3.83	9.60	13.43
Boltonia recognita	6.51	2.71	9.22
Erigeron annuus	4.21	1.50	5.71
Echinochloa crusgalli	3.06	2.57	5.63
Ambrosia bidentata	1.53	3.59	5.12
Eupatorium serotinum	3.83	0.72	4.55
Hypericum mutilum	2.68	1.84	4.52
Myosotis virginica	1.91	2.57	4.48
Digitaria sanguinalis	1.14	3.15	4.29
Ipomea purpurea	3.06	0.48	3.54
Solidago sp.	1.91	1.16	3.07
Polygonum pensylvanicum	2.29	0.67	2.96
Trifolium hybridum	1.91	1.01	2.92
Trifolium pratense	1.91	0.33	2.24
Lactuca canadense	1.91	0.33	2.24
Rumex acetocella	1.91	0.29	2.20
17 lesser species	14.07	3.94	18.01
TOTAL	100.00	100.00	200.00

Table 10.--Relative values and importance value for the dominant plants in field 1B on June 11, 1969.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	9.54	27.07	36.61
Allium canadense	9.54	10.52	20.06
Ambrosia artemisiifolia	10.73	7.06	17.79
Agrostis hyemalis	5.30	12.01	17.31
Digitaria sanguinalis	2.82	8.48	11.30
Eleocharis obtusa	1.41	9.84	11.25
Panicum huachucae	4.59	2.04	6.63
Myosotis virginicus	4.24	1.88	6.12
Hypericum mutilum	4.59	1.46	6.05
Centunculus minimus	2.82	2.93	5.75
Acalypha gracilens	3.53	1.57	5.10
Echinochloa crusgalli	2.47	2.51	4.98
Boltonia recognita	3.53	0.94	4.47
Eupatorium serotinum	3.53	0.78	4.31
Diodia teres	2.47	1.57	4.04
Bidens aristosa	2.12	1.83	3.95
Acer saccharinum	2.47	0.83	3.30
Erigeron annuus	2.47	0.62	3.09
Rumex crispus	2.47	0.52	2.99
Rumex acetocella	1.76	0.83	2.59
18 lesser species	17.60	4.71	22.31
TOTAL	100.00	100.00	200.00

Table 11.--Relative values and importance value for the dominant plants in field 1C on June 11, 1969.

Species	Relative Frequency	Relative Density	Importance Value
Agrostis hyemalis	9.18	26.32	35.50
Digitaria sanguinalis	6.71	25.78	32.49
Juncus tenuis	12.86	18.43	31.29
Ambrosia artemisiifolia	10.95	4.11	15.06
Hypericum mutilum	6.00	3.08	9.08
Alopecurus carolinianus	3.88	4.98	8.86
Centunculus minimum	5.30	2.95	8.25
Myosotis virginica	4.59	1.22	5.81
Polygonum pensylvanicum	4.24	0.92	5.16
Allium canadense	3.88	1.26	5.14
Bromus commutatus	3.18	1.52	4.70
Bidens aristosa	2.12	1.22	3.34
Trifolium pratense	2.82	0.43	3.25
Boltonia recognita	2.47	0.63	3.10
Acalypha gracilens	1.41	1.02	2.43
Eleocharis obtusa	0.70	1.66	2.36
Echinochloa crusgalli	1.41	0.92	2.33
23 lesser species	18.30	3.55	21.85
TOTAL	100.00	100.00	200.00

Table 12.--Relative values and importance value for the dominant plants in field 2A on June 10, 1969.

Species	Relative Frequency	Relative Density	Importance Value
Juncus tenuis	9.57	34.52	44.09
Eupatorium serotinum	9.57	8.87	18.44
Bidens aristosa	6.19	12.16	18.35
Solidago sp.	7.79	6.01	13.80
Allium canadense	6.42	5.88	12.30
Ambrosia artemisiifolia	5.27	4.49	9.76
Ipomea pandurata	4.81	1.08	5.89
Ranunculus abortivus	3.21	2.64	5.85
Rumex crispus	4.35	1.11	5.46
Centunculus minimus	2.52	2.85	5.37
Geum laciniatum	3.89	0.51	4.40
Panicum huachucae	2.75	1.17	3.92
Erigeron annuus	2.75	1.08	3.83
Eleocharis obtusa	0.45	2.47	2.92
Juncus acuminatus	0.45	2.34	2.79
Ipomea purpurea	2.29	0.43	2.72
Fraxinus americana	2.29	0.38	2.67
Ambrosia trifida	1.60	0.98	2.58
Oenothera biennis	2.06	0.46	2.52
Xanthium spinosum	1.37	0.98	2.35
Rumex altissimus	1.37	0.98	2.35
29 lesser species	19.03	8.61	27.64
TOTAL	100.00	100.00	200.00

Table 13.--Tabulation of results of all three surveys for all fields.

Date	Field Number	Number of Species	Number of Individuals of All Species
August 3, 1968	1A	34	1,705
August 3, 1968	1B	36	1,510
August 4, 1968	1C	33	1,329
August 4, 1968	2A	56	5,622
September 28, 1968	1A	45	3,428
September 29, 1968	1B	44	4,249
September 28, 1968	1C	40	3,888
September 28, 1968	2A	52	3,607
June 10, 1969	1A	38	2,061
June 11, 1969	1B	38	1,910
June 11, 1969	1C	40	3,011
June 10, 1969	2A	50	3,673