ANALYSIS OF THREE WOODLAND COMMUNITIES ON U. S. CORPS OF ENGINEERS PROPERTY

and Recommendation for Preserve Status Designation of an Oak-Hickory Woodland

CORALVILLE, JOHNSON COUNTY, IOWA

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and

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(Ornithological studies conducted by Mike Newlon;
Geological summary by Jean C. Prior)

July 87

Spoke to Dean Des Spring – he said he thought he had sent this in, couldn't remember for sure. I never received a final cc, or any more correspondence ... from him.

Aug 84

Connie Here is a xerox copy of the report as it stands now. Comment & return. I just found out of a butterfly record for "Sugar bottom" – the only report for Iowa since 1917. I'd incorporate that somehow Dean R.

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SUMMARY

In response to ~~the~~ planning for a ~~snowmobile~~ trail through a mature oak-hickory woodland on COE property near Coralville, investigators conducted ~~several~~ studies to compare the quality of several mature woodlands. The results of these studies are presented within. Using aerial photographs and ground surveys, three mature forests were chosen for intensive studies. Comprehensive species lists were compiled for each site. Quantitative sampling was conducted, using the point-quarter method for assessment of the larger woody vegetation; 3x3 meter quadrats were used to assess the shrub layer; and 1x1 meter quadrats were used to analyze the herb layer.

Ornithological studies were conducted using the Emlen transect method, and determining the "coefficient of detectability" for each species. Transects were run through each study area and a comparative analysis made.

A site visit was made to evaluate and compare geological attributes.

Of the three sites (Camp Daybreak, Squire Point, and Sugar Bottom), the Sugar Bottom site proved to be of highest quality as judged by the following:

- contained the largest number of sensitive forest-dwelling birds species and "indicator species"
- was the most discrete community-type
- was maintaining a static phase of a community (succession was not rapidly occurring and reproduction of oaks was apparent)
- contained the fewest exotic plant species
- was the least fragmented; this allows for occurrence of sensitive species.
- contained the greatest geological diversity.

As a result of the biological studies, the ~~area~~ Sugar Bottom site is recommended for permanent protection through designation as a State Preserve. We also recommend that the COE continue to include designation of natural areas as one of its considerations for its lands; such designation ideally would be undertaken jointly with the Iowa State Preserves System.

I. Introduction

Although the vast majority of Iowa's land has been transformed from prairie, forest, and wetland to farmland and city, a small amount retains its presettlement characteristics. The best of these unaltered segments--those that are prime representatives of Iowa's native ecosystems, those inhabited by rare or endangered species, and those that have significant geological or archaeological features--are worthy of long-term protection and management for the perpetuation of their natural features. Such natural areas are invaluable, irreplaceable educational and passive recreational resources, outdoor research laboratories, and reservoirs of genetic diversity. These "living museums" recreate our nation's ecological past for us, while helping to maintain our environment's quality by buffering fluctuations in environmental parameters.

This report discusses the potential for establishing one type of natural area on U.S. Army Corps of Engineers (COE) Coralville Lake land: a representative of the oak-history forests that once were plentiful in eastern Iowa. The natural area would be incorporated into Iowa's State Preserve System, but land ownership would be retained by the COE. Any use and management decisions would be made jointly by the State Preserves Board and the COE, with the stipulation that the land's natural features would be preserved.

Although oak-hickory woodlands still can be located near Coralville Lake, few remain in an undisturbed condition; most have been grazed, logged, or developed for housing. Indeed, although 19 percent of the state was forested originally, forests only cover four percent of Iowa today, and the vast majority of these remaining forests bear little resemblance to presettlement ecosystems. As pressures for housing and agricultural use of private land multiplies, the few remaining pristine COE forest tracts will become increasingly rare and invaluable. No forest tracts of any type are in protected status in Johnson County. The nearest natural area of this type (Palisades-Dows State Preserves) lies in Linn County, directly to the north. The increasing rarity at these forest ecosystems and the

lack of any similar nearly natural areas presents the COE with the opportunity for making an unusually valuable contribution to future generations.

II. History of this Proposal

Cooperative ventures between the State Preserves Board and the COE - Coralville Lake office commenced in 1969, when Old State Quarry and Merrill A. Stainbrook Preserve were established on Coralville Lake land.

Additional communications did not occur until March, 1981, when Dean Roosa, State Ecologist, wrote to the COE to request that the oak-hickory forest south and east of the east entrance to the Sugar Bottom Recreation Area be preserved as a natural area. (This segment had been brought to Roosa's attention by private citizens concerned about the destructive potential of a patrol and snowmobile road constructed through the forest in the fall of 1980.) Accordingly, on July 1, 1981, Roosa, COE personnel from Coralville Lake and from the Rock Island Environmental Analysis Section and Recreation Resource Management Branch, and concerned local residents met to discuss use of the roadway and the land's potential for designation as a natural area. COE personnel emphasized that before the forest could be so designated, field studies would have to clearly demonstrate that the segment was indeed a prime representative of the oak-hickory forest type, and that similar tracts did not abound on Coralville Lake land. Thus, on 8/3 and 8/4/81, field studies to systematically investigate COE Coralville Lake mature forests were initiated. Roosa, COE Environmental Analysis Section personnel, and Connie Mutel (a local resident and ecologist) visited several mature forests and sampled plant components in the best of these.

Field studies by Roosa, Mutel, and other biologists continued through 8/82, simultaneously with issuance of a FONSI for vehicular use of the patrol and snowmobile road (10/16/81), a revised FONSI

for mitigation of erosion problems and emergency use of the road (2/12/812), and a meeting between COE regional personnel, the State Preserves Board, and State Conservation Commission personnel (5/25/82). There, mechanisms for future interactions between the COE and State Preserves Board were discussed (see Appendix I). Attendants agreed that in addition to more negotiations concerning the ecosystems addressed by the proposal, meetings should be held to investigate the possibility of other types of natural areas on lands surrounding all three COE reservoirs in Iowa.

III.

A. Regional Setting

Johnson County lies on the western edge of the Eastern Deciduous Forest Formation, a relatively dry forest stretching from Texas to Canada. This formation, described by Braun (1950), forms a transition zone between moister deciduous forests to the east and drier prairies to the west. In general, the formation is dominated by oaks (red, white, and others), with hickories (shagbark, bitternut, and others) occurring less commonly. Prairies frequently interrupt the forest; in Iowa, prior to Euro-American settlement, these were found on the flatter uplands. Forests are limited to hillsides and are concentrated near major rivers, with more moisture-loving tree species dominating river bottoms and moister slopes.

Fires originally played a significant role in determining composition of these plant communities, regularly sweeping through the upland prairies and preventing invasion of woody species. Fire also probably maintained adequate habitat for oak-hickory forests. With Euro-American settlement and the disappearance of this influence, many of these forests have undergone or are undergoing a natural transition to maple-basswood forests, and the once common oak-hickory forests have become relatively rare in eastern Iowa. Protection of remaining oak-hickory forests is crucial because of their increasing rarity, and because these communities house species at the edge of their distributional limits, where environmental stresses and genetic selection are maximized.

Described in terms of landform regions, the Coralville Reservoir lies along the northern boundary of the Southern Iowa Drift Plain (Prior 1976; see Figure ___). This region is characterized by steep, rolling hills, intersected by level upland divides and alluvial lowlands. It was last glaciated approximately one-half million years ago, during the Kansan glacial stage, during which tens to hundreds of feet of glacial drift were deposited. Since then, the drift has weathered and been covered by loess, which has become deeply dissected and eroded into dendritic-patterned drainages. Many of the larger rivers of this landform region have eroded through the loess, ancient soils, and glacial drift to expose underlying limestone bedrock; this process is evident along the Coralville Reservoir. Because of their proximity to the reservoir, all three of the ~~study~~ studied for this report sites are dominated by the erosion patterns created by the Iowa River valley and its tributaries.

Iowa, as a whole, was 19 percent forested when Euro-Americans first surveyed the area; today, forests cover only 4 percent of Iowa, and the vast majority of these remaining forests bear little resemblance to presettlement forests (Thomson and Hertel, 1981). Johnson County reflects this massive landscape transformation. Originally including 108,545 acres of forested land, only 25,200 acres (or 23 percent) of the county remained forested by 1974 (Thomson, 1980). In just the 20 years between 1954 and 1974, 38 percent of the county's remaining forests had disappeared (Thomson, 1980). Today, most of the county's remaining forests have been grazed, logged, or developed for housing, activities that typically eliminate herb cover, modify habitat for native ~~faunas~~ animals, and alter

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Figure ___: "Landform Regions of Iowa" (with Coralville Reservoir sketched in) -- Prior, p. 23.

tree and shrub reproductive patterns. ~~Preserves~~ for housing developments are likely to increase in the corridor between Cedar Rapids and Iowa City, which includes the Coralville Reservoir area. ~~Many~~ oak-hickory forests ~~that have remained~~ are undergoing the natural transition to maple-basswood communities. Despite their increasing rarity, no oak-hickory forests or forests of any type are being preserves as natural areas in Johnson County. The nearest such preserve (Palisades-Dows State Preserve) lies in Linn County, to the north. The absence of ~~existing~~ forest preserves, the rapid disappearance of oak-hickory forests throughout eastern Iowa, and the biological significance of these once-common communities make preservation of such forests a crucial task.

Thus pristine oak-hickory forests, once common throughout eastern Iowa, are now islands surrounded by agricultural land, human settlements, and other human-created ecosystems.

III. IV. Field Study Techniques

A. Selection of Study Plots

Aerial photographs in the Coralville Lake office were studied in 8/81 and 4/82 to locate any COE Coralville Lake forests that might qualify for natural area status. Forests with mature trees were easily discerned, although tree species could not be identified.

A total of ten good-sized, mature forest tracts were identified (Figure 1). (Mature tracts that were very small were disregarded.) Site visits were made to seven of the ten. The remaining three (Nos. 2, 3, and 4) were not visited because of time constraints or because they were inaccessible.

Of the seven sites visited, the three least disturbed, most mature deciduous forests were selected for field studies. These three, Camp Daybreak, Squire Point, and Sugar Bottom, are outlined in Figures 2, 3, 4, and 5. The other four were eliminated for the following reasons:

1. (Linder Point): The broad shape of older trees indicates that these matured when the the area was a prairie savannah, which became forest when regular burning ceased approximately 100 years ago. The numerous prairie herbs

that still grow here (e.g. Lobelia inflata, Veronicastrum virginicum (Culver's root), Apios americana (groundnut), and Lespedeza capitata (bush clover) also demonstrate the site's prairie history.

2. (South and west of the North Liberty Radio Observatory): Extremely dense understory indicated heavy past grazing; not visited.

3. (North of the Knoll's Tree Farm, which is north of North Liberty): not readily accessible and not visited

4. (To the southeast of the marina that lies just south of the Highway 218 causeway): not visited, although the long, thin shape would not be amenable to natural area designation in any case.

5. (Lake Macbride Field Campus, south side of entrance road): Small size; ~~dominated~~ dominated by maple-basswood and trees not comparable to other forests; signs of past logging.

6. (Lake Macbride Field Campus, north and west of parking lot at road's end): Sections were previously prairie savannah, as was Linder Point; area developed for intensive public use (with multiple trails and picnic areas); many signs of human disturbance.

7. (Forested tracts north of Sandy Beach): Understory is species-poor and very homogeneous. Dense gooseberry (Ribes missouriense) throughout the forest indicates past intensive grazing.

B. Botanical Studies

1. Comprehensive Species List: This was compiled the first time each site was visited, with additional species added each time the sites were subsequently visited. Plants

were identified to species, except when absence of a needed fruit or flower prevented determination beyond genus.

2. Spring Flora List: Each site was surveyed twice, for approximately two hours each visit, between 4/22/82 and 5/25/82. Due to an unusually cool spring, in which early bloomers bloomed in late April and later species bloomed in rapid succession, most species could be found between these dates. At each visit, the woods were traversed in an attempt to cover each habitat type. All herbs and shrubs in bloom were ranked according to the abundance scale given in Appendix 2.

3. Quantitative Studies: Each study area was sampled twice using the point-quarter method. Trees were sampled at ten equidistant points along a 100 m. transect. At each point, the closest tree larger than two inches in diameter in each quarter was identified and measured for diameter at breast height. All shrub-layer plants (woody vegetation taller than one foot not classified as a tree) within a three by three meter plot at each of the ten points were identified and counted. Herbs (nonwoody plants, and woody plants less than one foot tall) within a one by one meter plot at each of the ten points were identified and counted.

Data were used to calculate importance value and absolute density, dominance, and frequency for trees, and the latter three values for herbs and shrubs, for each species in each layer, as defined in the appendices containing these data.

Sørenson's Index of Similarity was used to compare each study site with the others. This index is expressed as:

$$S = \frac{2C}{A + B}$$

where A = # species in sample A
B = # species in sample B
C = # species common to both samples

B4. Sorensen's Index of Similarity:

The similarity of each pair of study areas was calculated using Sorenson's index, which is based on the number of shared plant species in any two areas (see Mueller and Ellenberg, 1974, p. 214). The closer the index is to the maximum value of 100, the more nearly identical are the two areas (or at least their botanical features). This index is defined as follows:

$$\text{Sorensen's Index} = \frac{2C}{A + B} \times 100$$

A = Total number of species in community A

B = Total number of species in community B

C = Number of species common to communities A and B

C. Ornithological Studies

To determine the constitute avifauna, transect routes utilizing the Emlen (1980) transect method were run in each ~~of the three most mature tracts.~~ study site. ~~In this technique,~~ a route was walked through the wooded tract, beginning one-half hour after sunrise and recording each bird seen or heard within a ~~pre~~-determined distance on each side of the route. From this, (the number of) birds/hectare ~~can be~~ was determined. Additionally, complete species lists were compiled for ~~the entire tract.~~ each study site.

D. Geological Studies

Geological attributes of the three study areas were compared and contrasted by Jean C. Prior, a research geologist with the Iowa Geological Survey and author of A Regional Guide to Iowa Landforms. Ms. Prior visited the Sugar Bottom area in September, 1982, and was previously familiar with the other two study areas.

V. Results and Discussion

A. Botanical Studies. Species and [illegible] species lists for each site are given in Appendices 2 and 3. A bird species list is given in Appendix 9.

Squire Point: Squire Point and Sugar Bottom had very nearly identical total species, 159 and 161, respectively (Appendix 3). Squire Point is a heterogeneous community with 10 species having an importance value of 8 or higher (Appendices 4 and 5). To give an example of heterogenity, Quercus alba, Ostrya virginiana, and Tilia americana contributed the three highest importance values in one Squire Point transect (Appendix 4), while in the other Squire Point transect, Ostrya virginica, Quercus rubra, and Populus tremuloides contributed the highest three importance values (Appendix 5). In a homogeneous stand one would expect that the same two or three species would contribute the highest importance value in each transect.

Although rich in total number of species, Squire Point lacks certain indicator species which points to past human disturbance of the area. Indicator species not found on Squire Point include interrupted fern (Osmunda claytoniana), dissected grape fern (Botrychium dissectum var. obliquum), snow trillium (Trillium nivale), Toadshade (Trillium sessile), Putty Root (Apectrum hyemale), Wild ginger (Asarum canadense), and Ginseng (Panax quinquefolia). The absence of these species indicates a past history of incompatible land use such as heavy grazing. Using Sorenson's Index of Similarity to compare Squire Point to Sugar Bottom and to Camp Daybreak, computed for this site as compared to Squire Point and Sugar Bottom, showed similarity values of 63.0 and 57.9 respectively (out of a potential value of 100). These similarity values were lower than one would expect for relatively mature woodlands located in close proximity.

<u>Camp Daybreak</u>: The Camp Daybreak site is located on a peninsula. It consists of an upland forest component and a gentle, north-facing slope which terminates at the edge of the lake. This site had 100 species, the lowest number of any of the three tracts sampled (Appendix 3), and the largest population of Big-toothed Aspen (*Populus grandidentata*), which indicates severe logging in the past.

Tree sampling: Two transects were established through the woodland. In one, White Oak, with a value of 121, had the highest importance value (Appendix 3); in the other transect, Big-toothed Aspen, with 65, contributed the highest importance value (Appendix 4). In both transects, Basswood was second in importance value rank. This indicates a heterogeneity of the site and shows its trend toward a more mesic (Maple-Basswood) community. Some portions of the site were of extremely high quality, but at times samplers were uncertain where the COE property boundary was located; thus, these portions may have been on private property.

Shrub sampling: In both transects, Hard Maple (*Acer saccharum*) was either highest or second highest in shrub density. This reinforces the evidence that the community is rapidly being transformed to a more mesic one. Because this is being observed throughout eastern Iowa, the existing oak-hickory communities are becomming more rare and should be protected.

Herb layer: The herb layer was diverse, with 32 species occurring in the sample plots. Six species occurred in densities exceeding one or more plant per square meter (Appendix 2). The diversity and density indicates the site has been protected from close grazing for an extended period.

(See figures 10, 11, and 12)

Sugar Bottom:

~~Tree sampling:~~ Sugar Bottom is characterized by an oak dominance. ~~This is further affirmed by~~ the highest importance values in each transect being contributed by white oak or red oak (Appendix 7, 8). Equally significant is the absence of young maples in the shrub layer in one transect, and the presence of young oaks in both transects (Appendix 8, 9). This community is very close to a discrete oak or oak-hickory community. The community is being maintained as an oak-hickory forest ~~phase~~ in the area of one transect, but demonstrates a slow progression toward a more mesic comminity in the other.

~~Shrub sampling:~~ Ironwood ~~formed~~ was the most frequently encountered plant in the sub-canopy in one transect, with hard maple and basswood existing in low occurrence. In the other transect, no hard maples were encountered, but young hickory and red oaks were encountered. This indicates a part of this woodland is being maintained in an oak-hickory phase of the sere, forming an unusual ecosystem in eastern Iowa, and one which should not be disturbed.

Compared to the other two sites, Sugar Bottom is distinctive in many ways. The lack of cut stumps and multiple stems from one trunk near ground level (telltale signs of cutting in the past) illustrate the lack of human disturbance. Species are more evenly dispersed across the landscape, a product of the more even upland topography and lack of previous disturbance. Sugar Bottom, as a whole, is much more homogeneous, forming a discrete, mature oak-hickory forest. And, it is demonstrating a tendency toward stability (as opposed to the rapid transition to maple-basswood forest demonstrated by Camp Day-break and most other oak-hickory

forests of eastern Iowa).

While containing a great species diversity (161 plant species total, the highest number of any study site), Sugar Bottom lacks exotic species and species common in less mature woodlands (such as _____

Dean → _____

_____).

It does, however, contain a number of species that are indicators of mature woodlands that have been spared intensive grazing and other human-related disturbances. These species include _____

Dean → _____

Its difference from ~~Squire Point and~~ the other two ~~Camp Daybreak~~ study areas is confirmed by Sorensen's Index of ~~Similarity~~ Similarity values of 63.3 and 63.0 (comparing Sugar Bottom to Squire Point and Camp Daybreak, respectively).

B. Ornithological Studies.

In recent years, scientists have begun to assess the needs of forest birds and to present recommendations ~~which~~ that may help to prevent local extinctions of sensitive species. Robbins (1979) presented evidence that certain species are area-sensitive and once a woodland size has been decreased below a certain critical point, these species disappear and are replaced by more common permanent residents. These area-sensitive species are long-distance migrants and depend on temperate forests for rearing young. Examples are the Ovenbird (Seiurus aurocapillus), Kentucky Warbler (Oporornis formosus), and ~~the~~ Tufted Titmouse (Parus bicolor). Sensitive species like these are decreasing across their range due to loss or fragmentation of habitat. Their existence also is being threatened by habitat changes in their wintering range.

V. RESULTS AND DISCUSSION:

~~A. Ornithological studies~~

Squire Point- This tract exhibited the lowest number (lowest diversity) of forest-dwelling ~~birds~~ bird species (see Appendix ~~9~~ 10). Only 14 species of forest-dwellers were present, compared to over 20 in each of the other two tracts. Squire Point contained a higher number of individuals and species associated with edge (the area of mixing of different ecosystems). These, however, are the common permanent residents or species with a high degree of ecological amplitude (Cardinal, House Wren, Brown-headed Cowbird, Common Grackle, Indigo Bunting, etc.) for which habitat is not a limiting factor. Squire Point is rich in bird life (had the highest total number of individuals) because of the amount of forest edge - i.e., it is a more "patchy" community than the others. (Because of this richness, 14) ~~It~~ would be of outstanding value as a tract for study by Audubon Clubs.

Camp Daybreak- This tract contained the second highest number of forest-dwelling ~~birds~~ bird species (Appendix ~~9~~ 10), and the greatest density of birds per unit of area. It also had the highest number of cavity-nesters (Black-capped Chickadee; Hairy, Downy, and Red-headed Woodpeckers; Common Flicker; Great-crested Flycatcher), but lacked two sensitive species (Kentucky Warbler and Yellow-throated Vireo) which may indicate a habitat missing from this large tract. The presence of the large number of cavity-nesters may be the result of a rather large population of Big-toothed Aspen (Populus grandidentata), which are soft and easy for cavities to be made, ~~and which~~ have a short lifespan, ~~which is~~ and are conducive to cavity formation after their death.

Sugar Bottom: - Sugar Bottom contained the largest number of sensitive forest-dwellers, listed below:

- Tufted Titmouse
- White-breasted Nuthatch
- Wood Thrush
- Blue-gray Gnatcateher
- Yellow-throated Vireo
- Red-eyed Vireo
- American Redstart
- Kentucky Warbler
- Ovenbird
- Scarlet Tanager

which nest only in deep, mature, undisturbed forests,

The site had the highest number of forest-dwelling species (23) of any sites sampled. The "indicator species" listed above, coupled with the high number of forest-dwelling species, combine to show that the Sugar Bottom tract is the most important for protecting sensitive long-distance migrant bird species.

Summary of ornithological studies. Of the three sites sampled, Squire Point contained the lowest number of species but the highest number of individuals. Of the other two sites, Sugar Bottom contained the lowest number of individuals (62), but the highest number of "indicator species" and the highest total number of species (30). This is what is expected in a mature woodland. Camp Daybreak contained a significant number of species (27), and intermediate number of individuals (66), both of which would be expected from a community with varied habitats. Because it provides habitat to the largest number of forest species, including several sensitive species for which habitat is becoming increasingly rare, Sugar Bottom deserves highest protection; the others deserve protection coupled with an intermediate human use plan.

Geological Summary ~~of the Lower Coralville Reservoir Area~~

~~(Jean C. Prior, Iowa Geological Survey)~~

Northern Johnson County, in particular the Corps of Engineers' property adjacent to the Coralville Reservoir, is underlain by the Devonian-age Cedar Valley Limestone, a major formation widespread in the northeastern third of Iowa. This fossiliferous rock can be seen in outcrop along the edges of the Coralville Reservoir, downstream along the Iowa River valley, and exposed in local roadcuts and quarries. A second bedrock formation, the State Quarry Limestone, is restricted geographically to isolated occurrences in northern Johnson County. This limestone, composed largely of brachiopod shells, lies above the Cedar Valley formation, and was deposited in scattered depressions scoured into the Cedar Valley surface by near-shore ocean currents. Two of the best exposures of this limited formation can be seen at the State Quarry and Stainbrook Geological Preserves, both along the margins of the Coralville Reservoir near Mehaffey Bridge, and both established with the cooperation of the Corps of Engineers. Outcrops of these Devonian-age rock units are not common, as the eastern Iowa landscape is dominated by a considerable thickness of pebbly clay and silt deposited by glacial ice and wind during the more recent (Pleistocene) geologic past. Evidence of this glacial history is also seen at the Stainbrook Geological Preserve in the form of glacial grooves etched on the bedrock surface.

The landscape in the vicinity of the Coralville Reservoir is shaped largely by the drainage of the Iowa River. Erosion by this stream and its tributaries has dissected the relatively soft glacial-age deposits into the familiar rolling topography. Immediately along the Iowa Valley sides the slopes steepen, often in response to the deeper erosion cutting through the glacial deposits and into the more resistant underlying bedrock. It is in these restricted topographic positions that many of the area's scenic views, rock outcrops, native stands of timber, and remaining natural areas occur.

The Sugar Bottom site (SE½, E½, NE¼, Sec. 9, T80N, R6W), under specific consideration here, is characterized by these features. There is considerable topographic variability as small creeks and intermittent drainage tributary to the Iowa Valley have dissected the landscape. The contours of the lower slopes steepen where ledges of Cedar Valley Limestone protrude from the hillsides, and in one side valley, exposed bedrock breaks the flow of a small creek into a picturesque series of low falls and pools. These natural exposures with their weathered surfaces provide additional diversity of habitat for the site's flora and fauna, as well as enhancing the site's scenic diversity. The outcrops reveal abundant, well-preserved fossil corals, and some stromatoporoids, brachiopods, and crinoids. Glacial erratics, ice-transported boulders of igneous rock, have eroded out of the glacial drift above the bedrock and are found among the limestone slabs in the creek bed. This diversity of geological materials also enlarges the area's potential for educational interpretation.

Preservation of this association of topographic and geologic features with the undisturbed forest and its soils should be encouraged. Remnants of presettlement natural environments are sandwiched today between the agricultural activity of the uplands and the reservoir in the valley below. These remnant natural areas are limited; it is important that the ecosystem represented be sustained and the opportunity to study and experience it be protected.

VI. RECOMMENDATIONS

The ~~U. S. Army Corps of Engineers~~ COE owns extensive tracts in Iowa in the Coralville, Red Rock, Rathbun, and Saylorville complexes. Because of rapid destruction of natural areas, these holdings will become more important in the future. It is, therefore, essential that the ~~Corps of Engineers~~ COE identify especially significant tracts that still represent Iowa as a natural landform, and give adequate protection to these tracts. The State Preserves Advisory Board wishes to cooperate in such a venture and this document is the first such attempt to identify such areas and participate in protecting them. The State Preserves Advisory Board has the authority to establish State Preserves on lands owned by any agency of government, municipality, private party, or non-profit organization, so long as the owner and Governor concur. The selection criteria for natural areas are listed below:

- Community type: Excellent or highly representative example of native community-type, habitat for rare or endangered species, or representative geological formation
- Diversity: High number of plant and animal species, with a low number of exotics, high number of 'indicator species'.
- Disturbance: Minimum of human-induced alterations, including secondary effects, such as erosion
- Size: ~~Size must be~~ Sufficient to assure reproductive success of plants and animals; shape should allow for protection against intrusions.
- Value: ~~Site should be~~ Of regional or state-wide significance; must have scientific, interpretive, or educational value.
- Representation: Community-type not preserved in local area

Recommendations

~~(Summary of Sectors II and IV: overviewed region, qualities and characteristics of three study areas.)~~

Based on these findings of high-quality natural communities on COE land surrounding the Coralville Reservoir, and on the fact that Iowa's (including Johnson County's) native forests and other native ecosystems are rapidly declining, we recommend that the COE routinely include designation of natural areas when considering land use options. According to the joint meeting of the State Preserves Advisory Board and the COE held March 25, 1982, such a designation may ~~would~~ necessitate revision of the Master Plan (see Appendix 1). These COE natural areas would include a representative sampling of Iowa's original fauna and flora, and also would include habitat for rare and endangered species. The areas would differ from the COE's "reserve forest land" in that natural areas would be managed for preservation of natural attributes. Human activities that would destroy these attributes would be discouraged.

We further recommend that the COE and Iowa State Conservation Commission cooperate in identifying the best and most critically important natural areas, and that these be formally designated as part of the Iowa State Preserve System. In such cases, land ownership would be retained by the COE. Any use and management decisions would be made jointly by the COE and State Preserves Board. Precedence for this type of action has already been taken with the establishment of the Merrill A. Stainbrook and Old State Quarry Preserves on COE Coralville Reservoir land.

Appendix — minutes from the meeting of COE and State Preserves Board personnel (previously referenced in Section IA.)

Lastly, we recommend that the Sugar Bottom study area be entered into a COE natural areas system, and that it also be designated as a state preserve. The Sugar Bottom area was the highest quality forest studied. This oak-hickory forest meets ~~several of~~ the criteria for designation as a state preserve: it is an excellent example of a native forest type otherwise ~~habitat~~ unrepresented in the preserves system in this ~~landform region;~~ it has educational, interpretive, and scientific value; it is relatively free of human impact; ~~it is potentially threatened by an alternative use;~~ and it offers no significant management problems. Designation as a state preserve would imply use as an educational, scientific, and (to a limited degree) recreational resource. The forest provides excellent opportunities for nature photography, "botanizing," study ~~at all levels~~ of Iowa's native forests, and the like. Activities that could disturb natural attributes, such as regular vehicular use, horseback riding, camping, or fires, would (not) be (permitted) ~~discouraged.~~ Because this forest type, previously common throughout the region, is now becoming rare, and because the COE has no such preserves on existing Iowa land, preservation of this natural area would allow the COE to make an unusually valuable contribution to future generations.

rt/9EE

it provides habitat for a large number of species but are typical of oak-hickory forests, including many 'indicator species' and its size assures reproductive success of these species.

please type in alphabetical order

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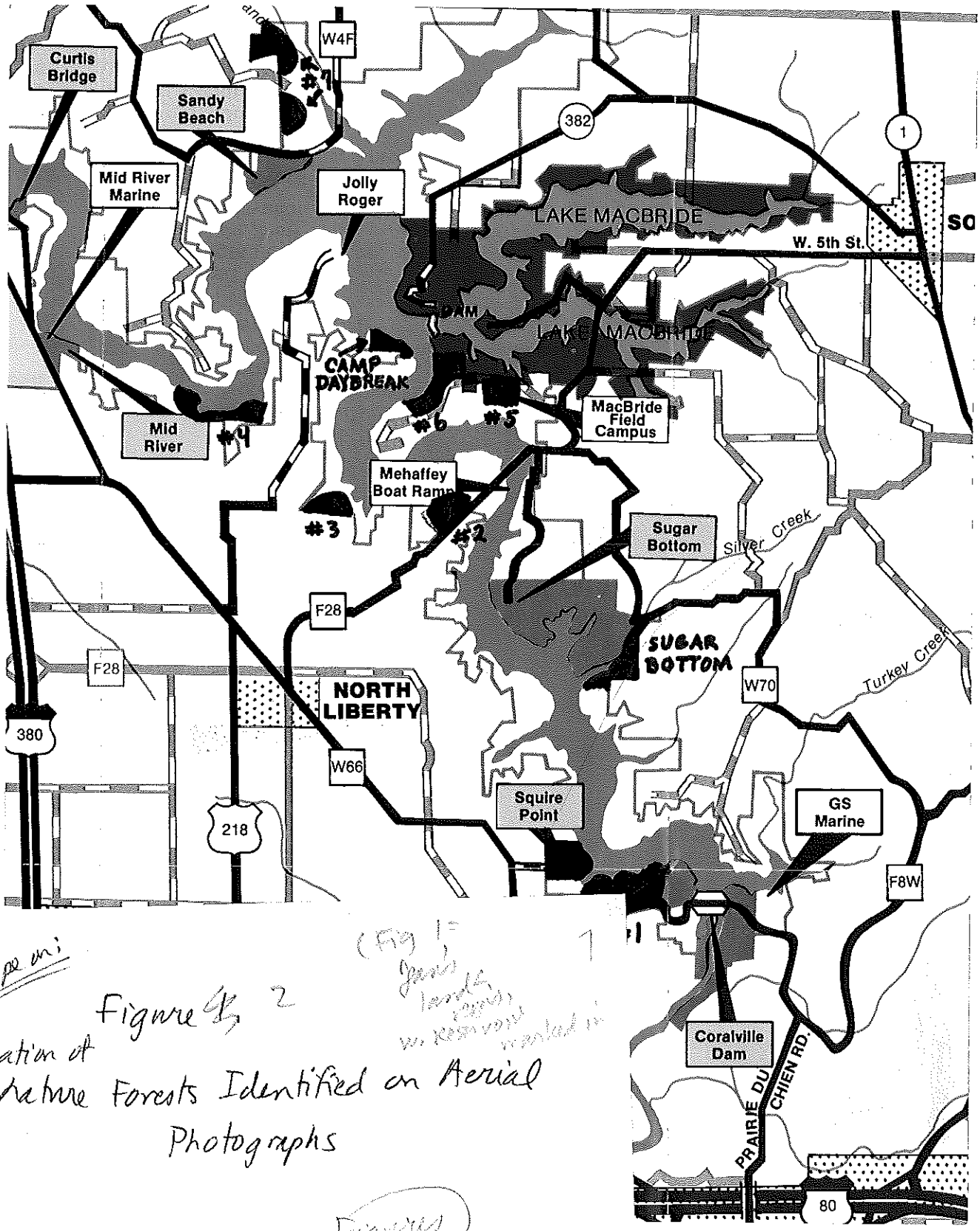
Robbins , 1979.

Emlen , 1980.



type on;

Figure 4, 2

Location of Mature Forests Identified on Aerial Photographs

Figures

Fig. 3. Location of Camp Daybreak study site.

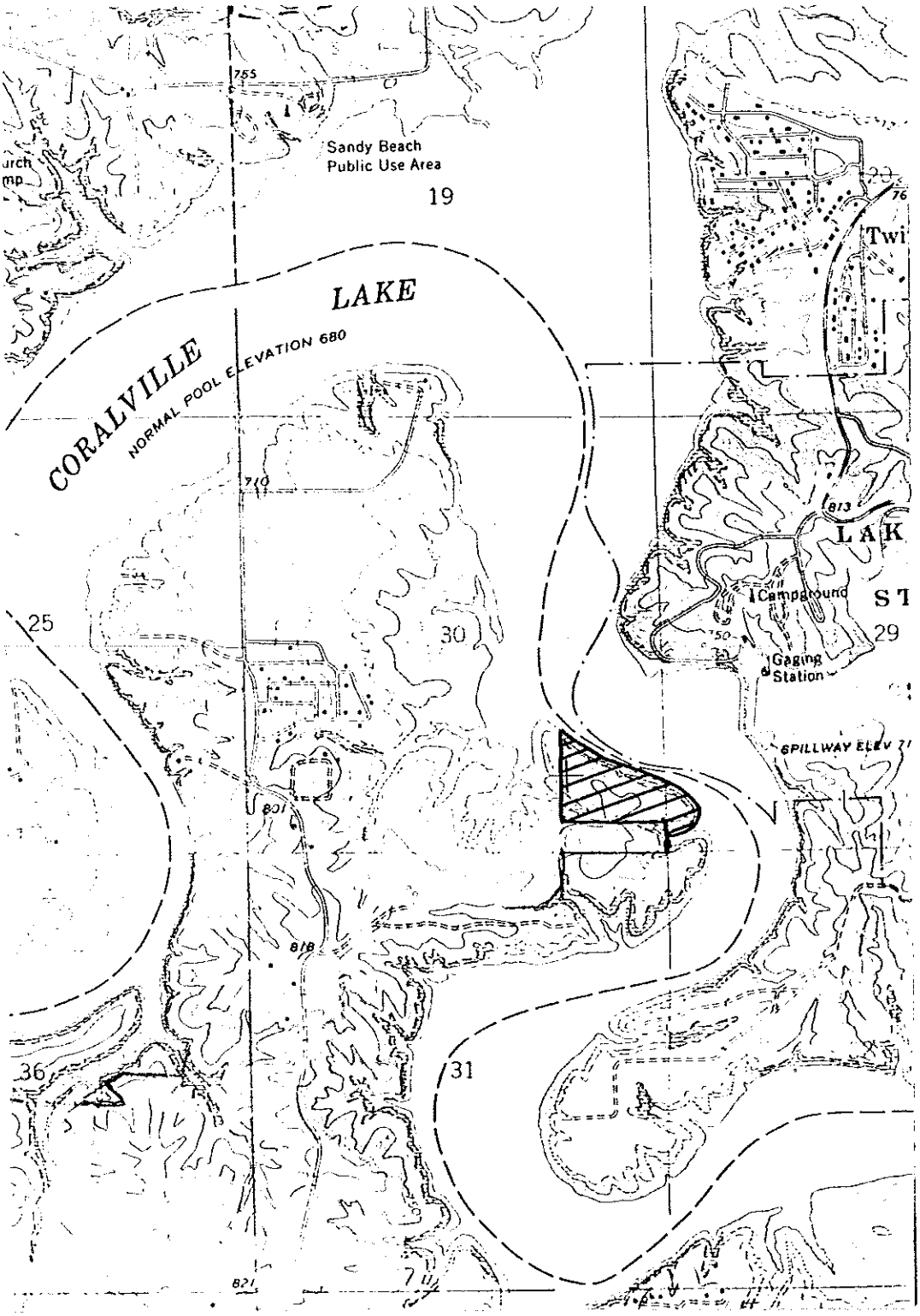

Sandy Beach
Public Use Area
19
LAKE
CORALVILLE
NORMAL POOL ELEVATION 680
710
755
813
Campground
750
Gaging
Station
SPILLWAY ELEV
25
30
29
801
818
36
31
821
Twi
LAK
ST

Fig. 4. Location of Squire Point study site

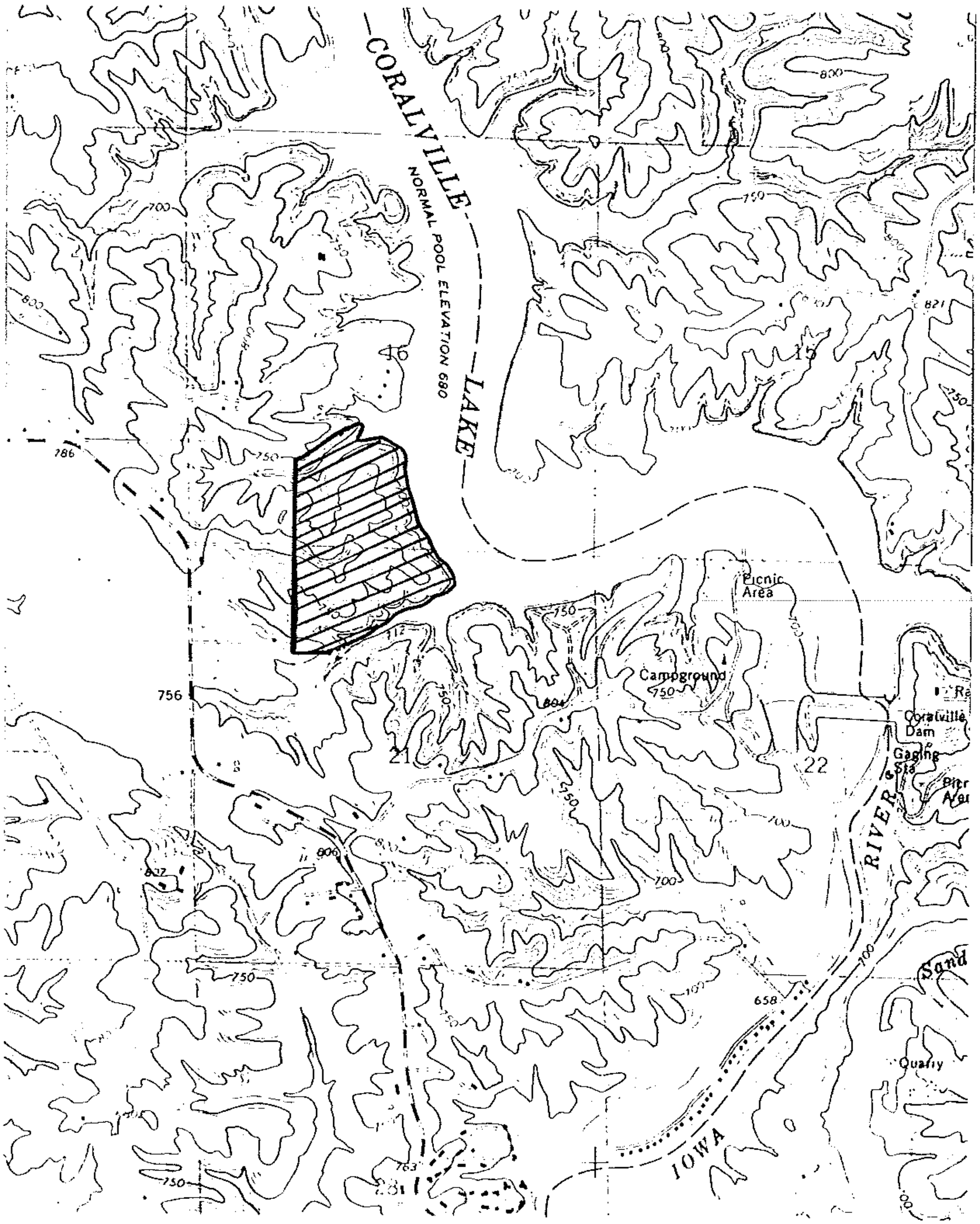
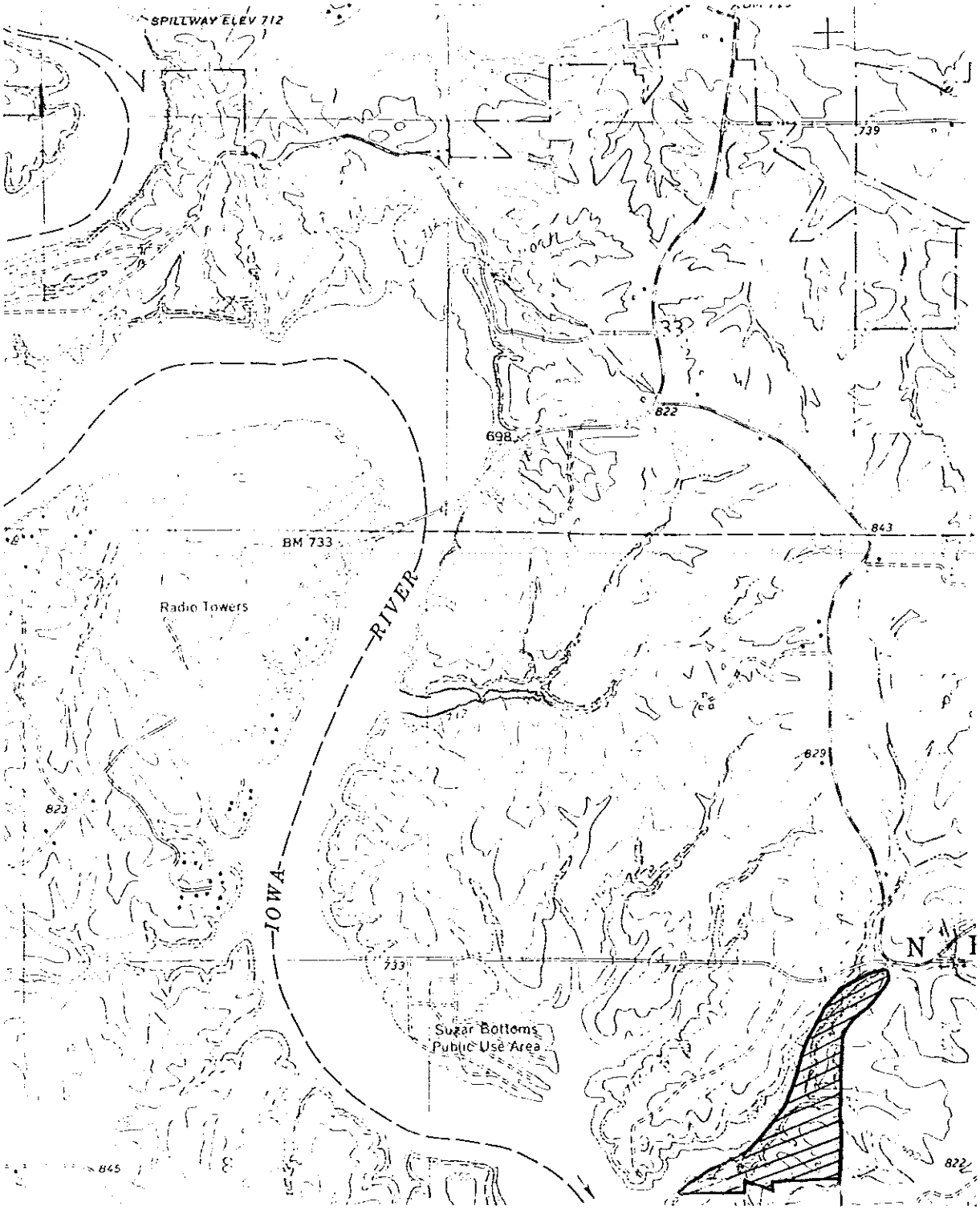

CORALVILLE LAKE
NORMAL POOL ELEVATION 680
Picnic Area
Campground
Coralville Dam
Gaging Sta
RIVER
IOWA
Quarry
16
15
21
22
756
786
750
700
800
821
806
658

Fig. 5 Location of Sugar Bottom study site


SPILLWAY ELEV 712
739
822
698
843
BM 733
Radio Towers
RIVER
IOWA
823
829
733
712
Suzar Bottoms
Public Use Area
845
822

6
Fig. ~~5~~. Camp Daybreak: An overview. Some areas of the site, such as this one, are dominated by mature trees and mixed-age stands, but many other other areas are characterized by dense, small trees

Fig. 7. Camp Daybreak: Signs of past use. Cut stumps, such as these, and basswood stumps with multiple sprouts, are obvious signs of logging in previous years.

Fig 8. Squire Point: An overview. This site is quite mixed, with areas of mature trees (such as this) interspersed with patches of dense younger trees and thick undergrowth, indicating previous disturbance or a more open, savanna-like forest in the past.

Fig. 9. Squire Point. A young woodland. Dense, young trees such as these indicate that this site has not been a homogeneous mature forest for decades.

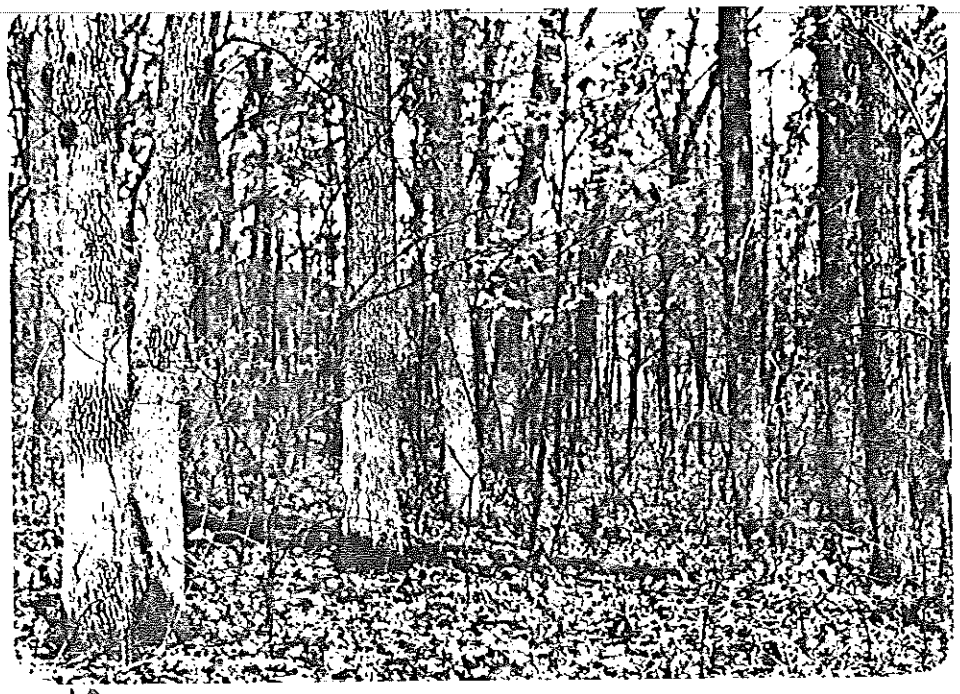


Fig 10. Sugar Bottom: An overview. Although a few patches of young dense trees can be found, this site is dominated by mature, mixed-age woodlands; its forest character is much more homogeneous than other sites sampled.

Fig 10. Sugar Bottom. Rocky ledges. The northern half of the site contains numerous outcrops of bedrock, which enhances its beauty and educational value

Fig. 11. Sugar Bottom. Rocky streambed. Exposed bedrock also is evident in picturesque streambeds, such as this one.

APPENDIX 1

COMPREHENSIVE SPECIES LIST

DEAN ROOSA

(Spring flora added 5/82 by C. Mutel)

	Sugar Bottom	Squire Point	Camp Daybreak
Ophioglossaceae			
Botrychium dissectum var. dissectum	X	X	
Botrychium dissectum var. obliquum	X		
Botrychium virginianum (rattlesnake fern)	X	X	X
Osmundaceae			
Osmunda claytoniana (interrupted fern)	X		
Polypodiaceae			
Adiantum pedatum (maindenhair fern)	X	X	X
Athyrium filix-femina (lady fern)	X	X	X
Cystopteris bulbifera	X	X	
Cystopteris protrusa	X	X	X
Onoclea sensibilis (sensitive fern)	X		X
Pellaea glabella	X		
Polystichum aerostichiodes (Christmas fern)		X	
Pinaceae			
Juniperus virginiana (red cedar)	X		
Pinus nigra		X	
Gramineae			
Agrostis alba		X	
Bromus purgans	X		
Cinna arundinacea (reed grass)		X	
Dactylis glomerata (orchard grass)	X	X	
Elymns villosus	X	X	
Elymus virginicus	X	X	X
Elymus wiegandii		X	
Festuca octaflora	X	X	X
Glyceria striata	X	X	X
Hystrix patula (bottlebrush grass)	X	X	X
Leersia oryzoides (rice cutgrass)	X		
Muhlenbergia sp.		X	

	Sugar Bottom	Squire Point	Camp Daybreak
Gramineae (Continued)			
Oryzopsis racemosa	X		
Panicum schribnerianum		X	
Phalaris arundinaceae (reed canary grass)	X		
Phleum pratense		X	
Setaria glauca		X	
Cyperaceae			
Carex pensylvanica (sedge)	X		
Carex bicknellii (sedge)	X	X	
Carex vulpinoidea (sedge)	X		
Carex sp. (sedge)		X	X
Scirpus atrovirens (bulrush)		X	
Araceae			
Arisaema triphyllum (jack-in-the-pulpit)	X	X	X
Juncaceae			
Juncus tenuis (path rush)	X	X	X
Liliaceae			
Allium tricoccum (wild leek)	X		X
Erithronium albidum (dogtooth violet)	X		
Hemerocallis fulva (day lily)		X	X
Polygonatum biflorum (solomon's seal)		X	X
Smilacina racemosa (false solomon's seal)	X	X	X
Smilacina stellata (starry solomon's seal)	X	X	X
Smilax herbacea (carrion flower)	X	X	X
Smilax hispida	X	X	X
Trillium nivale (snow trillium)	X		X
Trillium sessile (toadshade)			X
Uvularia grandiflora (bellwort)	X		X
Amaryllidaceae			
Hypoxis hirsuta	X		
Orchidaceae			
Aplectrum hyemale (putty root)	X		X
Corallorhiza odontorhiza (coral root)			X
Orchis spectabilis (showy orchis)	X	X	

	Sugar Bottom	Squire Point	Camp Daybreak
Iridaceae			
Sisyrinchium campestra (blue-eyed grass)	X		
Salicaceae			
Populus deltoides (cottonwood)	X	X	X
Populus grandidentata (big-toothed aspen)		X	X
Populus tremuloides (quaking aspen)	X	X	X
Salix amygdaloides (peach-leaved willow)	X		
Juglandaceae			
Carya cordiformis (bitternut hickory)	X	X	X
Carya ovata (shagbark hickory)	X	X	X
Juglans cinerea (butternut)	X	X	X
Juglans nigra (walnut)	X	X	
Corylaceae			
Carpinus carolinianum (blue beech)	X		
Corylus americana (hazel)	X	X	X
Ostrya virginiana (ironwood)	X	X	X
Fagaceae			
Quercus alba (white oak)	X	X	X
Quercus macrocarpa (bur oak)	X	X	
Quercus rubra (red oak)	X	X	X
Ulmaceae			
Celtis occidentalis (hackberry)	X	X	X
Ulmus americana (American elm)	X	X	X
Ulmus rubra (red elm)	X	X	X
Moraceae			
Morus rubra (red mulberry)		X	X
Urticaceae			
Laportea canadensis (wood nettle)	X	X	X
Pilea pumila (clearwood)	X	X	X
Urtica dioica (stinging nettle)	X	X	X

	Sugar Bottom	Squire Point	Camp Daybreak
Santalaceae			
Commandra umbellata	X		
Polygonaceae			
Fagopyrum esculentum (buckwheat)	X		
Polygonum lapathifolium	X		
Polygonum laevigatum		X	
Rumex crispus (curly dock)		X	
Tovara virginiana (jumpseed)	X	X	X
Aristolochiaceae			
Asarum canadense (wild ginger)	X		X
Chenopodiaceae			
Chenopodium album (lamb's quarters)	X		
Chenopodium paganum (pigweed)	X		
Portulacaceae			
Claytonia virginica (spring beauty)	X	X	X
Ranunculaceae			
Actaea pachypoda (white baneberry)	X	X	X
Actaea rubra (red baneberry)	X		
Anemone canadensis (Canada anemone)	X	X	X
Anemone cylindrica (thimbleweed)	X	X	X
Anemone quinquefolia (wood anemone)	X		
Anemonella thalictroides (rue anemone)	X	X	
Aquilegia canadensis (columbine)	X	X	
Hepatica acutiloba (hepatica)	X		X
Ranunculus abortivus (abortive buttercup)	X	X	X
Ranunculus septentrionalis (buttercup)	X	X	X
Ranunculus fascicularis (buttercup)		X	
Berberidaceae			
Berberis vulgaris (barberry)		X	
Caulophyllum thalictroides (blue cohosh)	X		X
Podophyllum peltatum (may apple)	X	X	X

	Sugar Bottom	Squire Point	Camp Daybreak
Menispermaceae			
Menispermum canadense	X		X
Papaveraceae			
Dicentra canadensis (squirrel corn)	X		
Dicentra cucullaria (dutchman's breeches)	X	X	X
Sanguinaria canadensis (bloodroot)	X	X	X
Cruciferae			
Arabis divaricarpa	X	X	
Cardemine bulbosa (bitter cress)	X	X	X
Cardemine pensylvanica	X		
Dentaria laciniata (toothwort)	X		X
Saxifragaceae			
Ribes americanum (currant)	X	X	
Ribes cynosbati	X		
Ribes missouriense (gooseberry)	X	X	X
Rosaceae			
Agrimonia gryposepala (agrimony)	X		
Agrimonia pubescens		X	
Crataegus sp. (hawthorne)	X		
Fragaria vesca (strawberry)		X	
Fragaria virginiana (strawberry)		X	
Geum canadense (white avens)	X	X	
Geum laciniatum		X	X
Potentilla arguta (cinquefoil)	X		
Potentilla recta (sulfur cinquefoil)		X	
Potentilla simplex (cinquefoil)		X	
Prunus serotina (black cherry)	X	X	X
Prunus virginiana (chokecherry)	X	X	X
Rosa carolina	X		X
Rosa multiflora (multiflora rose)	X		
Rubus allegheniensis (blackberry)		X	
Rubus idaeus (red raspberry)	X	X	X
Rubus occidentalis (black raspberry)	X	X	
Rubus pensilvanicus (blackberry)		X	

	Sugar Bottom	Squire Point	Camp Daybreak
Leguminosae			
Amphicarpa bracteata (hog peanut)	X	X	X
Desmodium canescens		X	
Desmodium cuspidatum	X		
Desmodium glutinosum	X	X	X
Desmodium illinoense			X
Desmodium nudiflorum	X	X	
Gleditsia traicanthos (honey locust)	X	X	
Melilotus alba (white sweet clover)		X	
Robinia pseudo-acacia (black locust)		X	
Trifolium repens (white clover)		X	
Geraniaceae			
Geranium maculatum (wild geranium)	X	X	X
Oxalidaceae			
Oxalis stricta (lady's sorrel)	X	X	
Oxalis violaea (wood sorrel)		X	
Rutaceae			
Xanthoxylum americanum (prickly ash)	X		
Anacardiaceae			
Rhus glabra (smooth sumac)		X	
Rhus radicans (poison ivy)	X	X	X
Staphyleaceae			
Staphylea trifolia (bladdernut)	X		
Aceraceae			
Acer negundo (box elder)		X	
Acer saccharinum (soft maple)	X		
Acer saccharum (sugar maple)	X	X	X
Balsaminaceae			
Impatiens biflora (spotted touch-me-not)	X	X	
Impatiens pallida (touch-me-not)	X	X	

	Sugar Bottom	Squire Point	Camp Daybreak
Vitaceae			
Parthenocissus quinquefolia (Virginia creeper)	X	X	X
Vitis riparia (riverbank grape)	X	X	X
Tiliaceae			
Tilia americana (basswood)	X	X	X
Violaceae			
Viola pubescens (yellow violet)	X	X	X
Viola spp. (blue violet)	X	X	X
Onagraceae			
Circaea quadrisulcata (enchanter's nightshade)	X	X	X
Gaura biennis	X		
Oenothera biennis (evening primrose)	X	X	
Araliaceae			
Aralia nudicaulis (wild sasparilla)	X		
Aralia racemosa (spikenard)	X		
Panax quinquefolius (ginseng)	X		
Umbelliferae			
Cryptotaenia canadensis		X	X
Daucus carota (Queen Anne's lace)		X	
Osmorhiza claytonii (sweet cicely)	X	X	X
Osmorhiza longistylis (anise root)	X	X	X
Pastinaca sativa (wild parsnip)		X	
Sanicula canadensis (black snakeroot)	X		
Sanicula gregaria (snakeroot)	X	X	X
Sanicula marilandica		X	X
Taenidia intergerrima (yellow pimpernel)		X	
Cornaceae			
Cornus alternifolia (alternate-leaved dogwood)	X	X	X
Cornus drummondii (rough-leaved dogwood)	X		
Cornus racemosa (gray dogwood)	X	X	X
Cornus stolonifera		X	

	Sugar Bottom	Squire Point	Camp Daybreak
Primulaceae			
Dodecatheon meadia (shooting star)	X		
Lysimachia ciliata (loosestrife)			X
Oleaceae			
Fraxinus americana (white ash)	X	X	
Fraxinus pennsylvanica (green ash)	X		X
Apocynaceae			
Apocynum androsaemifolium (spreading dogbane)		X	
Asclepiadaceae			
Asclepias verticellata (whorled milkweed)		X	
Polemoniaceae			
Phlox divaricata (phlox)	X	X	X
Phlox maculata (sweet William)		X	
Polemonium reptans (Jacob's ladder)	X	X	X
Hydrophyllaceae			
Ellisia nyctelea	X		
Hydrophyllum appendiculatum (appendaged waterleaf)			X
Hydrophyllum virginianum (Virginia waterleaf)	X		X
Boraginaceae			
Hacklea virginiana (stickseed)	X	X	
Verbenaceae			
Verbena stricta (hoary vervain)	X	X	
Verbena urticifolia		X	
Labiatae			
Monarda fistulosa (horsemint)		X	
Prunella vulgaris (self-heal)	X	X	
Pycnanthemum virginianum	X		

	Sugar Bottom	Squire Point	Camp Daybreak
Labiatae (continued)			
Scutellaria lateriflora		X	
Scutellaria ovata	X		
Stachys palustris	X	X	
Teuchrium canadense		X	
Solanaceae			
Physalis heterophylla (ground cherry)	X		
Scrophulariaceae			
Scrophularia lanceolata (figwort)	X	X	X
Verbascum phlomoides	X	X	
Phrymaceae			
Phryma leptostachya (lopseed)	X	X	X
Plantaginaceae			
Plantago major		X	
Plantago rugellii			X
Rubiaceae			
Galium concinnum (shining bedstraw)	X	X	X
Galium triflorum (bedstraw)	X	X	X
Caprifoliaceae			
Triosteum perfoliatum (tinker's weed)			X
Viburnum opulus (guelder-rose)		X	
Campanulaceae			
Campanula americana (tall bellflower)	X	X	X
Triodanis perfoliata (Venus' looking glass)	X	X	
Compositae			
Achillea sp (yarrow)	X	X	
Ambrosia artemisiifolia (small ragwood)		X	
Ambrosia trifida (giant ragweed)	X	X	X

	Sugar Bottom	Squire Point	Camp Daybreak
Compositae (continued)			
Antennaria plantaginifolia (pussytoes)	X	X	
Aster lateriflorus		X	
Erigeron annuus (daisy fleabane)		X	
Erigeron philadelphicus (fleabane)	X	X	
Eupatorium altissimum		X	
Eupatorium purpureum		X	
Eupatorium rugosum		X	
Helianthus strumosus (sunflower)		X	
Helianthus giganteus			X
Lactuca floridana (blue lettuce)	X	X	
Prenanthes alba			X
Rudbeckia serotina (black-eyed Susan)	X	X	
Senecio congestus (groundsel)	X	X	
Silphium perfoliatum	X		
Solidago flexicaulis			X
Taraxacum officinale (dandelion)		X	
Verbascum thapsus (mullein)		X	
Zizia aurea (golden Alexander)	X		X

Appx 1 - COE notes & mailing

Appendix 2

APPENDIX 2

SPRING FLORA LIST

(Flowers in bloom 4/82-5/82)

By: Dean Roosa, Connie Mutel

Herbs and small shrubs ranked according to the following abundance scale:

X: Only a few individuals present in the sample area.

1: Locally numerous within a very limited portion of the sample area.

2: Widespread, sometimes numerous within a limited area, but never abundant.

3: Large patches and numerous locally, but not present throughout sample area.

4: Widespread and abundant, but not present throughout sample area.

5: Widespread and abundant, present throughout sample area.

	Sugar Bottom	Squire Point	Camp Daybreak
Araceae			
Arisaema triphyllum (jack-in-the-pulpit)	2	2	2
Liliaceae			
Allium tricoccum (wild leek)	X		
Erithronium albidum (dogtooth violet)	3		
Smilacina racemosa (false solomon's seal)	4	2	2
Trillium nivale (snow trillium)	1		X
Trillium sessile (toadshade)			3
Uvularia grandiflora (bellwort)	2		2
Orchidaceae			
Aplectrum hyemale (putty root)	X		
Orchis spectabilis (showy orchis)	X	X	
Iridaceae			
Sisyrinchium campestra (blue-eyed grass)	X		

	Sugar Bottom	Squire Point	Camp Daybreak
Aristolochiaceae			
Asarum canadense (wild ginger)	3		X
Portulacaceae			
Claytonia virginica (spring beauty)	4	1	5
Ranunculaceae			
Actaea pachypoda (white baneberry)	X	X	X
Anemone canadensis (Canada anemone)	X	3	1
Anemone quinquefolia (wood anemone)	2		
Anemonella thalictroides (rue anemone)	4	4	
Aquilegia canadensis (columbine)	1		
Hepatica acutiloba (hepatica)	2		X
Ranunculus abortivus (abortive buttercup)	1	1	1
Ranunculus fascicularis (buttercup)		1	
Ranunculus septentrionalis (buttercup)	2	2	1.5
Berberidaceae			
Caulophyllum thalictroides (blue cohosh)	X		2
Podophyllum peltatum (may apple)	4	3	2
Papaveraceae			
Dicentra canadensis (squirrel corn)	X		
Dicentra cucullaria (dutchman's breeches)	3	3	4
Sanguinaria canadensis (bloodroot)	4	1	1
Cruciferae			
Arabis divaricarpa		X	
Cardemine bulbosa (bitter cress)			1
Dentaria laciniata (toothwort)	X		1
Saxifragaceae			
Ribes americanum (currant)	X	1	
Ribes cynosbati	X		
Ribes missouriense (gooseberry)	1	2	

	Sugar Bottom	Squire Point	Camp Daybreak
Rosaceae			
Fragaria virginiana (strawberry)		2	
Potentilla recta (sulfur cinquefoil)		1	
Rubus spp. (raspberry and blackberry species)	1	2	1
Leguminosae			
Trifolium repens (white clover)		3	
Geraniaceae			
Geranium maculatum (wild geranium)	3	2	2
Oxalidaceae			
Oxalis violaea (wood sorrel)		X	
Violaceae			
Viola pubescens (yellow violet)	2	2	1
Viola spp. (blue violet)	2	2	2
Umbelliferae			
Osmorhiza claytonii (sweet cicely)	4	4	2
Osmorhiza longistylis (anise root)	1		
Sanicula gregaria (snakeroot)	4	3	4
Primulaceae			
Dodecatheon meadia (shooting star)	1		
Polemoniaceae			
Phlox divaricata (phlox)	2	2	2
Polemonium reptans (Jacob's ladder)	2	1	2
Hydrophyllaceae			
Hydrophyllum appendiculatum (appendaged waterleaf)			3
Hydrophyllum virginianum (Virginia waterleaf)	3		3

	Sugar Bottom	Squire Point	Camp Daybreak
Rubiaceae			
Galium concinnum (shining bedstraw)	2	2	2
Galium triflorum (bedstraw)	3	2	4
Compositae			
Achillea sp.		1	
Antennaria plantaginifolia (pussytoes)	X	1	
Erigeron philadelphicus (fleabane)	X	1	
Senecio congestus (groundsel)	X	1	
Taraxacum officinale (dandelion)		3	
Zizia aurea (golden Alexander)	X		1

APPENDIX 3

Sample Data: Camp Daybreak, 8/ 4/81

Dean Roosa

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Quercus alba (white oak)	.28	60	94.6	121
Tilia americana (basswood)	.26	50	12.6	56
Carya ovata (shagbark hickory)	.07	30	8.6	25
Ulmus americana (American elm)	.09	40	6.7	21
Ulmus rubra (red elm)	.05	20	3.2	14
Morus sp. (mulberry)	.05	20	2.1	14
Carya cordiformis (bitternut hickory)	.05	10	6.1	13
Ostrya virginiana (ironwood)	.05	20	1.2	13
Acer saccharum (sugar maple)	.02	10	.6	8
Fraxinus pennsylvanica (green ash)	.02	10	.4	8

1. Absolute density; number of trees per unit area.

2. Absolute frequency; percentage of sample points at which tree species was found.

3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.

4. Sum of relative values for density, dominance, and frequency.

CAMP DAYBREAK

SHRUB-LAYER DATA (ten 3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Acer saccharum (sugar maple)	70	40.0
Ulmus americana (American elm)	50	22.2
Prunus serotina (black cherry)	30	25.5
Fraxinus pennsylvanica (green ash)	30	13.3
Celtis occidentalis (hackberry)	30	5.6
Crya ovata (shagbark hickory)	30	5.6
Ostrya virginiana (ironwood)	20	8.9
Tilia americana (basswood)	20	4.4
Rhus radicans (poison ivy)	10	11.1
Corylus americana (hazel)	10	2.2
Cornus racemosa (gray dogwood)	10	1.1
Cornus alternifolia (alternate leaved dogwood)	10	1.1
Quercus rubra (red oak)	10	1.1

CAMP DAYBREAK

HERB-LAYER DATA (ten 1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, (Virginia creeper)	40	230
Viola pubescens (yellow violet)	50	50
Smilax hispida	30	40
Galium concinnum (shining bedstraw)	20	40
Onoclea sensibilis (sensitive fern)	30	30
Botrychium virginianum (rattlesnake fern)	20	30
Polygonatum biflorum (Solomon's seal)	20	20
Sanicula sp.	10	10
Smilacina racemosa (false Solomon's seal)	20	20
Phryma leptostachya (lopseed)	20	20
Amphicarpeae bracteata (hog peanut)	10	10
Arisaema triphyllum (jack-in-the-pulpit)	10	10
Carex sp.	10	10
Celtis occidentalis (hackberry)	10	10
Desmodium illinoense	10	10
Festuca octaflora	10	10
Osmorhiza claytonii (sweet cicely)	10	10
Ribes missouriensis (gooseberry)	10	10
Smilacina stellata (starry Solomon's seal)	10	10
Smilax herbacea (Carrion flower)	10	10
Uvularia grandiflora (bellwort)	10	10

APPENDIX 4

Sample Data: Camp Daybreak, 7/19/82

Dean Roosa, Connie Mutel

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Populus grandidentata (bigtooth aspen)	.24	60	18.2	65
Tilia americana (basswood)	.21	60	16.5	60
Ulmus americana (American elm)	.15	40	11.7	42
Quercus rubra (red oak)	.12	30	3.7	25
Ulmus rubra (red elm)	.09	30	4.0	22
Ostrya virginiana (ironwood)	.12	30	0.9	20
Acer saccharum (sugar maple)	.09	30	1.2	18
Fraxinus pennsylvanica (green ash)	.04	10	3.1	11
Morus rubra (red mulberry)	.04	10	3.1	11
Carya cordiformis (bitternut)	.04	10	0.5	7
Carya ovata (shagbark hickory)	.04	10	0.5	7
Populus deltoides (cottonwood)	.04	10	0.8	7
Prunus serotina (black cherry)	.04	10	0.8	7

1. Absolute density; number of trees per unit area.

2. Absolute frequency; percentage of sample points at which tree species was found.

3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.

4. Sum of relative values for density, dominance, and frequency.

CAMP DAYBREAK

SHRUB-LAYER DATA (ten 3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, clumps (Virginia creeper)	90	240.0
Acer saccharum (sugar maple)	60	23.3
Ulmus rubra (red elm)	30	32.2
Rhus radicans (poison ivy)	40	17.8
Ribes missouriense (gooseberry)	40	16.7
Fraxinus pennsylvanica (green ash)	40	11.1
Carya cordiformis (bitternut hickory)	60	12.2
Tilia americana (basswood)	30	6.7
Ostrya virginiana (ironwood)	30	4.4
Quercus rubra (red oak)	20	5.6
Carya ovata (shagbark hickory)	20	2.2
Pilea pumila (clearweed)	10	4.4
Corylus americana (hazel)	10	3.3
Prunus serotina (black cherry)	10	1.1
Smilax hispida	10	1.1

CAMP DAYBREAK

HERB-LAYER DATA (ten 1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, clumps (Virginia creeper)	60	740
Viola spp. (blue violet)	80	240
Geranium maculatum (wild geranium)	50	270
Viola pubescens (yellow violet)	60	90
Solidago flexicaulis	20	130
Circaea quadrisulcata (enchanter's nightshade)	20	110
Carex sp., clump (sedge)	40	80
Uvularia grandiflora (bellwort)	50	60
Sanicula marilandica	30	50
Ulmus rubra (red elm)	10	50
Osmorhiza longistylis (anise root)	20	40
Rhus radicans (poison ivy)	20	40
Acer saccharum (sugar maple)	30	30
Smilacina racemosa (false Solomon's seal)	30	30
Amphicarpa bracteata (hog peanut)	20	30
Cryptotaenia canadensis	20	30
Podophyllum peltatum (may apple)	20	30
Ribes missouriense (gooseberry)	10	30
Arisdama triphyllum (jack-in-the-pulpit)	20	20
Fraxinus pennsylvanica (green ash)	20	20
Sanguinaria canadensis (bloodroot)	20	20
Galium concinnum (shining bedstraw)	10	20
Hydrophyllum appendiculatum (appendaged waterleaf)	10	20
Caulophyllum thalictroides (blue cohosh)	10	10
Cystopteris protrusa	10	10
Geum laciniatum	10	10
Polygonatum biflorum (Solomon's seal)	10	10
Prunus virginiana (chokecherry)	10	10
Quercus rubra (red oak)	10	10
Rosa sp. (rose)	10	10
Sanicula gregaria	10	10

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APPENDIX 5

Sample Data: Squire Point, 8/3/81

Dean Roosa

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Ostrya virginiana (ironwood)	.62	80	7.8	98.0
Quercus alba (white oak)	.29	90	90.1	153.0
Tilia americana (basswood)	.20	50	21.5	66.0
Prunus serotina (black cherry)	.07	20	1.7	19.5
Carya ovata (shagbark hickory)	.04	20	4.2	16.5
Quercus rubra (red oak)	.05	20	0.9	16.0
Celtis occidentalis (hackberry)	.02	10	0.6	7.5
Juglans nigra (walnut)	.02	10	0.3	7.5
Fraxinus americana (white ash)	.02	10	0.3	7.5
Ulmus americana (American elm)	.02	10	0.6	7.5

1. Absolute density; number of trees per unit area.

2. Absolute frequency; percentage of sample points at which tree species was found.

3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.

4. Sum of relative values for density, dominance, and frequency.

SQUIRE POINT SHRUB-LAYER DATA (ten 3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Ulmus americana (American elm)	70	68.9
Prunus serotina (black cherry)	70	51.1
Carya ovata (shagbark hickory)	40	16.7
Tilia americana (basswood)	30	8.9
Corylus americana (hazel)	20	2.2
Celtis occidentalis (hackberry)	20	2.2
Cornus racemosa (gray dogwood)	10	1.1
Quercus rubra (red oak)	10	1.1
Rhus radicans (poison ivy)	10	1.1
Ribes missouriensis (gooseberry)	10	1.1

SQUIRE POINT HERB-LAYER DATA (ten 1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia (Virginia creeper)	100	1170
Rhus radicans (poison ivy)	30	60
Phryma leptostachya (lopseed)	30	40
Galium concinnum (shining bedstraw)	20	50
Ulmus americana, seedling, (American elm)	20	40
Viola pubescens (yellow violet)	30	30
Arisaema triphyllum (jack-in-the-pulpit)	20	20
Circaea quadrisulcata (enchanter's nightshade)	20	20
Osmorhiza claytonii (sweet cicely)	20	20
Adiantum pedatum (maidenhair fern)	10	10
Anemone canadensis (Canada anemone)	10	10
Athyrium filix-femina (lady fern)	10	10
Botrychium virginiana (rattlesnake fern)	10	10
Botrychium dissectum var. dissectum	10	10
Campanula americana (tall bellflower)	10	10
Cystopteris protrusa	10	10
Rubus sp. (raspberry)	10	10
Smilacina racemosa (false solomon's seal)	10	10
Smilacina stellata (starry solomon's seal)	10	10
Smilax hispida	10	10

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APPENDIX

Sample Data: Squire Point, 7/19/82

Dean Roosa, Connie Mutel

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Ostrya virginiana (ironwood)	.62	80	7.8	98
Quercus rubra (red oak)	.10	30	18.1	56
Populus tremuloides (quaking aspen)	.12	30	5.6	33
Quercus alba (white oak)	.04	10	10.2	27
Juglans nigra (walnut)	.12	20	1.3	21
Ulmus rubra (red elm)	.10	20	0.7	18
Carya ovata (shagbark hickory)	.04	10	4.5	16
Celtis occidentalis (hackberry)	.04	10	2.0	11
Populus grandidentata (big-tooth aspen)	.06	10	1.0	11
Gleditsia traicanthos (honey locust)	.04	10	0.5	8

1. Absolute density; number of trees per unit area.

2. Absolute frequency; percentage of sample points at which tree species was found.

3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.

4. Sum of relative values for density, dominance, and frequency.

SQUIRE POINT SHRUB-LAYER DATA (ten 3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, clumps (Virginia creeper)	90	433.3
Rhus radicans (poison ivy)	80	52.2
Ostrya virginiana (ironwood)	50	24.4
Ribes missouriense (gooseberry)	40	22.2
Carya ovata (shagbark hickory)	30	7.7
Prunus virginiana (chokecherry)	30	7.7
Ulmus rubra (red elm)	30	7.7
Carya cordiformis (bitternut)	30	3.3
Cornus racemose (gray dogwood)	20	2.2
Prunus serotina (black cherry)	20	2.2
Quercus rubra (red oak)	20	2.2
Ulmus americana (American elm)	20	2.2
Acer negundo (box elder)	10	2.2
Cornus alternifolia (alternate-leaved dogwood)	10	2.2
Rubus pensilvanicus (blackberry)	10	2.2
Acer saccharum (sugar maple)	10	1.1
Carex sp., clump (sedge)	10	1.1
Pilea pumila (clearweed)	10	1.1
Vitis riparia (riverbank grape)	10	1.1

SQUIRE POINT HERB-LAYER DATA (ten 1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, clumps (Virginia creeper)	70	700
Circaea quadrisulcata (enchanter's nightshade)	40	310
Carex sp., clump (sedge)	60	240
Geranium maculatum (wild geranium)	30	120
Phryma leptostachya (lopseed)	20	70
Osmorhiza claytonii (sweet cicely)	30	50
Sanicula marilandica	30	50
Amphicarpa bracteata (hog peanut)	20	50
Galium concinnum (shining bedstraw)	10	50
Rhus radicans (poison ivy)	20	40
Sanguinaria canadensis (bloodroot)	20	40
Viola pubescens (yellow violet)	20	30
Cryptotaenia canadensis	10	30
Galium triflorum (bedstraw)	10	30
Prunus virginiana (chokecherry)	20	20
Desmodium glutinosum	10	10
Geum laciniatum	10	10
Impatiens pallida (touch-me-not)	10	10
Muhlenbergia sp., clump	10	10
Osmorhiza longistylis (anise root)	10	10
Oxalis stricta (lady's sorrel)	10	10
Smilax hispida	10	10
Vitis riparia (riverbank grape)	10	10

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APPENDIX B

Sample Data: Camp Daybreak, 8/14/81

Dean Roosa

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Quercus alba (white oak)	.28	60	94.6	121
Tilia americana (basswood)	.26	50	12.6	56
Carya ovata (shagbark hickory)	.07	30	8.6	25
Ulmus americana (American elm)	.09	40	6.7	21
Ulmus rubra (red elm)	.05	20	3.2	14
Morus sp. (mulberry)	.05	20	2.1	14
Carya cordiformis (bitternut hickory)	.05	10	6.1	13
Ostrya virginiana (ironwood)	.05	20	1.2	13
Acer saccharum (sugar maple)	.02	10	.6	8
Fraxinus pennsylvanica (green ash)	.02	10	.4	8

1. Absolute density; number of trees per unit area.
2. Absolute frequency; percentage of sample points at which tree species was found.
3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.
4. Sum of relative values for density, dominance, and frequency.

CAMP DAYBREAK SHRUB-LAYER DATA (ten 3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Acer saccharum (sugar maple)	70	40.0
Ulmus americana (American elm)	50	22.2
Prunus serotina (black cherry)	30	25.5
Fraxinus pennsylvanica (green ash)	30	13.3
Celtis occidentalis (hackberry)	30	5.6
Crya ovata (shagbark hickory)	30	5.6
Ostrya virginiana (ironwood)	20	8.9
Tilia americana (basswood)	20	4.4
Rhus radicans (poison ivy)	10	11.1
Corylus americana (hazel)	10	2.2
Cornus racemosa (gray dogwood)	10	1.1
Cornus alternifolia (alternate leaved dogwood)	10	1.1
Quercus rubra (red oak)	10	1.1

CAMP DAYBREAK HERB-LAYER DATA (ten 1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, (Virginia creeper)	40	230
Viola pubescens (yellow violet)	50	50
Smilax hispida	30	40
Galium concinnum (shining bedstraw)	20	40
Onoclea sensibilis (sensitive fern)	30	30
Botrychium virginianum (rattlesnake fern)	20	30
Polygonatum biflorum (Solomon's seal)	20	20
Sanicula sp.	10	10
Smilacina racemosa (false Solomon's seal)	20	20
Phryma leptostachya (lopseed)	20	20
Amphicarpeae bracteata (hog peanut)	10	10
Arisaema triphyllum (jack-in-the-pulpit)	10	10
Carex sp.	10	10
Celtis occidentalis (hackberry)	10	10
Desmodium illinoense	10	10
Festuca octaflora	10	10
Osmorhiza claytonii (sweet cicely)	10	10
Ribes missouriensis (gooseberry)	10	10
Smilacina stellata (starry Solomon's seal)	10	10
Smilax herbacea (Carrion flower)	10	10
Uvularia grandiflora (bellwort)	10	10

APPENDIX 4

Sample Data: Camp Daybreak, 7/19/82

Dean Roosa, Connie Mutel

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Populus grandidentata (bigtooth aspen)	.24	60	18.2	65
Tilia americana (basswood)	.21	60	16.5	60
Ulmus americana (American elm)	.15	40	11.7	42
Quercus rubra (red oak)	.12	30	3.7	25
Ulmus rubra (red elm)	.09	30	4.0	22
Ostrya virginiana (ironwood)	.12	30	0.9	20
Acer saccharum (sugar maple)	.09	30	1.2	18
Fraxinus pennsylvanica (green ash)	.04	10	3.1	11
Morus rubra (red mulberry)	.04	10	3.1	11
Carya cordiformis (bitternut)	.04	10	0.5	7
Carya ovata (shagbark hickory)	.04	10	0.5	7
Populus deltoides (cottonwood)	.04	10	0.8	7
Prunus serotina (black cherry)	.04	10	0.8	7

1. Absolute density; number of trees per unit area.

2. Absolute frequency; percentage of sample points at which tree species was found.

3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.

4. Sum of relative values for density, dominance, and frequency.

CAMP DAYBREAK

SHRUB-LAYER DATA (ten 3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, clumps (Virginia creeper)	90	240.0
Acer saccharum (sugar maple)	60	23.3
Ulmus rubra (red elm)	30	32.2
Rhus radicans (poison ivy)	40	17.8
Ribes missouriense (gooseberry)	40	16.7
Fraxinus pennsylvanica (green ash)	40	11.1
Carya cordiformis (bitternut hickory)	60	12.2
Tilia americana (basswood)	30	6.7
Ostrya virginiana (ironwood)	30	4.4
Quercus rubra (red oak)	20	5.6
Carya ovata (shagbark hickory)	20	2.2
Pilea pumila (clearweed)	10	4.4
Corylus americana (hazel)	10	3.3
Prunus serotina (black cherry)	10	1.1
Smilax hispida	10	1.1

CAMP DAYBREAK HERB-LAYER DATA (ten 1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia, clumps (Virginia creeper)	60	740
Viola spp. (blue violet)	80	240
Geranium maculatum (wild geranium)	50	270
Viola pubescens (yellow violet)	60	90
Solidago flexicaulis	20	130
Circaea quadrisulcata (enchanter's nightshade)	20	110
Carex sp., clump (sedge)	40	80
Uvularia grandiflora (bellwort)	50	60
Sanicula marilandica	30	50
Ulmus rubra (red elm)	10	50
Osmorhiza longistylis (anise root)	20	40
Rhus radicans (poison ivy)	20	40
Acer saccharum (sugar maple)	30	30
Smilacina racemosa (false Solomon's seal)	30	30
Amphicarpa bracteata (hog peanut)	20	30
Cryptotaenia canadensis	20	30
Podophyllum peltatum (may apple)	20	30
Ribes missouriense (gooseberry)	10	30
Arisaema triphyllum (jack-in-the-pulpit)	20	20
Fraxinus pennsylvanica (green ash)	20	20
Sanguinaria canadensis (bloodroot)	20	20
Galium concinnum (shining bedstraw)	10	20
Hydrophyllum appendiculatum (appendaged waterleaf)	10	20
Caulophyllum thalictroides (blue cohosh)	10	10
Cystopteris protrusa	10	10
Geum laciniatum	10	10
Polygonatum biflorum (Solomon's seal)	10	10
Prunus virginiana (chokecherry)	10	10
Quercus rubra (red oak)	10	10
Rosa sp. (rose)	10	10
Sanicula gregaria	10	10
Pilea pumila (Clearweed)	10	10

APPENDIX 8

Sample Data: Sugar Bottom, 8/4/81

Dean Roosa, Connie Mutel, Jon Duyvejonck

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Quercus alba (white oak)	.34	100	79.90	183.4
Quercus rubra (red oak)	.08	40	20.90	52.6
Carya ovata (shagbark hickory)	.04	30	3.84	24.6
Ostrya virginiana (ironwood)	.04	30	0.92	21.9
Prunus serotina (black cherry)	.02	10	0.76	8.9
Fraxinus americana (white ash)	.02	10	0.40	8.6

1. Absolute density; number of trees per unit area.
2. Absolute frequency; percentage of sample points at which the tree species was found.
3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.
4. Sum of relative values for density, dominance, and frequency.

SUGAR BOTTOM

SHRUB-LAYER DATA (ten 3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Cornus racemosa (gray dogwood)	70	28.9
Ulmus americana (American elm)	60	34.4
Prunus serotina (black cherry)	50	25.5
Rhus radicans (poison ivy)	30	24.4
Ribes missouriensis (gooseberry)	60	13.3
Carya ovata (shagbark hickory)	40	8.9
Ostrya virginiana (ironwood)	50	7.8
Carya cordiformis (bitternut hickory)	30	3.3
Quercus rubra (red oak)	10	3.3
Fraxinus americana (white ash)	10	1.1
Fraxinus pennsylvanica (green ash)	10	1.1
Juglans cinerea (butternut)	10	1.1
Juglans nigra (walnut)	10	1.1
Prunus virginiana (chokecherry)	10	1.1
Xanthoxylum americanum (prickly ash)	10	1.1

SUGAR BOTTOM HERB-LAYER DATA (ten 1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Parthenocissus quinquefolia (Virginia creeper)	90	740
Galium concinnum (shining bedstraw)	60	260
Amphicarpa bracteata (hog peanut)	50	50
Circaea quadrisulcata (enchanter's nightshade)	10	50
Phryma leptostachya (lopseed)	40	40
Geranium maculatum (wood geranium)	20	40
Quercus rubra, seedling (red oak)	30	30
Smilax hispida	30	30
Viola pubescens (yellow violet)	20	20
Botrychium virginianum (rattlesnake fern)	10	20
Laportea canadensis (wood nettle)	10	20
Rosa spp.	10	20
Carex bicknellii	10	10
Cornus alternifolia (alternate-leaved dogwood)	10	10
Cornus drummondii (rough-leaved dogwood)	10	10
Desmodium glutinosum	10	10
Fraxinus pennsylvanica (green ash)	10	10
Glyceria striata	10	10
Osmorhiza claytonii (sweet cicely)	10	10
Prunus serotina (black cherry)	10	10
Sanguinaria canadensis (bloodroot)	10	10
Smilacina stellata (starry Solomon's seal)	10	10
Smilacina racemosa (false Solomon's seal)	10	10
Staphylea trifolia (bladdernut)	10	10
Tilia americana (basswood)	10	10
Uvularia grandiflora (bellwort)	10	10

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APPENDIX 8

Sample Data: Sugar Bottom, 5/15/82

Dean Roosa, Connie Mutel

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Quercus rubra (red oak)	.31	100	74.2	156
Quercus alba (white oak)	.11	50	19.4	55
Tilia americana (basswood)	.08	40	13.9	41
Ostrya virginiana (ironweed)	.09	40	2.2	33
Ulmus americana (American elm)	.02	10	2.7	9
Carya ovata (shagbark hickory)	.02	10	1.0	8

1. Absolute density; number of trees per unit area.

2. Absolute frequency; percentage of sample points at which tree species was found.

3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.

4. Sum of relative values for density, dominance, and frequency.

SUGAR BOTTOM SHRUB-LAYER DATA (3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Ostrya virginiana (ironwood)	100	71.1
Ulmus americana (American elm)	70	33.3
Fraxinus pennsylvanica (green ash)	90	30.0
Acer saccharum (sugar maple)	90	21.1
Tilia americana (basswood)	50	16.6
Ribes missouriensis (gooseberry)	40	13.3
Carya ovata (shagbark)	30	12.2
Carya cordiformis (bitternut hickory)	20	7.8
Quercus rubra (red oak)	30	4.4
Rhus radicans (poison ivy)	30	3.3
Prunus serotina (black cherry)	20	3.3
Celtis occidentalis (hackberry)	10	3.3

SUGAR BOTTOM HERB-LAYER DATA (1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Anemone quinquefolia (wood anemone)	70	820
Geranium maculatum (wild geranium)	80	370
Parthenocissus quinquefolia (Virginia creeper)	40	260
Hydrophyllum virginianum (Virginia waterleaf)	50	210
Anemonella thalictroides (rue anemone)	50	190
Phlox divaricata (phlox)	40	110
Galium concinnum (bedstraw)	30	110
Circaea quadrisulcata (enchanter's nightshade)	20	100
Hepatica americana, clump (hepatica)	40	90
Ulmus americana, seedling (American elm)	50	60
Claytonia virginica (spring beauty)	20	60
Prunus serotina (black cherry)	30	30
Ribes missouriensis (gooseberry)	20	30
Viola pubescens (yellow violet)	20	30
Aster sp. (aster)	10	30
Menispermum canadense (moonseed)	20	20
Osmorhiza longistylis (sweet cicely)	20	20
Lactuca sp.	10	20
Sanicula canadensis (snakeroot)	10	20
Tovara virginiana (jumpseed)	10	20
Acer saccharum (sugar maple)	10	10
Asarum canadense (wild ginger)	10	10
Carex sp. (sedge)	10	10
Polemonium reptans (Jacob's ladder)	10	10
Potentilla sp. (cinquefoil)	10	10
Rhus radicans (poison ivy)	10	10
Rosa sp. (rose)	10	10
Sanguinaria canadensis (bloodroot)	10	10
Trillium nivale (snow trillium)	10	10

10

APPENDIX 8 - RESULTS OF BIRD TRANSECTS

Location:	Squire Point		Camp Daybreak		Sugar Bottom	
Date/Time	3 June/5:45-7:35		11 June/5:50-8:00		12 June/6:22-7:15	
Transect length	1.3 miles		.50 miles		.70 miles	
Forest Species	indiv.	birds/100 ac	indiv.	birds/100 ac	indiv.	birds/100 ac.
Red-tailed Hawk			1	1		
B.b. Cuckoo			1	8	1	6
Common flicker	3	9	3	25	1	6
Red-head Wdpkr.	9	28	2	16	1	6
Red-bel. Wdpkr.			1	4	1	3
Downy Wdpkr.	2	6	1	8	1	6
Hairy Wdpkr.			2	16	2	12
Gr-crest Flyc.	5	16	5	41	4	24
E. wood Pewee	7	11	3	12	6	18
Blue Jay			3	12	2	6
Common Crow			2	8	2	6
B-cap Chickadee	3	8	7	52		
Tuft. titmouse	3	5	2	8	1	3
W. br Nuthatch	1	3	1	7	3	15
Grey Catbird	3	9	2	16	1	6
Wood thrush	6	9	2	8	1	3
Bl-grey Gnatcatch.	2	13			1	12 (nesting)
Yel-thr Vireo			3	25	1	6
Red-eye Vireo	3	9	3	25	2 3	24 18
Kentucky Warbler			1	16	1	12
Ovenbird	6	16	6	41	4	20
N. Oriole					2	10
Scarlet Tanager			4	33	2	12
R.br. Grosbeak	4	13	4	33	4	24
TOTAL forest individuals	87 59	155	59	415	48 49	258
Total forest species Number species	14		22		23	
Edge Species						
Mourning Dove					3	
Acadian Flyc.					1	
House Wren	3					
Br. Thrasher	1		1			
Bl.-wing Warbler	1					
Com. Yel. throat	2				1	
Red-wing Blackbird					1	
Com. Grackle	2					
Br. head Cowbird	3		1		1	
Indigo bunting	2		2		5	
N. Cardinal	10/8		2		4/7	
Am. Goldfinch			1/5			
Total edge species TOTAL (individuals)	8 24		7		14	8
Total Forest & Edge spp	22		27		30	
Tot. for. & edg. indiv.	111 81		66		62 61	240

APPENDIX 8

Sample Data: Sugar Bottom, 5/15/82

Dean Roosa, Connie Mutel

TREE DATA	Density[1] (#/100 ft^2)	Frequency[2] (%)	Dominance[3] (in^2/100 ft^2)	Importance[4] value
Quercus rubra (red oak)	.31	100	74.2	156
Quercus alba (white oak)	.11	50	19.4	55
Tilia americana (basswood)	.08	40	13.9	41
Ostrya virginiana (ironweed)	.09	40	2.2	33
Ulmus americana (American elm)	.02	10	2.7	9
Carya ovata (shagbark hickory)	.02	10	1.0	8

1. Absolute density; number of trees per unit area.

2. Absolute frequency; percentage of sample points at which tree species was found.

3. Absolute dominance; ground area covered by all tree trunks, measured at breast height, per unit area.

4. Sum of relative values for density, dominance, and frequency.

SUGAR BOTTOM

SHRUB-LAYER DATA (3x3 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Ostrya virginiana (ironwood)	100	71.1
Ulmus americana (American elm)	70	33.3
Fraxinus pennsylvanica (green ash)	90	30.0
Acer saccharum (sugar maple)	90	21.1
Tilia americana (basswood)	50	16.6
Ribes missouriensis (gooseberry)	40	13.3
Carya ovata (shagbark)	30	12.2
Carya cordiformis (bitternut hickory)	20	7.8
Quercus rubra (red oak)	30	4.4
Rhus radicans (poison ivy)	30	3.3
Prunus serotina (black cherry)	20	3.3
Celtis occidentalis (hackberry)	10	3.3

SUGAR BOTTOM

HERB-LAYER DATA (1x1 m. plots)	Frequency (Percent)	Density (# plants per $100m^2$)
Anemone quinquefolia (wood anemone)	70	820
Geranium maculatum (wild geranium)	80	370
Parthenocissus quinquefolia (Virginia creeper)	40	260
Hydrophyllum virginianum (Virginia waterleaf)	50	210
Anemonella thalictroides (rue anemone)	50	190
Phlox divaricata (phlox)	40	110
Galium concinnum (bedstraw)	30	110
Circaea quadrisulcata (enchanter's nightshade)	20	100
Hepatica americana, clump (hepatica)	40	90
Ulmus americana, seedling (American elm)	50	60
Claytonia virginica (spring beauty)	20	60
Prunus serotina (black cherry)	30	30
Ribes missouriensis (gooseberry)	20	30
Viola pubescens (yellow violet)	20	30
Aster sp. (aster)	10	30
Menispermum canadense (moonseed)	20	20
Osmorhiza longistylis (sweet cicely)	20	20
Lactuca sp.	10	20
Sanicula canadensis (snakeroot)	10	20
Tovara virginiana (jumpseed)	10	20
Acer saccharum (sugar maple)	10	10
Asarum canadense (wild ginger)	10	10
Carex sp. (sedge)	10	10
Polemonium reptans (Jacob's ladder)	10	10
Potentilla sp. (cinquefoil)	10	10
Rhus radicans (poison ivy)	10	10
Rosa sp. (rose)	10	10
Sanguinaria canadensis (bloodroot)	10	10
Trillium nivale (snow trillium)	10	10