ILLINOIS NATURAL HISTORY SURVEY

Swainson's Warbler Status Survey in the Cave and Cedar Creek Area

DRAFT REPORT

Submitted by

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To

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Introduction

The Swainson's warbler (*Limnothlypis swainsonii)* is one of the least abundant warbler species throughout its range in the southeastern states (Meanley 1971). The rarity of this species has been attributed to combined effects of low nesting success and specialized habitat requirements exacerbated by loss of floodplain forest nesting habitat. Loss of wintering habitat, especially in Cuba, also probably adversely affected Swainson's warbler populations (Morse 1989).

The Swainson's warbler always has been an uncommon breeding species in Illinois, but has become especially rare in recent years. In 1991, the species appeared to be extirpated in Illinois, but I discovered a singing male the following year along Cedar Creek, in the floodplain that historically supported the largest population of Swainson's warbler in the state. In 1976, 22 Swainson's warbler territories, the highest number documented in Illinois, were located along Cave and Cedar creeks during a study of Swainson's warbler habitat selection (Eddleman 1978).

The known breeding range of the Swainson's warbler extends into southern Illinois only as far north as Perry County (Gross 1908, Herkert 1992). Some researchers believe the nesting range of this species is limited by the distribution of Giant Cane (*Arundinaria gigantea*), a plant that forms dense thickets, or canebrakes, which may provide structural characteristics preferred by Swainson's warblers (Meanley 1971, Eddleman 1978). Many cane stands apparently were destroyed by logging, local harvest, and severe winters in the Swainson's warbler breeding area surrounding Cave and Cedar creeks (George 1972, Eddleman 1978). Whether cane is a limiting factor, however, remains to be proven. In other parts of its range the Swainson's warbler nests in habitats dominated by pepperbush or rhododendron, which indicates that species other than cane provide suitable structural characteristics.

In 1976-77, Swainson's warbler territories along Cave and Cedar creeks were located mostly in or near successional stages ranging from late old field to late successional forest (Eddleman et al. 1980). Eddleman (1978) found that the vigorous cane stands and dense undergrowth preferred by Swainson's warblers usually were located near areas where openings in the forest had been created within the last 30 years. Cane stands apparently become established in open sites and eventually lose vigor as the surrounding canopy closes.

Most warbler territories were on sites with more than 10,000 shrub stems/ha, and with an understory dominated by cane. Swainson's warblers also preferred shady sites, usually with at least 75% canopy closure (Eddleman et al. 1980). Age of trees typically was greater than 20 years and height of trees at least 7.6 m. Other Swainson's warbler habitat associations documented in the Illinois study were alluvial soils, sparse ground cover, muddy-bottomed streams (rather than gravel-bottomed), nearness to a permanent water source, and a forest tract size of at least 350 ha (Eddleman 1978). In general, these characteristics agree with habitat descriptions from other parts of the warbler's range (Meanley 1971).

Since the decline of the Swainson's warbler in the Cave and Cedar creek bottomlands no studies have documented whether suitable Swainson's warbler habitat is present in the area. The purpose of this study was to 1) assess the suitability of existing habitat for the Swainson's warbler in Cave and Cedar creek valleys in Jackson County, Illinois, 2) to assess potential future availability of habitat, 3) to search for remaining Swainson's warblers, and 4) to develop a research plan to continue studies of Swainson's warbler in the Cave and Cedar creek area.

Methods

Land Use History

I used topographic maps, aerial photographs, wildlife opening maps, and records of clearcuts and plantations to identify areas in the Cave and Cedar creek area that may provide Swainson's warbler habitat as described by Meanley (1971) and Eddleman (1978). I copied clearcut and plantation information from records on file at the U. S Forest Service Station in Murphysboro, Illinois. While visiting the station I also looked at old photographs of the study area and discussed land-use history with Larry Burkhart, Murphysboro District Ranger. Aerial photographs were obtained from the Illinois Department of Transportation and are available for future surveys of the Cave and Cedar creek area.

Avian and Vegetation Surveys

After reviewing clearcut histories I discovered that almost no areas in the Cave and Cedar floodplains are in the 20- to 25-year-old successional stage identified as optimal habitat by Eddleman (1978). I therefore surveyed for Swainson's warblers in all flat, muddy floodplains of Cave and Cedar creeks that were not inundated during the severe spring and summer flooding of 1993 (Figure 1). Most areas surveyed were on alluvial soils and were located within large forested tracts and within 200m of streams, and included all territories located by Eddleman in the 1970's.

Ten survey routes were walked during 21 May through 12 June (Figure 1). Surveys began shortly after dawn and were completed by approximately noon, depending on the difficulty of gaining access to the floodplains. During these surveys I characterized plant and bird communities in sites containing a fairly dense shrub layer and at least some cane.

I assessed vegetation by looking for areas of moderate-to-dense shrub understory, and usually with at least some cane. In areas with relatively high shrub cover I noted approximate canopy closure, maximum canopy height, ground cover, shrub density, and dominant species in tree, shrub, and herbaceous strata. These characteristics were not measured quantitatively. Potentially suitable areas were marked on enlarged topograpjhic maps.

Bird communities were sampled in the areas with high shrub density using a 15-minute point count with 5- and 6-minute subtotals to allow comparisons with other sites in southern Illinois (S. K. Robinson, pers. comm.). Using the fixed-radius method (Hutto et al. 1986), compass direction and distance to bird were recorded for each bird observation. Avian species recorded within a 70 m radius on 30 point counts (Figure 1) at least 150 m apart in possible suitable habitats are compared with avian associates on Swainson's warbler territories listed by Eddleman (1978). Three of the 30 point counts were located at the 1992 Swainson's warbler territory, one in the middle of the territory and one each 150 m on either side of the territory (Figure 1). In suitable areas I also played a tape recording of the Swainson's warbler song.

The northwestern part of the Cedar Creek floodplain remained completely or partly indundated with waters backed up from the Big Muddy and Mississippi rivers throughout the summer. On 14 and 15 June, during a period of relatively low floodwater levels, I canoed this remaining section of Cedar Creek three times (Figure 1). Tapes of Swainson's warbler songs were played from the canoe in areas with dense shrub layers and cane growth (except where such sites were inundated). I was unable to evaluate vegetation communities in these areas because of the difficulty of viewing into the forest from the canoe and because the shrub layer was inundated.

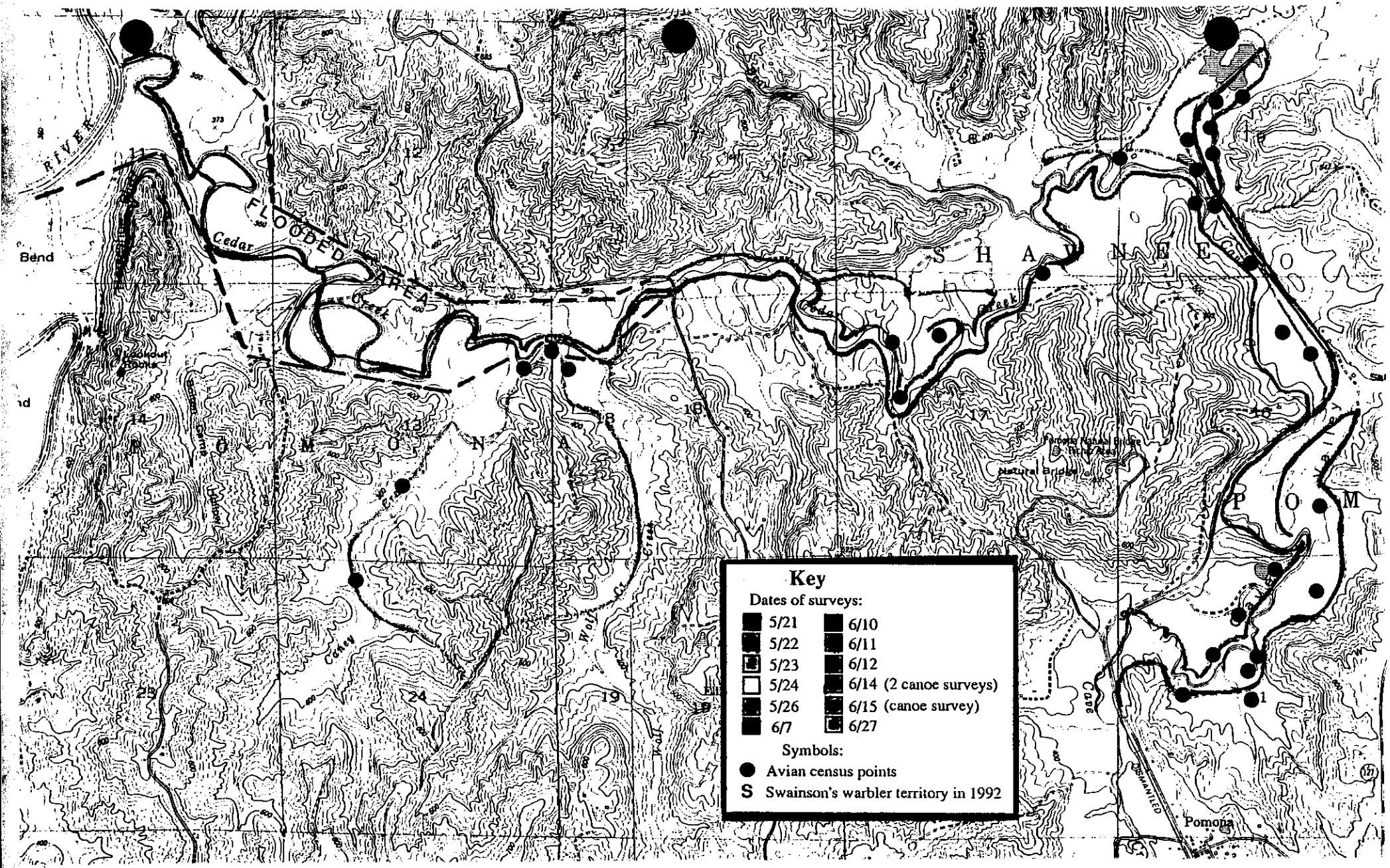

Figure 1. Routes surveyed for Swainson's warblers and Swainson's warbler habitat in 1993 in the Cave and Cedar creek area, Jackson County, Illinois.

Vegetation Sampling from 1992

To look at possible changes in plant communities since Eddleman's study I used vegetation data collected in 1992 in areas of former Swainson's Warbler territories. Though these analyses were performed for a different study, many of the vegetation plots lie within or near Eddleman's Swainson's warbler territories that were evaluated in 1976-77 (Figures 2 and 3). I have included some of these analyses in this report only as a means of viewing how successional stage in Swainson's warbler habitat may have changed since the warblers disappeared from their former nesting areas along Cave and Cedar creeks. The plots are not directly comparable because they were not in identical locations.

In 1992 I measured vegetation characteristics along Cave and Cedar creeks using the method of James and Shugart (1970), the same method used by Eddleman in 1976-77 to characterize vegetation on Swainson's warbler territories in these floodplains. Within a 0.04-hectare (0.1-acre) circle, species and size class of all trees (diameter at breast height [dbh] >7.5 cm [3 in]) were recorded. Percentage canopy cover, percentage ground cover, and composition of the shrub/sapling layer in the circle were evaluated by walking two perpendicular transects. Tree basal area, tree size class distribution, and tree and shrub density/ha can be quantified with this method.

I have also included the vegetation analysis performed in the area of the 1992 Swainson's warbler singing male on Cedar Creek (Figure 1; data from plot in Appendix A). This vegetation plot, again, was conducted for another study, but was located less than 25 m from the site where the male was first heard singing.

Avian Censuses from 1992

In 1992 S. K. Robinson and I evaluated bird communities on a transect along parts of Cave and Cedar creeks. These data are compared to avian species associates of Swainson's warblers cited by Eddleman (1978). Six census points from the 1992 transect fell within an area where four Swainson's warbler territories were concentrated in 1976 (Figure 4). Because Eddleman did not use a standard bird census method, the species associates can only be compared qualitatively.

Results

Swainson's Warbler Surveys and Point Counts

I found no Swainson's warblers in the Cave and Cedar creek areas searched in 1993. The area where the Swainson's warbler occupied a territory on Cedar Creek in 1992 remained inundated throughout the the usual settling period in May. When the area dried out in June I checked for Swainson's warblers nine times, but found none.

Forty-three bird species were recorded within a 70-m radius on the 30 point counts. The eight most abundant avian species and those recorded on at least 50% of points centered in areas of relatively high shrub density were acadian flycatcher, American redstart, indigo bunting, red-eyed vireo, northern cardinal, yellow-billed cuckoo, white-eyed vireo, and Kentucky warbler (Table 1).

Habitat Suitability

A review of U.S Forest Service records indicated that few areas in the Cave and Cedar creek floodplains would provide appropriate successional stages for Swainson's warblers as defined by Eddleman (1978) and Eddleman et al. (1980). Most clearcuts since Eddleman's study (Figures 5A

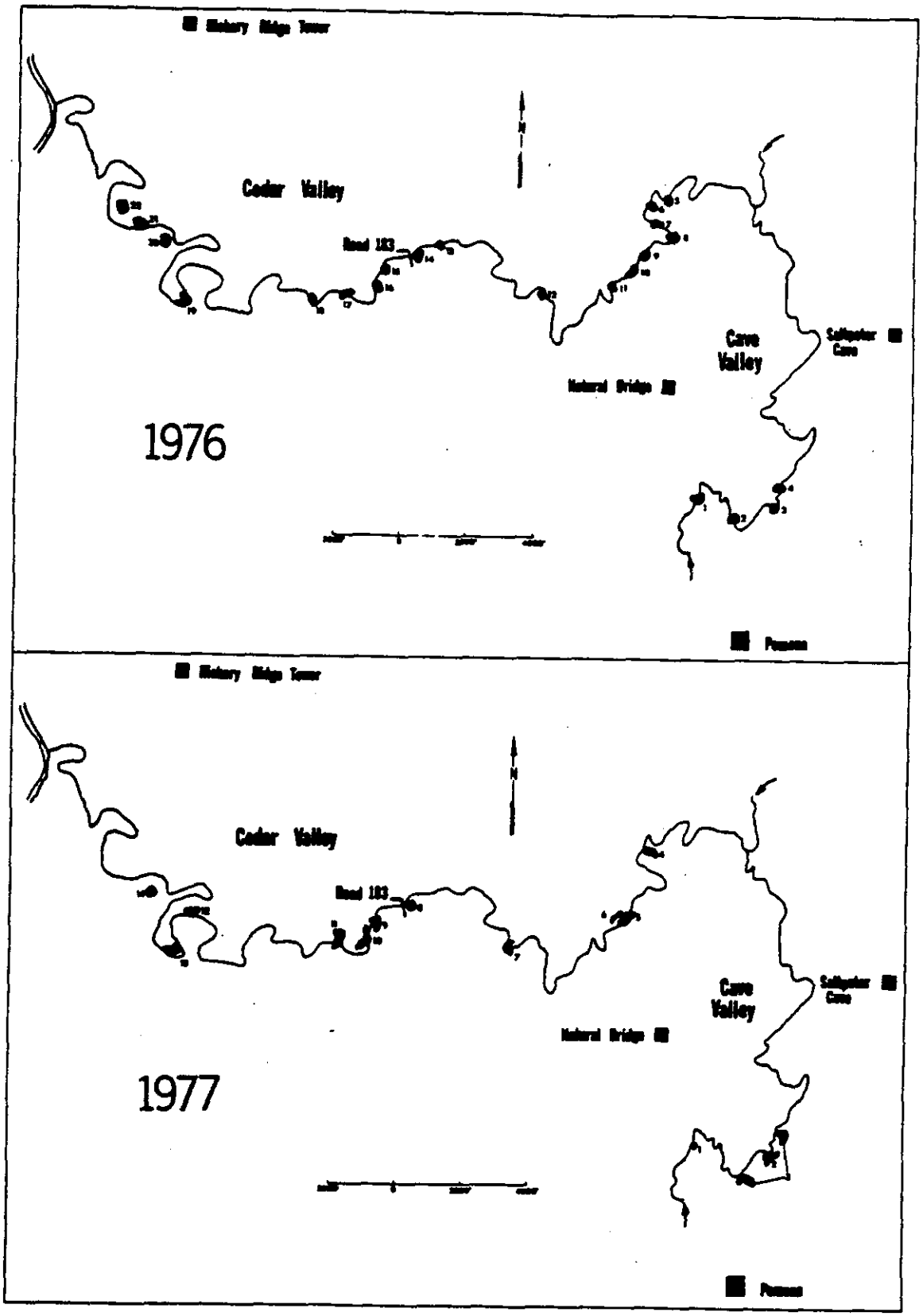

Figure 2. Locations of Swainson's warbler territories in 1976-77 on Cave and Cedar creeks, Jackson County, Illinois. Figure taken from Eddleman (1978), p. 32.

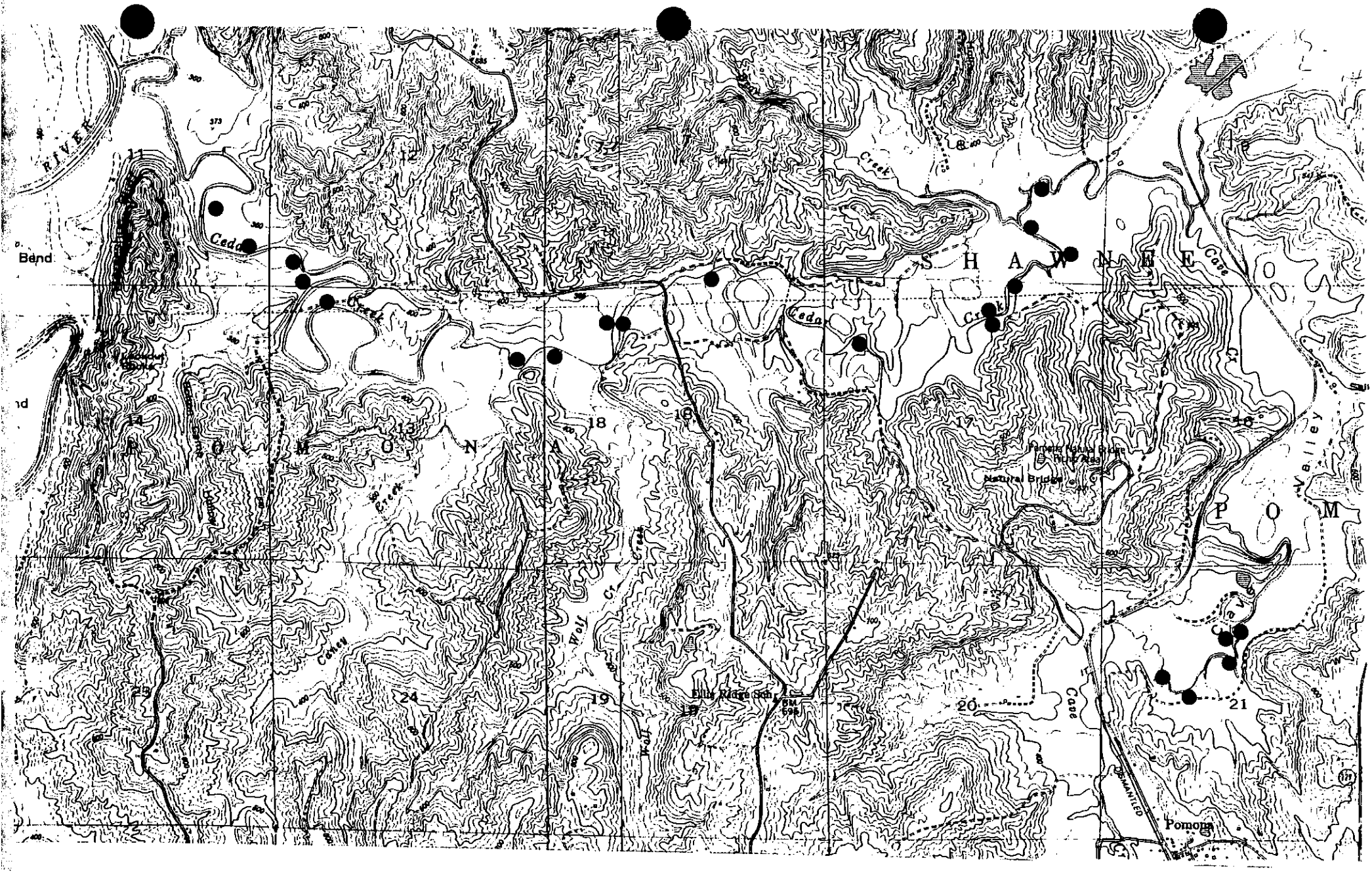

Figure 3. Locations of 22 1992 vegetation plots that approximately coincided with 1976-77 Swainson's warbler territories along Cave and Cedar creeks, Jackson County, Illinois.

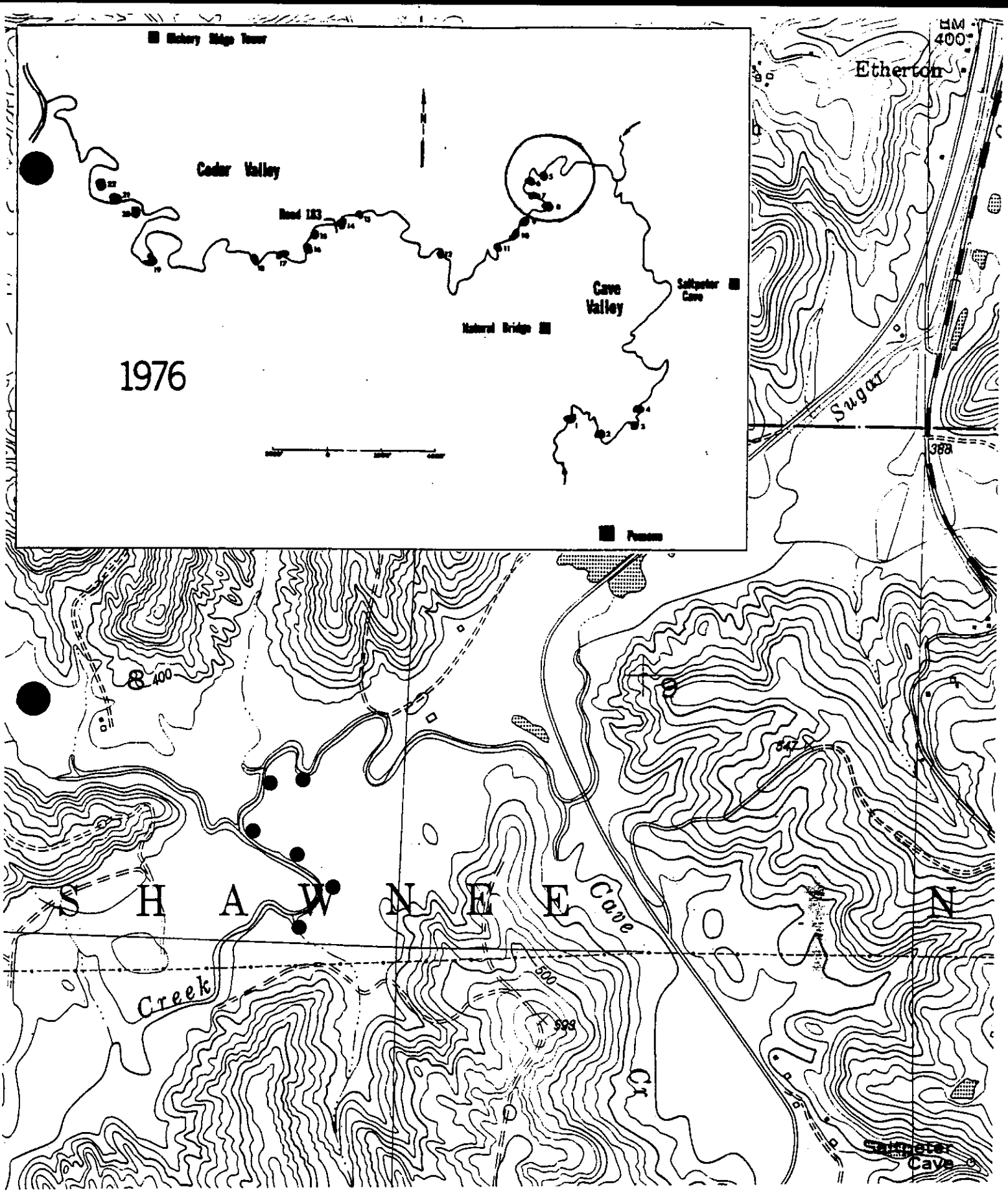

Figure 4. Six avian census points (blue dots) surveyed in an area where four Swainson's warbler territories were concentrated in 1976 on Cedar Creek, Jackson County, Illinois. Figure inset from Eddleman (1978), p. 32.

Table 1. Species recorded within 70 m of observer on 30 point counts (each point separated by at least 150 m) along Cave and Cedar creeks, Jackson County, Illinois.

Species	Number recorded	Number of points	Percentage of points	Mean number of birds/point
Wild turkey	1	1	3.3	0.03
Mourning dove	1	1	3.3	0.03
Yellow-billed cuckoo	19	16	53.3	0.63
Ruby-throated hummingbird	1	1	3.3	0.03
Red-headed woodpecker	4	4	13.3	0.13
Red-bellied woodpecker	12	11	36.7	0.40
Downy woodpecker	4	2	6.7	0.13
Hairy woodpecker	1	1	3.3	0.03
Pileated woodpecker	6	5	16.7	0.20
Eastern wood pewee	8	7	23.3	0.27
Acadian flycatcher	47	25	83.3	1.57
Willow flycatcher	1	1	3.3	0.03
Great crested flycatcher	7	6	2.0	0.23
Blue jay	1	1	3.3	0.03
Carolina chickadee	9	8	2.7	0.30
Tufted titmouse	20	13	43.3	0.67
White-breasted nuthatch	5	5	16.7	0.17
Carolina wren	14	12	40.0	0.47
Blue-gray gnatcatcher	12	11	36.7	0.40
Swainson's thrush	1	1	3.3	0.03
Wood thrush	2	2	6.7	0.07
White-eyed vireo	23	15	50.0	0.77
Yellow-throated vireo	2	2	6.7	0.07
Red-eyed vireo	29	19	63.3	0.97
Blue-winged warbler	4	3	10.0	0.13
Northern parula	12	10	33.3	0.40
Yellow-throated warbler	9	8	26.7	0.30
Cerulean warbler	19	14	46.7	0.63
American redstart	42	23	76.7	1.40
Prothonotary warbler	15	10	33.3	0.50
Ovenbird	1	1	3.3	0.03
Louisiana waterthrush	9	9	30.0	0.30
Kentucky warbler	20	15	50.0	0.67
Common yellowthroat	22	14	46.7	0.73
Yellow-breasted chat	7	7	23.3	0.23
Summer tanager	2	2	6.7	0.07
Northern cardinal	24	17	56.7	0.80
Rose-breasted grosbeak	1	1	3.3	0.03
Indigo bunting	39	23	76.7	1.30
Rufous-sided towhee	1	1	3.3	0.03
Brown-headed cowbird	14	11	36.7	0.47
Nothern oriole	1	1	3.3	0.03
American goldfinch	1	1	3.3	0.03

and B) are in uplands or are too recent to have enough overstory to provide the ample shading preferred by this warbler. Cleared land that is privately owned generally has remained cleared. Two sweetgum plantations planted in 1971 that appear to reach into the floodplain may be in a suitable successional stage, but could not be checked because of flooding (Figure 6A). Generally, other sweetgum plantations are too old (Figures 6A and B).

Two clearcuts appeared to be in the correct successional stage for Swainson's warblers (Figure 5B: clearcut A and B). One located just northwest of Pomona was cut in 1969 and the other located northeast of the intersection of Cave and Cedar creeks was cut in 1973. Both areas contained denser growths of cane than found in other areas of Cave and Cedar creeks, but only along the edges.

The 1969 clearcut contained areas of mixed dense shrub undergrowth composed of giant cane, spicebush, paw paw, greenbrier, and grape. Cane reached more than 10 ft, but was mostly 6-8 ft tall. In the denser shrub areas main overstory trees were boxelder, with some American elm, ash, and hackberry. Maximum canopy height in these areas was 50-60 ft. and the canopy contained some openings, but was mostly closed. Ground cover was often sparse where shrub density was high and bare leafy areas preferred by Swainson's warblers for foraging were present. An active golden mouse nest was found in a cane stalk in this area. Dense shrub thickets are preferred habitat for this species (Herkert 1992) and Eddleman (1978) noted that it is associated with cane stands.

A very dense, but not extensive giant cane stand was found next to the 1973 clearcut area. This area was very dark with a closed canopy no taller than 21 m (70 ft). Cane height ranged from 0.9-3 m (3-10 ft) tall, and most was tall. Main overstory trees were boxelder, ash, and locust. The cane stand extended approximately 200 m along a wet ditch of the former railroad bed, but the stand was only approximately 25 m wide. A swamp was located across the railroad bed from this area.

Another area apparently not associated with a cut also contained more dense shrub and cane growth than generally found in the Cave and Cedar area (Figure 7: Area A). In this area canopy trees reached approximately 27 m (90 ft) and the canopy contained openings. Dense cane was concentrated at the edge of Cedar Creek and grew to 4.5 m (15 ft) tall. In other parts of this peninsular area cane was shorter and mixed with other shrub vegetation such as spicebush, blackberry, boxelder saplings, and vines. Some areas contained thick undergrowth but no cane. Other areas located during surveys that contained moderate-to-dense canestands (though small in size) or thicker shrub understories are shown in Figure 7.

I found few other areas that appeared to satisfy the Swainson's warbler habitat requirements described by Meanley (1971), Eddleman (1978), and others. Most areas seemed unsuitable mainly because they lacked dense shrub layer undergrowth. Giant cane stands were uncommon and small and usually were present as very narrow strips along the disturbed riparian zone of the creeks. Thinly scattered cane was present throughout the forest, especially in the floodplains.

Clearcuts of the late 1970's and 1980's may provide Swainson's warbler habitat within the next ten years. The 1985 clearcut located just northeast of Pomona on Cave Creek (Figure 5B: Area C) contains a dense growth of giant cane along the riparian edge. A 1987 clearcut along the northern bank of Cedar Creek also contains some stands of giant cane along the creek edge (Figure 5B: Area D).

I also looked for cane growth in U.S. Forest Service/Illinois Department of Conservation wildlife openings within the creek floodplains. If cane was present in these openings, it generally grew only in a narrow strip at the edge of the opening.

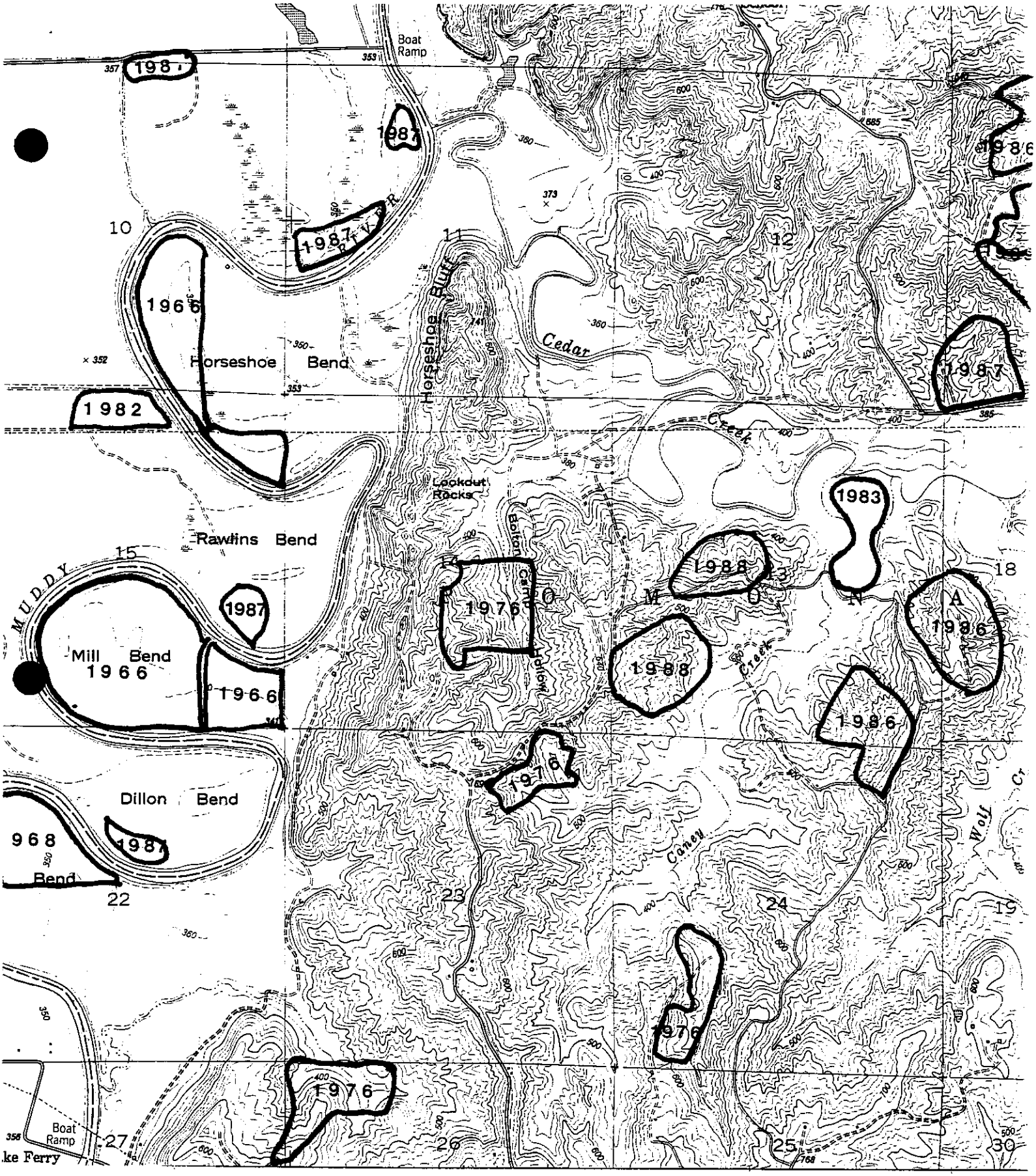

Figure 5A. Clearcuts (delineated in red) and intermediate cuts (delineated in blue) in the northwestern part of the Cave and Cedar creek study area, Jackson County, Illinois.

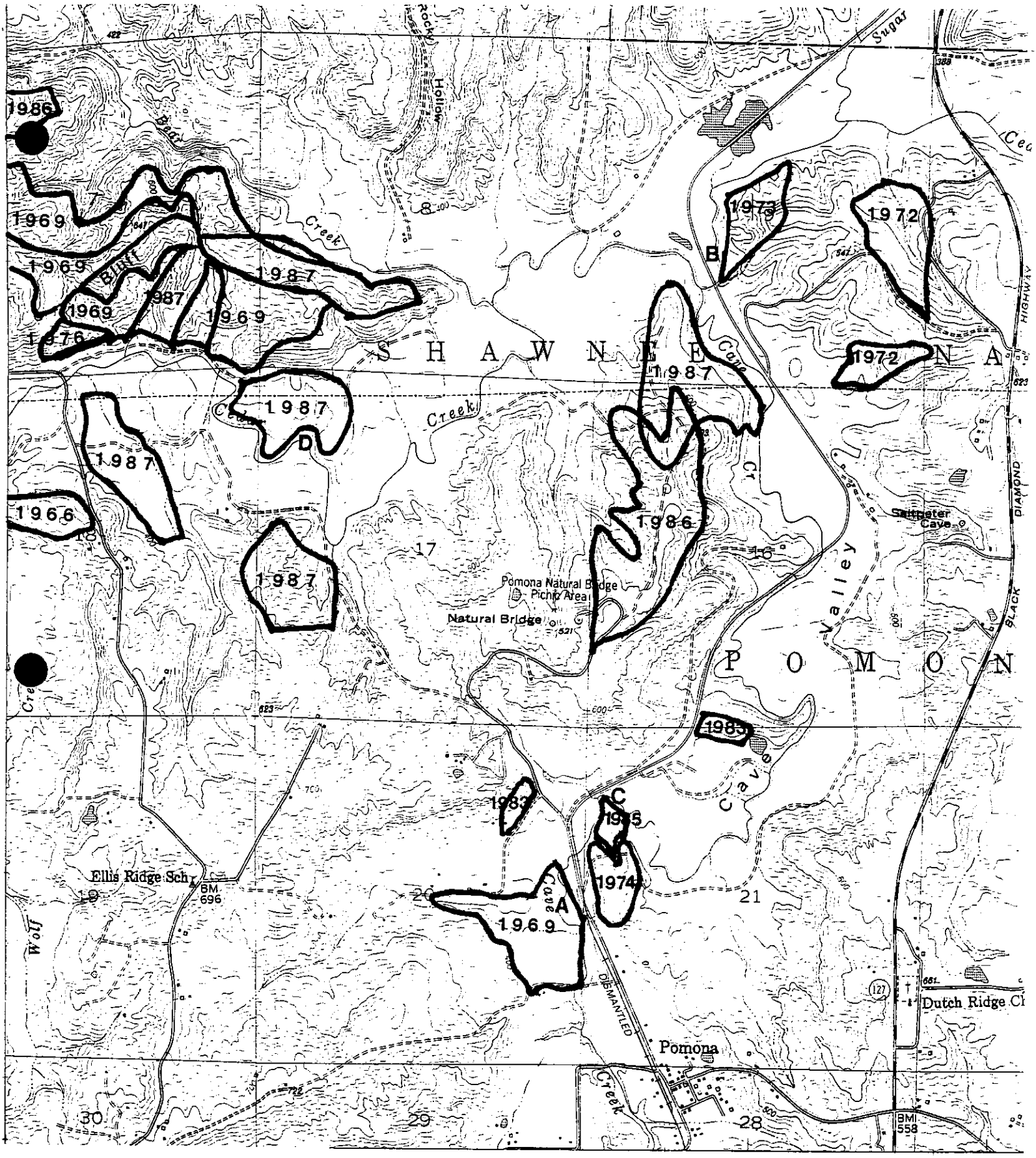

Figure 5B. Clearcuts (delineated in red) and intermediate cuts (delineated in blue) in the southeastern part of the Cave and Cedar creek study area, Jackson County, Illinois. Areas A and B are clearcuts where cane growth was found.

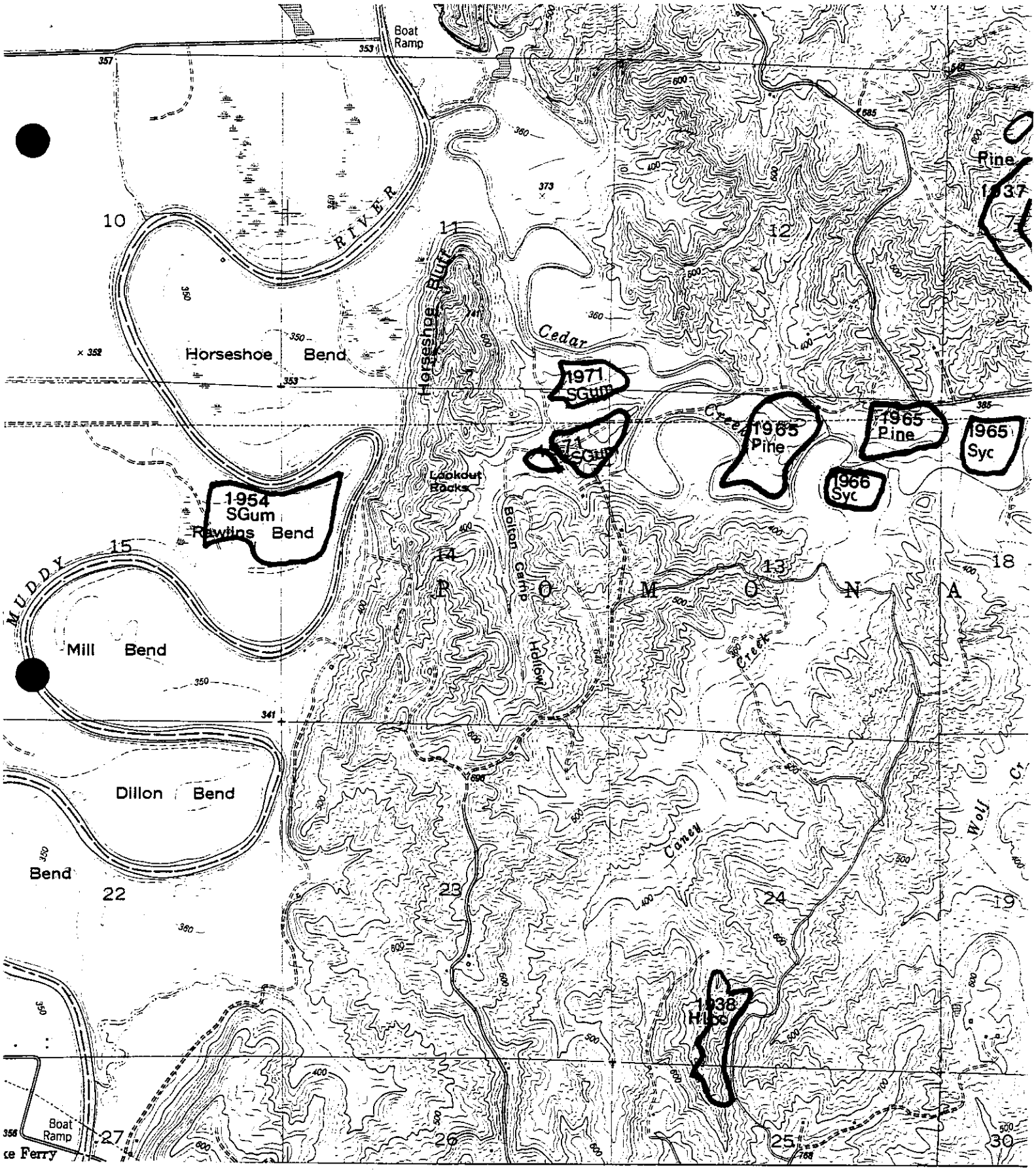

Figure 6A. Plantations in the northwestern part of the Cave and Cedar creek study area, Jackson County, Illinois.

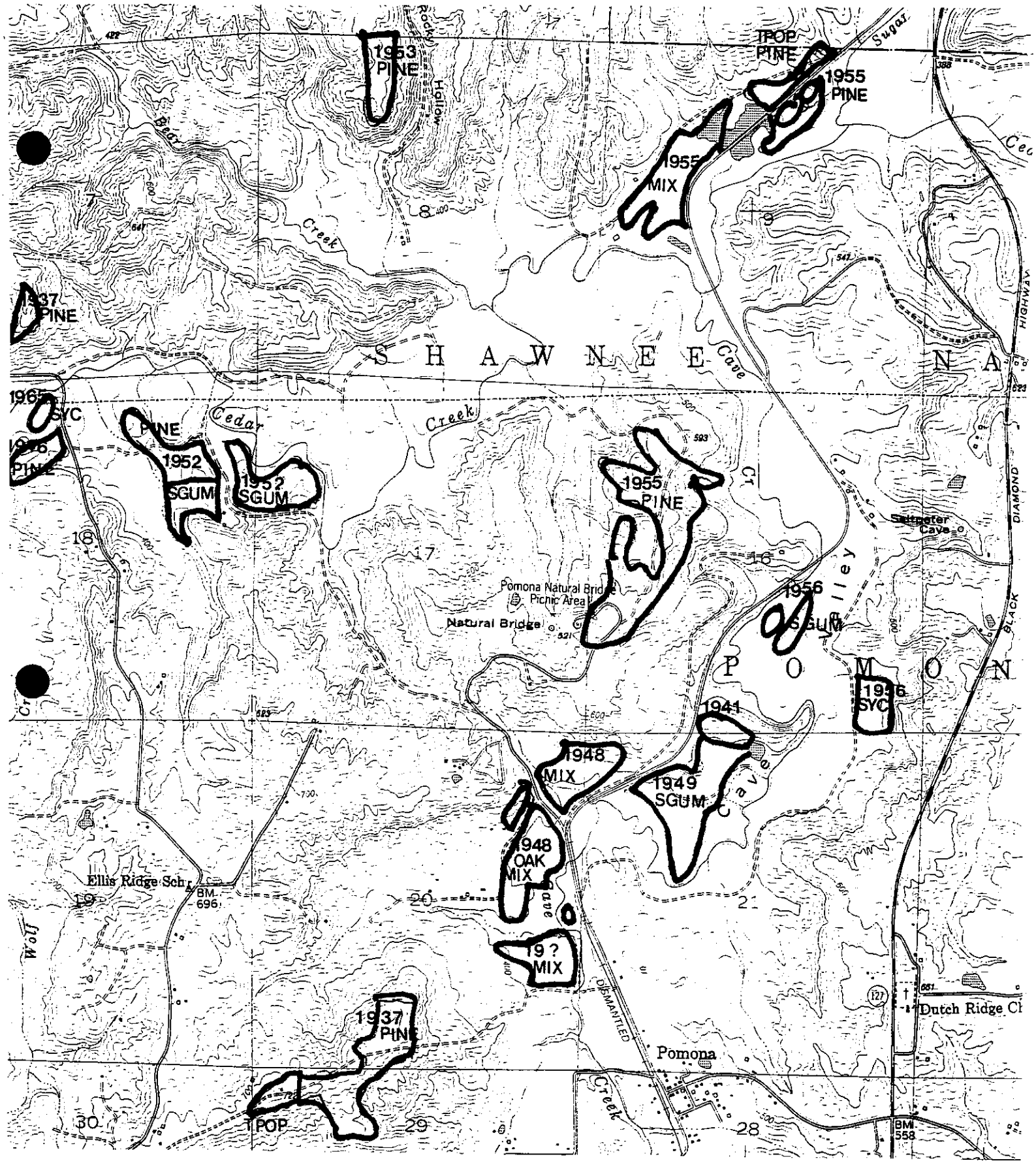

Figure 6B. Plantations in the southeastern part of the Cave and Cedar creek study area, Jackson County, Illinois.

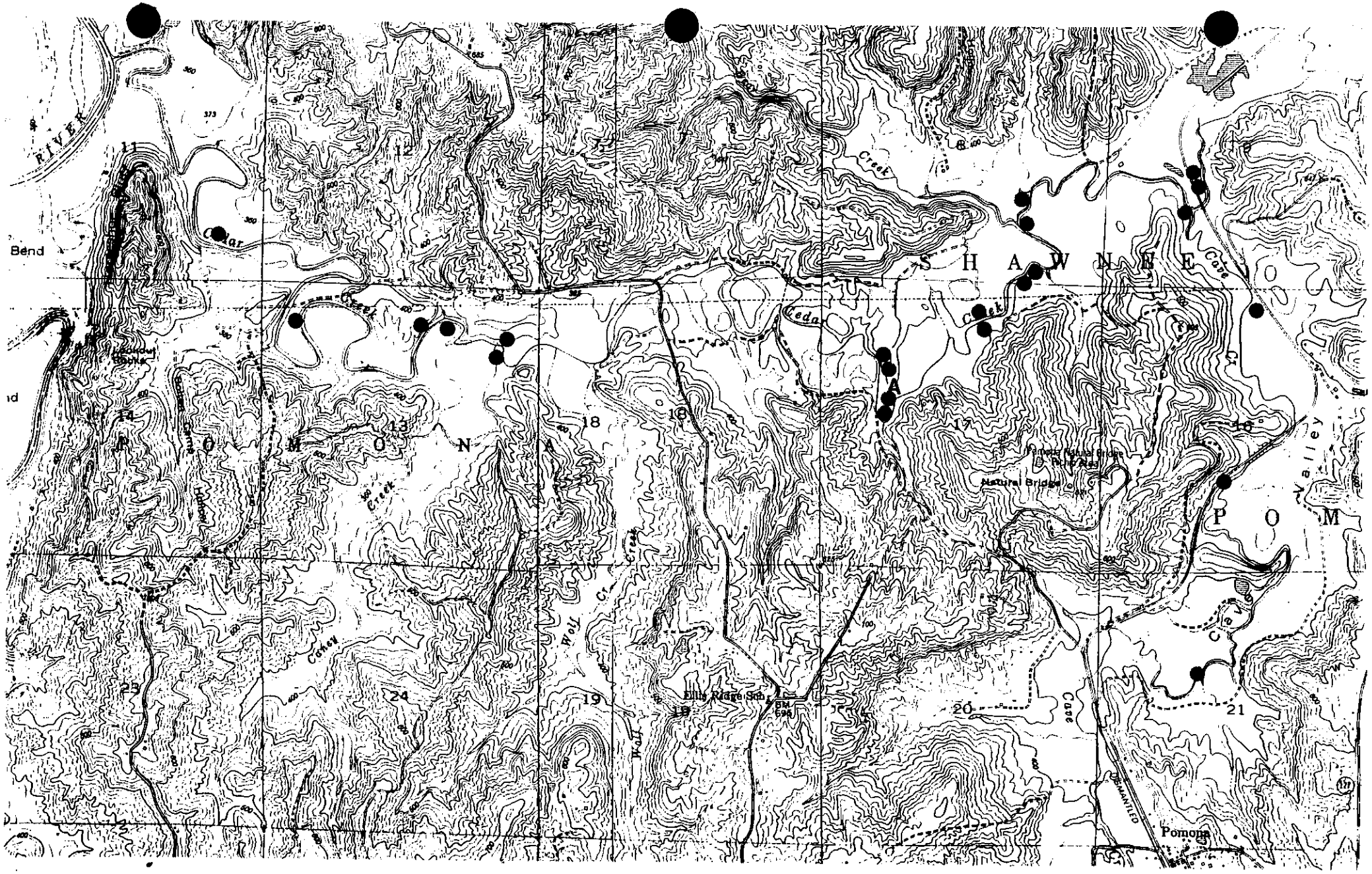

Figure 7. Areas with moderate or dense cane growth found during 1993 surveys (red dots). Area A contained high shrub and cane density. Green dots indicate 1992 vegetation plots with more than 5,000 stems/ha giant cane in the Cave and Cedar creek area, Jackson County, Illinois.

Avian Species Associates on Swainson's Warbler Territories: 1976-77 vs. 1992

Twenty-four bird species were recorded on six point counts in an area where four Swainson's warbler territories were concentrated in 1976 (Table 2). The American redstart was the most abundant species in this area. Also fairly common were acadian flycatcher, northern cardinal, cerulean warbler, and red-eyed vireo (Table 2).

Vegetation on Swainson's Warbler Territories: 1976-77 vs. 1992

In 1992, percentage canopy cover was greater than in 1976-77, maximum canopy height was higher, and the frequency distribution of tree size classes was shifted toward larger size classes on former Swainson's warbler territories (Tables 3 and 4). Shrub density in the 1992 plots was much lower than in 1976-77. Average shrub stem density/ha on the 1992 plots was only 6,670--Eddleman (1978) considered 5,000 shrub stems/ha to be a minimum requirement for Swainson's Warblers. The 1976-77 plots were heavily dominated by cane, whereas only 6 plots of 22 in 1992 contained more than 1,250 cane stems/ha.

Vegetation Analysis and Avian Species Associates on 1992 Swainson's Warbler Territory

On a vegetation analysis plot (Appendix A) located next to the area where a singing male Swainson's warbler was found in 1992, shrub density was measured at 7,375 stems/ha; the shrub layer was composed mainly of spicebush (4,375 stems/ha) and giant cane (2,000 stems/ha). Trees on this plot were more mature than generally found on Eddleman's plots (G. Vanderah, unpubl. data).

Twenty species were recorded within a 70 m radius of three census points centered in and near the 1992 Swainson's warbler territory (Table 5). The most abundant bird species in this area in 1993 was the acadian flycatcher, followed by indigo bunting and northern cardinal. Also fairly abundant were American redstart, blue-gray gnatcatcher, downy woodpecker, red-eyed vireo, and white-eyed vireo.

Discussion

In 1993 Swainson's Warblers appeared to be extirpated from the Cave and Cedar creek area. Possibly the extensive and prolonged flooding of northwestern Cedar Creek prevented the 1992 territory from being occupied again this year. Northwestern Cedar Creek should be surveyed again for Swainson's warblers and suitable habitat when the floodplains are not flooded.

Principal avian species associates in Swainson's warbler territories during Eddleman's study were American redstart, white-eyed vireo, acadian flycatcher, northern cardinal, prothonotary warbler, and Kentucky warbler (Eddleman 1978). In 1992 on censuses in the area where four Swainson's warbler territories were concentrated, the American redstart was the most abundant species and the acadian flycatcher, indigo bunting, northern cardinal, cerulean warbler, and red-eyed vireo also were common (Table 1). Three of the most abundant species (American redstart, acadian flycatcher, northern cardinal) were similar between studies, but in 1992 bird species associated with more mature forest (cerulean warbler, red-eyed vireo) also were quite common in and near these former Swainson's warbler territories. The most abundant bird species on the 30 point counts in areas of more dense undergrowth in the Cave and Cedar floodplains were mostly second-growth and edge species. Some mature forest bird species such as the red-eyed vireo were

Table 2. Species recorded within 70 m of observer on 6 point counts (each point separated by at least 150 m) in former (1976) Swainson's Warbler habitat on Cedar Creek, Jackson County, Illinois.

Species	Number recorded	Number of points	Mean number of birds/point
Yellow-billed cuckoo	2	2	0.33
Ruby-throated hummingbird	2	2	0.33
Red-bellied woodpecker	1	1	0.17
Downy woodpecker	3	3	0.50
Eastern wood pewee	3	2	0.33
Acadian flycatcher	8	6	1.00
Tufted titmouse	4	2	0.33
White-breasted nuthatch	3	3	0.50
Carolina wren	1	1	0.17
Blue-gray gnatcatcher	2	2	0.33
Gray-cheeked thrush	1	1	0.17
White-eyed vireo	2	1	0.17
Red-eyed vireo	7	4	0.67
Northern parula	3	3	0.50
Cerulean warbler	7	5	0.83
American redstart	16	6	1.00
Prothonotary warbler	1	1	0.17
Louisiana waterthrush	3	3	0.50
Kentucky warbler	3	3	0.50
Common yellowthroat	4	4	0.67
Summer tatnager	1	1	0.17
Northern cardinal	7	5	0.83
Indigo bunting	5	5	0.83
Brown-headed cowbird	4	3	0.50

Table 3. Canopy conditions in 1976-77 (53 plots) vs. 1992 (22 plots), Cave and Cedar creeks, Jackson County, Illinois.

	1976-77 Vegetation Plots*		**1992 Vegetation Plots**	
	Mean	Range	Mean	Range
Maximum canopy height (m)	17.0	7.6-29.7	28.3	22.5-30.0
Percentage canopy cover	80.2	55.0-100.0	90.2	70-100

* Data from Eddleman 1978, p.41

Table 4. Size class distributions of vegetative overstory in 1976-77 (53 plots) vs. 1992 (22 plots), Cave and Cedar creeks, Jackson County, Illinois.

	1976-77 Vegetation Plots*		1992 Vegetation Plots	
Size class (cm dbh)	Stems/ha	Overstory stems (%)	Stems/ha	Overstory stems (%)
A 8-15	563.2	54.9	280.7	38.0
B 15-23	239.5	23.3	145.5	19.7
C 23-38	114.2	11.1	159.1	21.5
D 38-53	65.5	6.4	80.7	10.9
E 53-69	28.0	2.7	45.5	6.1
F 69-84	10.0	1.0	20.5	2.8
G 84-102	4.5	0.4	5.7	0.8
H > 102	0.5	0.05	1.1	0.1
	1025.7	100.00	738.8	100.0

* Data from Eddleman 1978, p.37

Table 5. Species recorded within 70 m of observer on 3 point counts (each point separated by at least 150 m) on and next to 1992 Swainson's warbler territory on Cedar Creek, Jackson County, Illinois.

Species	Number recorded	Number of points	Mean number of birds/point
Yellow-billed cuckoo	1	1	0.33
Red-headed woodpecker	2	2	0.67
Downy woodpecker	4	2	0.67
Eastern wood pewee	1	1	0.33
Acadian flycatcher	6	3	1.00
Carolina chickadee	3	2	0.67
Tufted titmouse	3	2	0.67
Carolina wren	2	2	0.67
Blue-gray gnatcatcher	4	3	1.00
Wood thrush	1	1	0.33
White-eyed vireo	4	3	1.00
Red-eyed vireo	4	2	0.67
Northern parula	1	1	0.33
Yellow-throated warbler	1	1	0.33
Cerulean warbler	1	1	0.33
American redstart	4	2	0.67
Prothonotary warbler	3	2	0.67
Kentucky warbler	1	1	0.33
Northern cardinal	5	3	1.00
Indigo bunting	5	3	1.00

somewhat common in these areas also. Possibly these mixes of second-growth and mature forest bird species simply confirmed that the successional stage of much of the Cave and Cedar creek area was more mature than it was in the mid-1970's, but that shrubs were still dense enough to provide habitat for second-growth bird species. .

The three most common bird species (acadian flycatcher, northern cardinal, indigo bunting) on and near the 1992 Swainson's warbler territory were similar to the common species on territories in 1976-77. In 1992, however, several cerulean warblers, which prefer tall tree habitats, were singing in and near this territory. Use of avian species associates may not be an appropriate method of predicting the presence or absence of Swainson's warblers or of viewing the suitability of Swainson's warbler habitat.

Comparisons of vegetation data from Eddleman's study and the 1992 study indicate that, as expected, during the 15 years between the two studies the forest vegetation has continued to undergo succession. Vegetation succession in Cave and Cedar valleys in the mid-seventies may have been at an optimal stage for Swainson's warblers in the mid-seventies. In the late 1930's large areas of the floodplains were in agricultural use (Appendix 2). These same areas are shown on Eddleman's map of 1947 clearings, which he associated with canebrakes (Figure 8). Apparently much of this cleared land became part of the Shawnee National Forest in the 1950's (Eddleman 1978) and grew back into forest. In the mid-seventies the formerly cleared areas would have been 20- to 25-years-old forests. The two areas checked in 1993 within this range of succession (1969 and 1973 clearcuts) did contain higher densities of cane and shrub growth.

The vegetation analysis plot located next to the area where a singing male Swainson's warbler was found in 1992 did not contain the high shrub density described by Eddleman (1978). Eddleman's vegetation plots, however, were centered on song perches, which were usually in the part of the territory with the highest shrub density (Eddleman 1978). Even so, the presence of this bird in a more mature and less dense habitat could indicate that Swainson's warblers can tolerate later successional stages and areas with less cane than found on territories during Eddleman's study.

During the 15 years since Eddleman's study, populations of both Swainson's warblers and giant cane apparently have declined significantly in the Cave and Cedar creek area. Whether the loss of cane is responsible for the loss of Swainson's warblers is difficult to determine. Hamel (1980) found Swainson's Warblers commonly in the Coastal Plain in habitats without canebrakes. All researchers, however, agree that this warbler requires a dense understory for nesting. Shrub density also may have declined in the Cave and Cedar floodplains. Most of my vegetation plots had much lower shrub densities than did Eddleman's. Before decreased shrub density is verified, however, more precise attempts should be made to compare former Swainson's Warbler plots with current conditions.

The loss of large cane stands in Cave and Cedar valleys could have resulted from a combination of factors. The decline of cane in Cave and Cedar valleys was evident during Eddleman's study, when most cane was killed back during the 1976-77 winter. A series of severe winters might significantly affect this species, which exists in Jackson County near the northern limit of its range. Hughes (1957) found that cane stands in North Carolina become decadent after ten years of being left undisturbed. Whether this was caused by competition from other vegetation or disease was unclear. Cane commonly may die off in patches as a result of disease or after flowering (Hughes 1957). Cane also is susceptible to grazing (Hughes 1957). Whether deer grazing affects cane in the Cave and Cedar area is unknown.

Hamel (1980) stated that Swainson's warblers may nest in clearcuts after 10-20 years. Ten-to-fifteen-year-old clearcuts in the study area are impenatrable thickets with no overstory. Swainson's Warblers were never heard at the edges of these inacessable areas. During the next ten

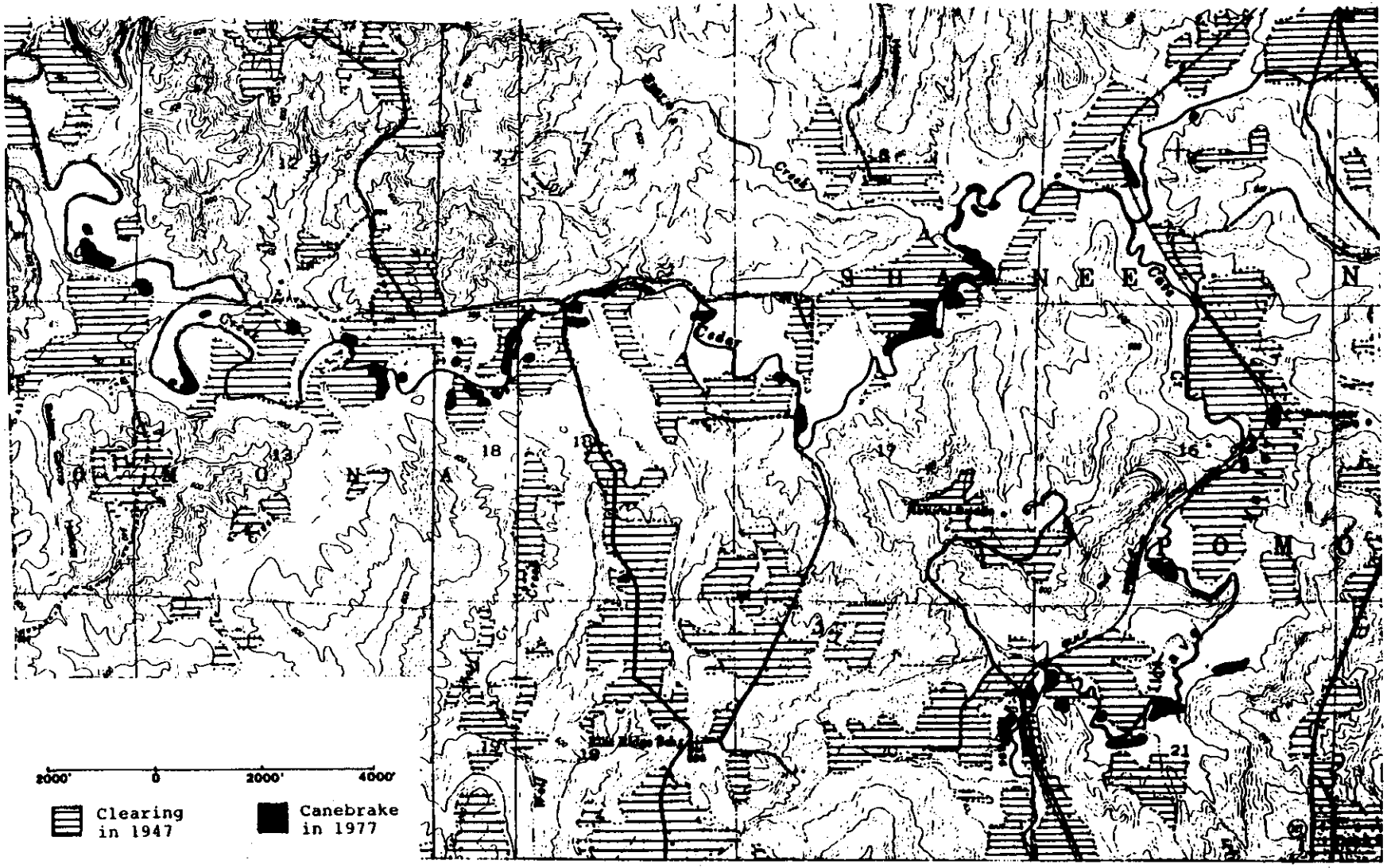

Figure 8. Clearings in 1947 and canebrakes in 1977 in the Cave and Cedar creek area, Jackson County, Illinois. Figure taken from Eddleman (1978), p. 46.

years, however, areas cleared in the 1980's in the Cave and Cedar floodplains may provide suitable habitat for Swainson's warbler.

Though large canestands were not found in wildlife openings, these openings could provide suitable Swainson's warbler habitat if they are allowed to close. The usual management prescription for wildlife openings may remove any cane that was present in these openings. The openings have been maintained on a 3-year cycle of disc-tilling and seeding (1st year), mowing (2nd year), and setting aside (3rd year) (L. Burkhart, U. S. Forest Service, pers. comm.). Eddleman (1978) noted that agricultural practices may destroy canestands. According to new Forest Service plans, however, the wildlife openings in the Cave and Cedar creek area no longer will be opened or maintained and could provide potential habitat for Swainson's warblers in 15-25 years.

Hamel (1980) noted that dense understory habitat for Swainson's warbler is created following disturbances to canopy trees. Tree loss during and after the severe flooding in 1993 potentially may improve habitat for Swainson's warblers along Cave and Cedar Creeks. Areas shown in Figure 1 that were flooded for long periods in 1993 may provide suitable Swainson's warbler habitat if the canopy becomes more open.

Conclusions and Recommendations

1. Cave and Cedar creeks currently have few areas with vegetation structure similar to areas where Eddleman found Swainson's warblers in 1976-77 because of succession, cane die-back and, possibly, cutting.

2. If clearcuts create suitable habitat, then Cave and Cedar creeks have several clearcuts that should provide appropriate habitat over the next 10-20 years (Figures 5A and B).

3. These clearcut areas should be monitored annually using the maps as guides to record cane regrowth (using simple James and Shugart [1970] methods) and to check for presence of Swainson's warblers.

4. Experimental cane plantings might be tried in some areas.

5. Clearcutting should not be used as a management method until it is determined if the Swainson's warbler recolonizes the existing clearcuts as they reach the appropriate age.

6. Damage from the flood of 1993 should also be monitored for cane growth and Swainson's warblers as a possible "natural" area of regrowth.

7. Areas with healthy cane (Figure 7) should be checked annually.

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Appendix A. Vegetation analysis summary sheet from 1992 Swainson's warbler territory.

B86T-Swainson's warbler

Circle#:	B86T									Trees/	Rel.den.	Basal area									
	Number of trees: Density									ha	by spp.	0.1	0.3	0.8	1.8	3.1	4.9	7.1	9.5	Basal	Rel.
SPECIES	A	B	C	D	E	F	G	H	Total			A	B	C	D	E	F	G	H	area	dom.
Dead			1						1	25	5.26316	0	0	0.8	0	0	0	0	0	0.8	2.38806
Box elder	2	1	3	1	1				8	200	42.1053	0.2	0.3	2.4	1.8	3.1	0	0	0	7.8	23.2836
Hackberry				2	1				3	75	15.7895	0	0	0	3.6	3.1	0	0	0	6.7	20
Silver maple	1	1			1	1			4	100	21.0526	0.1	0.3	0	0	3.1	4.9	0	0	8.4	25.0746
Sycamore				1	1	1			3	75	15.7895	0	0	0	1.8	3.1	4.9	0	0	9.8	29.2537
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	3	2	4	4	4	2	0	0	19	475	100	0.3	0.6	3.2	7.2	12.4	9.8	0	0	33.5	100
Trees/ha:	75	50	100	100	100	50	0	0	Basal area by s.c.:			7.5	15	80	180	310	245	0	0		
Rel. density:	15.79	10.53	21.05	21.05	21.05	10.53	0	0	Rel. basal area by s.c.:			0.9	1.79	9.55	21.5	37	29.3	0	0		
Logfalls:	snag- 1C; 1 old B, 1 old E																				
Shrubs:	No.:	59	Stems/ha:		7375	spicebush: 4375 stems/ha				Cane:2000 stems/ha											
Ground cov:	No.:	13	%ground cover:		65																
Canopy cov:	No.:	17	%canopy cover:		85	2 on stream bank															
Canopy ht:	Max:	25.5-28.5 m																			
Distances:	stream 10m,clearcut edge																				
NOTES	% Slope:		0		beaver damage on trees																

Appendix B. Photographs of some parts of the Cedar and Cave creek area taken in 1937.

BGU-3

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