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VEGETATION COMPOSITION AND COVER AT SUNNYHILL FARM

by

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INTRODUCTION

This is a report summarizing analysis of vegetation dynamics on the Sunnyhill Farm, located in southeastern Marion County, on the western edge of the Ocala National Forest (see Figure 1). The property was purchased by the St. Johns River Water Management District (the District) for the purposes of restoring wetland ecosystems on lands that had been converted to agricultural uses around the turn of the century.

The purpose of this vegetation study was to document natural recruitment and successional patterns over the site and relate environmental variables (soil types, hydrology) with vegetation and succession. The idea was to broadly characterize vegetation and successional patterns and to determine recruitment over the entire site. As a result, the study was organized to collect field data at a scale and frequency to determine overall patterns of change. Soil survey data were used to assist in surmising historic vegetation patterns, while trends in successional patterns and relationships to depths and periods of inundation will help determine management strategies for "reclamation" of the wetland communities of the site.

Description of the Study Site

The study site is approximately 1580 hectares (3900 acres), divided into 6 fields separated by a network of drainage canals and roads (see Figure 2). Fields have been numbered separately to facilitate discussions.

Historic Hydrology

The agricultural fields, which comprise the majority of the Sunnyhill Farm site, were at one time in the floodplain of the Oklawaha River, and were subject to flood inundation, probably on an annual basis. Initial work on the channelization of the river and subsequent conversion of the wetlands associated with the old floodplain into agricultural uses occurred in the 1920s. The canal and levees were substantially reworked and "improved" in the late 1960s and early 1970s, as part of the Four River Basins Project (D. Walker, District Field Program Manager, personal communication). Interpreted from 1940 aerial photography where remnants of the old river channel were still visible, the map in Figure 3 gives an indication of the location of the Oklawaha River channel prior to the construction of the downstream (north) dam at Moss Bluff and channelization of the river along the western boundary of the site.

Recent Hydrology

Sunnyhill Farm was extensively ditched and cross ditched for purposes of water control, especially during summer wet seasons. Several pumps were used at various points within the site for the movement of water, since the minor topographic relief of the tract precluded gravity flows.

Since the Oklawaha River was channelized, the site has been entirely removed from the effects of its floodwaters, and receives water inputs from rainfall, and groundwater seepage and overland flow from the surrounding lands. The drainage area associated with the site is thus substantially reduced from its historic patterns. A 2-foot-diameter culvert in the canal dike by the southwest corner of the site is the only connection with the canal, and is an additional source of water available to the site.

Soils

A map of soil types as classified by the Soil Conservation Service (SCS) is given in Figure 4. This map shows the site to be dominated by the soil series Everglades Muck in the southern areas (fields 1-5) and Iberia Clay throughout the northern areas (field 6). Both of these soil types are classified by the SCS as hydric soils (Hurt, 1986).

Everglades Muck is a flat, poorly drained soil that is frequently flooded, and has a deep organic layer--this latter characteristic making it attractive for drainage and conversion to agricultural uses. The native vegetation of Everglades Muck "consists of thick stands of sawgrass in some areas and willow, loblolly pine, bay, buttonbush, and maidencane in others" (Aydelott et al. 1975, p. 14).

Iberia Clay is also level, poorly drained, and frequently flooded. In contrast to Everglades Muck, however, Iberia Clay is dominated by clays of very low permeability, and are thus of less agricultural value. "Natural vegetation consists of sweetgum, hickory, hornbeam, magnolia, cabbage palm, wild grape, smilax, and poison-ivy" (Aydelott et al. 1975, p. 15).

Historic Vegetation Patterns

Vegetation patterns of adjacent areas along the river that had not been disturbed are apparent from the 1940 aerial photography. Interpretation of the photography for these adjacent areas and use of soils as indicators of past vegetation suggested that the old river channel was dominated by mixed hardwood swamps in the northern portion of the site and open expanses of marsh in the southern portion. Hypothesized vegetation cover, based on the soils map of the site and interpretation of the 1940 photography, is shown in Figure 3. The marshes appear to be dominated by saw grass (*Cladium jamaicense*), although the quality and scale of photography is such that confirmation is difficult. Vegetation community types shown in Figure 3 are combinations of classification systems used by the Florida Department of Transportation (FDOT 1985) and the Center for Wetlands and Water Resources (Brown and Starnes 1983), using native vegetation given by Aydelott et al. (1975).

Alternately, an 1891 Annual Report and 1912 survey by the U.S. Army Corps of Engineers (R. Fulton, District Environmental Specialist IV, pers. comm.) suggest that even the northern portions of the site were historically dominated by sawgrass marsh. The discrepancy between these two sources cannot be easily resolved. However, based on the high degree of sinuosity exhibited by the old river channel in the northern portion of the site and familiarity with SCS mapping techniques, the authors lean towards the interpretation given in Figure 3.

Recent Vegetation Patterns

Prior to purchase by the District, Sunnyhill Farm was used as a dairy farm with rotation areas of pasture and crops given over to silage. Following purchase, water management practices that maintained "dry" conditions favorable to cattle and crop production were discontinued. As a result, water levels over the site have risen. Installed water level gages have recorded water levels since early 1989.

While no systematic vegetation surveys were conducted prior to the increases in water levels, the following vegetation patterns can be surmised from site visits and conversations with individuals familiar with the site prior to and immediately following purchase. During the time of abandonment and prior to inundation, the old fields in the southern portions of the site (fields 1-5 in Figure 2) were dominated by a mix of early successional weedy species that were subsequently killed by rising water levels. Luxuriant growths of sicklepod (*Cassia obtusifolia*), day-flower (*Commelina diffusa*) and thick vines of morning glories (*Ipomoea* spp.) were observed in late 1988.

Many of the old drainage ditches in this same area were "clogged" with floating and emergent aquatic vegetation, including pennywort (*Hydrocotyle ranunculoides*), cattails (*Typha* spp.), water hyacinths (*Eichhornia crassipes*), duckweed (*Lemna* spp.), water ferns (*Salvinia rotundifolia*), and bog-mats (*Wolffiella gladiata*). With increasing water levels, conditions throughout the site are more conducive to wetland and aquatic vegetation.

Plan of Study

Vegetation patterns, recruitment, and successional changes were studied over two growing seasons beginning with the change in water management in the winter of 1988-1989. Vegetation transects through portions of the site were established at the end of the first growing season (September 1989), and elevation, water depth, and vegetation were measured at regular intervals along their entire lengths. Similar transects were established at the beginning (May 1990) and end (September 1990) of the second growing season. The inset on Figure 2 summarizes the sampling dates for each of the transects shown on the map.

Color infrared aerial photography, which was taken in the fall of 1990, was used in conjunction with the field data to quantify vegetation patterns over the entire site. Water level data collected by District staff at regular intervals were related to field data to gain insight into the dynamics of depth and duration of flooding as they relate to vegetation patterns and successional changes.

METHODS

On September 23, 1989, May 7-9, 1990, and September 23, 1990, vegetation analyses were conducted in several areas of the old agricultural fields at Sunnyhill Farm. These analyses involved the establishment of transects which were used to measure relative elevations of the ground surface, water depths, and vegetative cover in 1-m^2 plots at regular intervals along the transects.

Since transects were established to characterize vegetation on the site as a whole, permanent transects were not established; rather, beginning locations were established and transects were extended along a compass bearing. As a consequence, each sampling quadrat on each of the sampling trips is considered a unique set of data rather than two or three replicates (depending on number of times sampled) of the same location.

Transect Establishment

The approximate locations of the transects are shown in Figure 2. The intention was to collect data in areas representative of the varying conditions that existed on the site at the time of measurement. Transects lengths varied depending on the homogeneity of the area, and on two occasions were ended when impassable conditions prevented forward progress. Vegetation was measured on a total of 12 transects during 3 sampling trips at 6 different locations.

Transect #1 (T1) was begun in the southeastern section of the site (field #2), near the water level recorder that has been used to monitor water depths since February, 1989. The transect was run due west for 470 meters, stopping at a transecting drainage canal. Transect #2 (T2) was begun in the central portion of the site (field #4), and run northwest 400 m. These were the only transects measured on all 3 sampling trips.

Transect #3 (T3) was begun along the southwestern edge of the site (field #3), from atop the levee bordering the Oklawaha River Canal, and run northeastward into the site 100 meters, and east an additional 260 m. This transect was stopped at 360 m at a thick stand of wax myrtles (*Myrica cerifera*) and blackberry vines (*Rubus* spp.). Because of its more upland characteristics, T3 was not sampled on subsequent field trips.

To better characterize field #3, transect #4 (T4) was established on the second field trip, running due north from the levee, starting approximately 200 meters north of T3. This transect was 200 meters long, and was also measured on the final sampling trip.

Also on the second sampling trip, a transect (T5) was established to characterize field #5. This transect was 200 meters in length, was run due east from the western levee, and was also sampled on the final field trip.

Finally, transect #6 (T6) was established on the second sampling trip, in order to characterize the remnant forest area in field #6. Tree species and underlying herbaceous cover were measured along this 100-meter transect, just on this single occasion.

Elevations and Water Levels

For each transect, several 100-m fiberglass measuring tapes were laid end to end until the desired length was attained. Relative elevations along the transects were measured using a survey level and stadia rod on dry land, and depths of water where the ground was inundated. Elevations were measured at 10-meter intervals, except where extreme variations in the ground surface warranted smaller intervals. At transition points from dry land to standing water, both elevation and water depth were measured at two consecutive points, for accurate correlation. From that point on, water depths alone were measured, and later converted to relative ground-surface elevation.

Long-term Water Levels

Staff gages for monitoring daily changes in water levels were established in each of the major fields by the District in early 1989. A continuous water level recorder was established in the southeast field around the same time by CFWWR personnel. Locations of these gages are shown in Figure 2.

From data collected at the staff gages, it was possible to determine the true elevation (feet, mean sea level) of the ground surface and water levels on the transects on the day field sampling was conducted, making the assumption that water levels at the gages were representative of the entire fields. Using elevation data along the transects in conjunction with daily water levels from the staff gages, it was then possible to determine the percent of time during the period of water level measurements that there was standing water in each of the plots (hydroperiod), and the extent of that inundation (range and average water depths). These data were then compared to the parameters determined from the analyses of the vegetation data that were collected. Data from station SE were used for T1, from station SW for T2-4, and from station NW for T5 and T6 (see Figure 2).

Hydroperiod

Water level data from the staff gages received from the District are for the period 2/13/89-12/31/90 for NW, SE and SW, and 4/13/89-12/31/90 for DC. Elevations of the water levels for each day of the period of record were compared to the elevation of each plot in the transects, to determine the number of days that there was standing water at each plot. Number of days of standing water, divided by total period of record (588 days), multiplied by 100, produced hydroperiod for each plot as percent of time.

Vegetation Measurements

Vegetation was measured using techniques developed by Pielou (1986), and modified in a recent study by CFWWR and the U.S. Environmental Protection Agency (Brown and Tighe 1989). At each interval along the transects (10 or 20 meters, depending on overall length of the transect) a 1-m^2 sampling frame (quadrat) was laid

out along the tape. Within each quadrat species were identified, and both "commonness" (Pielou) and percent cover (cover) were estimated.

Estimating Commonness Using the Pielou Method

The Pielou method is a means of comparing the relative commonness or rarity of the vegetation species at a site. It is a somewhat subjective technique, in which the observer (botanist) denotes species that are seen within certain time frames. Specifically, all species observed in the first 15 seconds are most common, denoted by a 3 on the field sheet. Those observed in the next 15 seconds (15-30 sec.) are less common, and are denoted by a 2. Those in the next 30 seconds (30-60 sec.) are uncommon, and denoted by a 1. Those species that are not observed in the first minute, but which are subsequently found during the cover analysis (see below), are rare, and are denoted by 0.

Estimating Percent Cover

Cover is an estimation of the areal extent of a particular species. Using grid marks along the edges of the quadrat as a guide, the botanist estimates the percent of the quadrat that is covered by all vegetative structures of each species. Because of stratification of species perpendicular to the ground surface, it is possible (and frequently occurs) to have cover of greater than 100% within a quadrat.

Importance Values

Data from the commonness and cover estimates were used to derive a modified importance value. This parameter gives an indication of the importance each species plays in the vegetative composition of a transect. Generally, importance values are based on the average of three terms known as relative frequency, relative dominance, and relative density (Smith 1980). Because of the types and methods of measurements made in this study, the importance value was derived from the factors relative frequency, relative cover, and relative commonness.

Relative frequency. The frequency of a species is the number of quadrats that it appears in along the transect. The relative frequency of a species is its frequency divided by the sum of the frequencies of all species on the transect.

Relative cover. A species' cover (dominance) is the average of the covers of that species in all quadrats along the transect. The relative cover is the cover divided by the sum of all covers of all species on the transect.

Relative commonness. A species' commonness is the average of its commonness values from all quadrats on a transect. The relative commonness is the species commonness divided by the sum of the commonness of all species.

Finally, the importance value (IV) for a species is determined by summing the relative frequency, relative cover, and relative commonness, and dividing by 3. The sum of all IVs on a transect, excepting rounding errors, is 1.0.

Forested Plots. On transect T6 diameter at breast height (dbh--approximately 1.3 m above ground level) was measured for all tree species. This obviously included only those species that were at least 1.3 meters tall; those of less height--considered to be the shrub layer--were not measured, and were thus not included in analyses.

Importance values for species along this transect were based on the traditional measures of relative frequency, relative density, and relative dominance (Smith, 1980). The transect was 100 meters long by 10 meters wide. Trees were measured for dbh in each 10 x 10 m block along the transect. There were thus 10 sampling plots along the transect.

For each species on the transect, the number of plots in which it was found was divided by the total number of plots (10), to determine frequency. The frequency of each species was then divided by the sum of frequencies of all species to determine the relative frequency of the species.

The relative density for each species was determined by dividing the number of individual stems of the particular species by the total number of stems of all species. The dbh values for each individual tree was converted to basal area, and summed for each species. Total basal area for each species was then divided by total basal area of all species, to determine the relative dominance of each species. The 3 relative values were then summed for each species, and divided by 3 to determine the importance value of each species.

Herbaceous species and seedlings of woody species were observed for approximate percent cover in a 1-m^2 quadrat located at the beginning of each plot. Relative frequencies and relative covers were determined for each species, as described above. Since the Pielou method was not applied to these plots, importance values were determined by adding the relative frequency and relative cover for each species, and dividing by 2.

Species Richness

Species richness refers to the quantity of species per given area. Since there were varying numbers of plots along each transect, the absolute numbers of species cannot necessarily be compared between transects. However, it would not be accurate to simply divide the numbers of species by the number of plots sampled, since cumulative species occurrence generally increases greatly with initial sample plots and then levels off (Smith 1980). There thus occurs a point where additional sample plots add no new species to the list of species found. Instead, cumulative species curves were developed for each transect to determine the number of plots at which species numbers levelled off. Species occurrence was then standardized between transects, using an equivalent number of quadrats.

Range of Inundation

All vegetation species have certain moisture requirements, and thus varying tolerance to drought and flood regimes. Some species are also more tolerant to greater depths and frequency of flooding than others.

Based on water depths occurring in the plots measured during the field survey, the range of depths of water in which each species was found was determined. The water depths of all plots in which an individual species was found were analyzed, and minimum, maximum, and average water depths for the species were determined.

Vegetation Mapping

A vegetation map was interpreted from false color infrared aerial photography at a scale of 1"=600 feet. The photography was taken in the fall of 1990. The classification system used was developed for the Sunnyhill property to reflect its early successional wetland and upland vegetation. The classification scheme is based on dominant vegetation. In each class there may be more than one plant species present, but the species for which the class is named is clearly dominant. Table 1 gives the classification scheme. It was developed and numbered so that classes of vegetation could be easily added as the photo interpretation and ground truthing progressed. In general, numbers less that 10 were reserved for open water and floating aquatics, numbers from 10 to 19 were reserved for wetland emergent vegetation, and numbers from 20-29 were reserved for shrubs and drier, successional vegetation. To speed reproduction of the map and to reduce error in redrafting, the classification scheme was not renumbered using consecutive numbers.

Production of the vegetation map was accomplished in a three step process. First, vegetation signatures were interpreted from false color infrared photography by placing a clear acetate overlay on each frame of the photography and outlining the different vegetation associations. Outlined vegetation associations were numbered according to the classification scheme given in Table 1. Second, the map was groundtruthed in the field during early September, 1991. And third, once groundtruthing was complete, the individual acetate overlays were combined using a controlled base map provided by the District and redrawn on a single sheet at a scale of 1"= 600 feet.

RESULTS AND DISCUSSION

Elevations and Water Levels

Elevation profiles for the 12 transects measured on the three sampling trips are shown on the figures given in Appendix A. The profiles are scaled alike for comparison of transect lengths and ground surface roughness. Water depths on the day the measurements were made are also shown on these profiles. Ground surface roughness varies from one sampling date to the next on the same transect because transect locations were relative.

Average monthly values of water levels during the period of record for the four staff gages are shown in Figure 5. These data are given in feet since they were recorded as feet msl by District staff. The spikes in the data for the SW/SE drainage canal (DC) in October 1989 and January-February 1990 were probably due to pumping activities undertaken by the District at that time (Fulton, District Environmental Specialist IV, pers. comm.). Water from both the southeast and southwest fields was pumped into the drainage canal, which is located on the north side of the levee separating fields 4 and 5 (Figure 2). This water failed to drain quickly, causing short-term flooding in the drainage canal.

Water levels varied about 1.7 feet (51.2 feet msl to 52.9 feet msl) throughout the site during the period of record with the exception of two events in the drainage canal where water levels were approximately 53.8 feet msl. For the most part, water levels at the NW and SW gages were identical, but departed during August - December of 1990. Water levels at the SE gage averaged about 0.7 feet lower than the NW and SW gages during the period of record.

Hydroperiod

Hydroperiods (as percent inundation) for each plot on transects 1, 2, 4, and 5, for the period of record, are listed in Table 2. These were the four transects which were sampled on the final (9/90) field trip, and corresponded to the marsh areas that were analyzed. Transect 3 (T3) was composed of mostly upland shrub species, and most of the plots were at elevations above any standing water during the period of record (POR). T6 was completely dry during the POR.

Transect T1 was nearly 100% inundated for the entire POR. Four plots were dry at some time during the POR, and only two of these for more than 2% of the time. T2 was completely inundated in the marsh portions of its length (plots 1-11, Table 2) for the entire POR. The shrub region (approximately 230-285 m) was primarily dry, although standing water did occur here for a portion of the study period. Transects 4 and 5 were also inundated for essentially the entire POR. A 40-m stretch of T4 was dry less than 3% of the study period, while only 1 plot (#14) was ever dry on T5 (Table 2).

Vegetation Measurements

Importance Values

Commonness and cover values for all species on each transect are listed in Appendix B-D. Importance values for species on each transect, for each sampling period, are listed in Tables 3-8. The species found on all sampling trips are listed in each table (when applicable), so that changes in species' importance and composition at each transect in the site can be compared.

By far the dominant species on the marsh transects (T1, T2, T4 and T5) were duckweed (*Lemna* spp.), water hyacinths (*Eichhornia crassipes*), bog-mats (*Wolffiella gladiata*), floating pennywort (*Hydrocotyle ranunculoides*), and water ferns (*Salvinia rotundifolia*), all of which are free-floating, herbaceous wetland species. Giant duckweed (*Spirodela* spp.) was also important on T2 and T5 while frog's bit (*Limnobium spongia*) was the dominant species on T5. In various combinations, these seven species accounted for greater than 45% of the importance on all sampling trips on all marsh transects, and generally greater than 60% (see Tables 3, 4, 6, and 7).

Transect 3, on the other hand, was mostly dry, and was dominated by species indicative of early succession on drier soils. Most common was sicklepod (*Cassia obtusifolia*), with an importance value of 0.34. A substantial amount of day-flower (*Commelina diffusa*) was also present on this transect (IV=0.16). Only 1 quadrat on this transect was in deep water (plot #19) and was the only plot in which marsh species were dominant (see Appendix B, Table B3a).

As shown in Table 8, the primary tree species in the remnant floodplain was red maple (*Acer rubrum*), with an IV of 0.58. Wax myrtle (*Myrica cerifera*) was important in the understory (IV=0.20). The ground cover was dominated by the wetland indicators royal fern (*Osmunda regalis*), cinnamon fern (*O. cinnamomea*), and lizard's-tail (*Saururus cernuus*), with importance values of 0.37, 0.21, and 0.16, respectively.

Species data were summarized for the three field sampling events and are given in Figure 6 and Tables 9, 10 and 11. Table 9 lists all species in alphabetical order, giving the number of quadrats in which they were found, and their range of water levels. Table 10 lists the 20 most common species and their range of water levels, and Table 11 list the 20 species found in deepest mean water depths.

The frequency distribution in Figure 6 and tabular data in Table 10 shows that of the 63 species found on all transects, eight species dominated in a number of occurrences (*Eichhornia crassipes, Salvinia rotundifolia, Lemna* spp., *Hydrocotyle ranunculoides, Wolffiella gladiata, Spirodela* spp., *Typha domingensis, and Limnobium spongia*). Of these 8 species, 5 are floating aquatic plants (*Eichhornia crassipes, Salvinia rotundifolia, Lemna* spp., *Wolffiella gladiata, Spirodela* spp.), one is a floating aquatic during its juvenile phase (*Limnobium spongia*), one is often a floating plant in dense mats, but can be rooted (*Hydrocotyle ranunculoides),* and one is a rooted perennial herb (*Typha domingensis*).

The most common rooted, aquatic plant species (other than *Typha*) were *Juncus effusus, Pontederia cordata, Panicum hemitomon, Alternanthera philoxeroides,* and *Ludwigia* spp. The most common non- aquatic species were *Eclipta alba* and *Eupatorium capillifolium.*

Species Richness

Table 12 summarizes the change in species richness for each of the transects. A general trend of increasing numbers of species at each transect for successive sampling trips can be seen.

The cumulative number of species found on transects sampled in May 1990 versus successive plot number for the transects in Figure 7. First, on plots 1 through 20 on each transect, it can be seen that somewhere between 5 and 10 plots suffice to account for nearly all of the species found on each transect. Transects 1 and 2, which go beyond 20 plots, each next encountered an entirely different community from the deep marsh measured in the earlier plots. Transect 1 ended at a berm along a drainage canal, and thus was drier with new species for the last two plots measured (see Figure A3 [top] and Table C1a). Transect 2 crossed a substantial stretch of dry land and more than tripled the numbers of species encountered (see Figures 7 and A3 [bottom], and Table C2a). But even with this new community and additional species, the cumulative total leveled off again after about 10 plots (Figure 7).

Based on this finding, species data were reevaluated using only species occurring in the first 10 plots of each transect. For transect 2, the herbaceous and upland portions were divided into separate components. Revised data are presented in the lower portion of Table 12. The primary finding of these results is that a greater number of species were found in drier habitats. The marshes, particularly in the SE and SW fields (T1 and T2, respectively), had a much less diverse mix of species.

Range of Inundation

Table 9 gives upper, lower, and mean water depths for each species found on all transects, summarized for all field sampling events. These data are the recorded water depths on the day of field measurements. Positive numbers indicate standing water above the ground surface, and negative numbers indicate groundwater below the soil surface. Table 9 also lists the number of plots in which each species was found. The range of water depths for the 20 species with deepest mean depths is given in Table 11 (species with only one occurrence are omitted from the table). Figure 8 summarizes variation between maximum and minimum water levels for the 26 "wetland species" having quadrat occurrences greater than 3, and Figure 9 gives the same data for the 10 "upland species" occurring in greater than 3 quadrats[1].

[1] definition of "wetland" and "upland" species follows the listed species under Florida Administrative Code Rule 17-4.022. Any exceptions to this nomenclature are noted in the text.

Of the most common "wetland species", the floating aquatics: *Eichhornia crassipes*, *Salvinia rotundifolia*, and *Lemna* spp. were found in areas with deepest maximum water levels and had the widest variation in water depths. The rooted aquatic (and sometime floating mat), *Hydrocotyle ranunculoides* was also found in deep water and had the widest variation between maximum and minimum water levels, although mean water level was shallower than the floating aquatics. *Wolffiella gladiata* had the deepest mean water depths, but was not found in water depths greater than 88 cm.

An unidentified *Polygonum* spp. was found in the deepest mean water depths (varying from 163 cm to 22 cm). In general the floating aquatics were found at mean water depths greater than 44 cm and the rooted emergent species at mean water depths less than 30 cm. The exceptions were *Alternanthera philoxeroides* (37 cm), *Cyperus strigosus* (35 cm), and *Panicum hemitomon* (31.4 cm). *Typha domingensis* was found at a mean water depth of 28.6 cm (70 cm to -15 cm).

Relatively common species with ranges of water depth of less than 70 centimeters included: *Azolla caroliniana* (70 cm to 1 cm), *Pontederia cordata* (71 cm to 1 cm), *Panicum hemitomon* (70 cm to 0 cm), *Alternanthera philoxeroides* (70 cm to 3 cm), an unidentified *Ludwigia* spp (41 cm to 15 cm), and *Commelina diffusa* (37 cm to 5 cm). Three species (*Commelina diffusa, Cyperus strigosus* and *Ipomoea trifida*) are not listed as "wetland species" in Chapter 17-4 FAC.

The 10 species in Figure 9 have mean water depths of 0 cm to -30 cm. Of these species 8 are upland and 2 are considered wetland species (*Cyperus haspan* and *Juncus marginatus*). *Eclipta alba, Cassia obtusifolia, Cyperus haspan* and *Eupatorium capillifolium* were each found in quadrats that were inundated, but whose mean depths of inundation were less than 0. The remaining species were all found in quadrats that ranged in water depth from -5 cm to -36 cm.

Vegetation Map

A vegetation map of the Sunnyhill Farm is included as a map folio. The old patterns of drainage canals and levees, exhibited by differences in vegetation were still quite obvious throughout the site. Ditching was most evident in fields 1, 2, and 3, and the northwest portion of field 4. Remnants of the original river channel were evident in field 5 and the upper portion of field 4.

Field 1 appeared to be dominated by *Typha* spp. with large areas of *Hydrocotyle ranunculoides* and smaller patches of open water. Field 2 had large areas of the floating aquatic, *Eichhornia crassipes* and significant areas of open water. The extreme northern portion of field 2 was drier, and supported areas of the shrubs *Ludwigia* spp., *Myrica cerifera* and *Salix* spp. Field 3 was most difficult to classify since it had a larger diversity of vegetation, presumably the result of drier conditions. Areas of *Typha* spp. were mixed with early successional shrub and herbaceous species. There were fairly large areas of open water and *Lemna* spp. in the southern and central portions of field 4. The northwest portion of field 4 was drier, supporting the shrubs *Ludwigia spp., Myrica*

cerifera and *Salix* spp. Field 5 had significant areas of open water, *Lemna* spp., and *Hydrocotyle ranunculoides* along both sides of the remnant river channel. Drier areas of shrubs and herbaceous species dominated the extreme eastern and western edges of the field. The driest field was field 6, the southern portion of which was dominated by forested areas and stands of robust concentrations of *Myrica cerifera*.

SUMMARY

During the two growing seasons (1989-1990) that were the subject of these field samplings since the change in water regimes, some general trends in successional patterns might be deduced:

* The soil seed bank seems to be depauperate of species characteristic of the communities originally occupying the site. It is possible that this is simply a result of a lack of conditions conducive to the germination of such species. However, when one considers the amount of time that has elapsed since conversion to agricultural uses and the effects of such uses on the soil, this result is not surprising.
* A significant component of wetland herbaceous species have colonized the site in areas where water depths favor their establishment.
* In the two growing seasons observed, there was little change in species composition as measured at the transects. All of the marsh areas were dominated by floating and rooted aquatic species, with the same five or six species of greatest importance values throughout the site. There was a slight trend in increasing species richness over all sampling trips.
* Based on observations of successional patterns of the site, it is unlikely that the original (hypothesized) vegetation characteristic of the site will recolonize. If the original vegetation was saw grass (*Cladium jamaicense*), the changes in water quality, quantity and flow regimes, and the disturbance to soils may not be conducive to its re-establishment. In addition, saw grass is known to be very difficult to germinate or transplant.
* Species richness tended to be greatest in those areas of lowest overall water depths. Transect 2 had highest overall richness because it had both submerged and "exposed" areas.
* Sites with mean water depths greater than 40 cm were dominated in large part by floating aquatics and rooted floating aquatics, and sites with mean water depths from 10 cm to 39 cm appeared to be favored by emergent vegetation.
* The mean depth for *Typha* spp. was 28.6 cm. It was not found in areas with inundation depths greater than 70 cm., but was found in "dry" areas where water depths were as much as 15 cm below the soil surface.

LITERATURE CITED

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Table 1. Vegetation classification system used at Sunnyhill

Map Number	Vegetation Association
1	Roads and levees
2	Open water
3,4	Duckweed and other small floating plants
5	Dead water hyacinth
10	*Typha* spp.
11	Water hyacinth/*Limnobium*
12	Broad leaved emergents
13	*Hydrocotyle*
14, 15	Sedges and rushes
16	*Salix* spp.
20	Grasses
21	*Ludwigia* spp.
22	Shrubs (*Salix /Myrica*)
23	*Elderberry/ Baccharis*
24, 25	Mixed herbs and grasses
26	Dry Shrubs (*Baccharis/Rubus*)
30	Forest (*Quercus, Acer, Liquidamber*)

Table 2. Percent inundation of sampling plots at Sunnyhill Farm, February 1989 to September 1990. Transects 3 and 6 were dry for the period of record.

Transect #1			Transect #2			Transect #4			Transect #5		
Dist. (m)	Plot #	% Inun.	Dist. (m)	Plot #	% Inun.	Dist. (m)	Plot #	% Inun.	Dist. (m)	Plot #	% Inun.
20	1	86	20	1	100	30	1	100	20	1	100
40	2	100	40	2	100	40	2	97	30	2	100
60	3	100	60	3	100	50	3	97	40	3	100
80	4	100	80	4	100	60	4	99	50	4	100
100	5	100	100	5	100	70	5	99	60	5	100
120	6	100	120	6	100	80	6	99	70	6	100
140	7	100	140	7	100	90	7	100	80	7	100
160	8	100	160	8	100	100	8	100	90	8	100
180	9	100	180	9	100	110	9	100	100	9	100
200	10	100	200	10	100	120	10	100	110	10	100
220	11	100	220	11	99	130	11	100	120	11	100
240	12	100	240	12	33	140	12	100	130	12	100
260	13	100	260	13	33	150	13	100	140	13	100
280	14	100	280	14	59	160	14	100	150	14	90
300	15	100	300	15	100	170	15	100	160	15	100
320	16	100				180	16	100	170	16	100
340	17	98				190	17	100	180	17	100
360	18	98				200	18	100	190	18	100
380	19	100							200	19	100
400	20	100									
420	21	100									
440	22	100									
460	23	58									
470	24	100									

Table 3. Importance values of species found on transect #1, all sampling dates.

Transect #1	Sampling Date		
Species	**9/89**	**5/90**	**9/90**
Amaranthus australis		0.01	0.01
Azolla caroliniana		0.07	0.00
Cyperus strigosus		0.01	0.01
Eclipta alba		0.01	
Eichhornia crassipes	0.25	0.36	0.28
Eupatorium capillifolium		0.01	
Hydrocotyle ranunculoides	0.10	0.27	0.14
Ipomoea trifida			0.01
Lemna spp.	0.23	0.04	0.11
Limnobium spongia			0.02
Ludwigia leptocarpa			0.04
Ludwigia spp.	0.01		
Polygonum densiflorum	0.01		0.03
Polygonum spp.		0.03	
Rumex pulcher		0.01	
Sagittaria latifolia	0.01		0.04
Salvinia rotundifolia	0.19	0.04	0.15
Spirodela spp.		0.01	0.06
Typha spp.	0.03	0.14	0.10
Wolffia spp.	0.02	0.01	
Wolffiella gladiata	0.15		0.02
Totals:	1.00	1.00	1.00

Table 4. Importance values of species found on transect #2, all sampling dates.

Transect #2	Sampling Date		
Species	**9/89**	**5/90**	**9/90**
Aster subulatus	0.00		
Azolla caroliniana		0.03	
Carex alba		0.00	
Cassia obtusifolia	0.02	0.02	0.01
Commelina diffusa	0.03		0.01
Cyperus haspan		0.02	0.02
Cyperus spp.	0.02		
Cyperus strigosus			0.01
Digitaria bicornis		0.05	
Digitaria ciliaris			0.01
Eclipta alba	0.02	0.02	0.03
Eichhornia crassipes	0.14	0.18	0.19
Erechtites hieracifolia		0.02	
Eupatorium capillifolium		0.05	0.01
Eupatorium compositifolium			0.01
Eupatorium jucundum		0.00	
Eupatorium spp.	0.01		
Fuirena pumila			0.01
Gnaphalium falcatum		0.02	0.01
Hydrocotyle ranunculoides	0.03	0.10	0.08
Ipomoea trifida	0.01		
Juncus effusus	0.03	0.04	0.04
Juncus marginatus		0.04	
Juncus megacephelus			0.01
Leersia hexandra			0.01
Lemna spp.	0.22	0.02	0.08
Linaria canadensis		0.02	
Ludwigia leptocarpa			0.02
Ludwigia peruviana			0.01
Ludwigia spp.	0.04		
Luziola fluitans			0.01
Mikania scandens			0.01
Panicum anceps		0.02	
Panicum distichum		0.00	
Panicum spp.	0.02		
Polygonum punctatum			0.03
Polygonum spp.	0.00		
Pontederia cordata	0.02	0.02	
Rhynchospora spp.		0.00	
Rubus argutus		0.00	
Rumex pulcher		0.01	
Salvinia rotundifolia	0.14	0.11	0.19
Sambucus canadensis	0.01		

Transect #2	Sampling Date		
Species	**9/89**	**5/90**	**9/90**
Scirpus spp.	0.00		
Senecio glabellus		0.01	
Sesbania exaltata			0.00
Solidago spp.		0.02	
Spirodela spp.		0.12	0.09
Typha domingensis	0.05	0.03	0.06
Wolffia spp.	0.00		0.02
Wolffiella gladiata	0.20	0.04	0.04
Totals:	1.00	1.00	1.00

Table 5. Importance values of species found on transect #3, all sampling dates.

Transect #3	Sampling Date		
Species	**9/89**	**5/90**	**9/90**
Cassia obtusifolia	0.34	Not	Not
Commelina diffusa	0.16	Sampled	Sampled
Cyperus spp.	0.03		
Digitaria ciliaris	0.01		
Eclipta alba	0.01		
Eupatorium spp.	0.03		
Fimbristylis autumnalis	0.01		
Hydrocotyle ranunculoides	0.03		
Ipomoea trifida	0.01		
Juncus effusus	0.02		
Lemna spp.	0.01		
Ludwigia spp.	0.06		
Melothria pendula	0.01		
Murdannia nudiflora	0.02		
Oxalis spp.	0.03		
Panicum spp.	0.02		
Phyllanthus urinaria	0.02		
Rubus argutus	0.01		
Salvinia rotundifolia	0.01		
Sedge spp.	0.04		
Sorghum halepense	0.02		
Verbena scabra	0.07		
Wolffiella gladiata	0.01		
Zizaniopsis miliacea	0.03		
Totals:	1.00		

Table 6. Importance values of species found on transect #4, all sampling dates.

Transect #4	Sampling Date		
Species	**9/89**	**5/90**	**9/90**
Azolla caroliniana	Not	0.06	
Cyperus strigosus	Sampled		0.01
Eclipta alba			0.01
Eichhornia crassipes		0.37	0.29
Habenaria repens		0.01	
Hydrocotyle ranunculoides		0.08	0.04
Hydrocotyle umbellata		0.16	
Ipomoea trifida			0.02
Juncus effusus		0.03	0.02
Lemna spp.			0.01
Ludwigia peruviana			0.03
Mollugo verticillata			0.01
Panicum dichotimoflorum			0.01
Panicum hemitomon			0.15
Polygonum punctatum		0.03	0.02
Pontederia cordata		0.06	0.06
Sacciolepis striata			0.02
Sagittaria latifolia			0.05
Salvinia rotundifolia		0.12	0.11
Spirodela spp.		0.03	
Typha domingensis		0.04	0.05
Utricularia spp.			0.02
Wolffiella gladiata		0.02	0.06
Totals:		1.00	1.00

Table 7. Importance values of species found on transect #5, all sampling dates.

Transect #5	Sampling Date		
Species	**9/89**	**5/90**	**9/90**
Alternanthera philoxeroides	Not	0.01	0.09
Azolla caroliniana	Sampled	0.01	
Eichhornia crassipes		0.03	
Hydrocotyle ranunculoides		0.11	0.14
Hydrocotyle umbellata		0.01	0.01
Juncus effusus			0.01
Lemna spp.		0.21	0.08
Limnobium spongia		0.17	0.21
Panicum hemitomon		0.03	
Panicum repens			0.01
Polygonum punctatum			0.01
Pontederia cordata		0.03	0.02
Salvinia rotundifolia		0.14	0.20
Scirpus cyperanus		0.01	
Spirodela spp.		0.14	0.11
Typha spp.		0.03	
Wolffiella gladiata		0.07	0.13
Totals:		1.00	1.00

Table 8. Importance values of species found on transect #6, all sampling dates.

Transect #6	Sampling Date		
Species	**9/89**	**5/90**	**9/90**
Tree Species:	Not Sampled		Not Sampled
Acer rubrum		0.58	
Camphor spp.		0.02	
Cephalanthus occidentalis		0.02	
Ilex cassine		0.04	
Magnolia virginiana		0.02	
Myrica cerifera		0.20	
Nyssa sylvatica		0.11	
Quercus spp.		0.02	
Totals:		1.00	
Herbaceous Species:			
Ampelopsis spp.		0.05	
Myrica cerifera		0.03	
Osmunda cinnamomea		0.21	
Osmunda regalis		0.37	
Rubus argutus		0.07	
Parthenocissus quinquefolia		0.02	
Saururus cernuus		0.16	
Smilax spp.		0.02	
Vitus spp.		0.06	
		1.00	

Table 9. Range of depths of occurrence and number of occurrences for all species and all sampling events.

Species Number	Species name	Depth (cm)* Max	Min	Mean	No. Occur.
1	*Alternanthera philoxeroides*	70	3	37.0	11
2	*Amaranthus australis*	3	-2	0.5	2
3	*Aster subulatus*	29	29	29.0	1
4	*Azolla caroliniana*	70	1	29.9	19
5	*Carex alba*	-21	-21	-21.0	1
6	*Cassia obtusifolia*	19	-36	-8.1	8
7	*Commelina diffusa*	37	5	27.3	8
8	*Cyperus haspan*	5	-30	-20.3	6
9	*Cyperus spp.*	37	15	29.8	5
10	*Cyperus strigosus*	65	3	35.0	4
11	*Digitaria bicornis*	-19	-36	-29.0	6
12	*Digitaria ciliaris*	-30	-30	-30.0	1
13	*Eclipta alba*	37	-30	-1.5	13
14	*Eichhornia crassipes*	163	-15	44.4	151
15	*Erechtites hieracifolia*	-19	-29	-24.0	5
16	*Eupatorium capillifolium*	3	-36	-25.0	11
17	*Eupatorium jucundum*	-36	-36	-36.0	1
18	*Eupatorium spp.*	29	19	25.7	3
19	*Fuirena pumila*	-30	-30	-30.0	1
20	*Gnaphalium falcatum*	-21	-36	-29.7	6
21	*Hydrocotlye ranunculoides*	163	-29	40.7	125
22	*Hydrocotyle umbellata*	71	35	47.5	4
23	*Ipomea trifida*	29	-2	14.2	5
24	*Juncus effusus*	90	-30	23.9	16
25	*Juncus marginatus*	-19	-36	-27.7	6
26	*Juncus megacephelus*	-30	-30	-30.0	1
27	*Leersia hexandra*	-30	-30	-30.0	1
28	*Lemna spp.*	163	-15	46.8	133
29	*Limnobium spongia*	80	1	47.4	37
30	*Linaria canadensis*	-19	-34	-26.5	6
31	*Ludwigia leptocarpa*	48	-30	18.8	8
32	*Ludwigia peruviana*	37	0	12.3	3
33	*Ludwigia spp.*	41	15	29.0	10
34	*Luziola fluitans*	-30	-30	-30.0	1
35	*Mikania scandens*	-15	-30	-22.5	2
36	*Mollugo verticillata*	5	5	5.0	1
37	*Panicum anceps*	30	-23	11.7	3
38	*Panicum dichotimoflorum*	0	0	0.0	1
39	*Panicum distans*	-28	-28	-28.0	1
40	*Panicum hemitomon*	70	0	31.4	12

Table 9. Continued.

Number	Species name	Depth* Max	Depth* Min	Depth* Mean	No. Occur.
41	*Panicum repens*	16	16	16.0	1
42	*Panicum spp.*	35	20	29.0	4
43	*Polygonum densiflorum*	70	26	40.3	4
44	*Polygonum punctatum*	57	-30	22.7	6
45	*Polygonum spp.*	163	22	52.8	6
46	*Pontederia cordata*	71	1	25.9	16
47	*Rhynchospora spp.*	-28	-28	-28.0	1
48	*Rubus argutus*	-23	-23	-23.0	1
49	*Rumex pulcher*	3	-36	-20.7	3
50	*Sacciolepis striata*	41	41	41.0	1
51	*Sagittaria latifolia*	70	-2	20.5	8
52	*Salvinia rotundifolia*	163	-15	46.5	151
53	*Sambucus canadensis*	20	20	20.0	1
54	*Scirpus cyperanus*	70	70	70.0	1
55	*Scirpus spp.*	19	19	19.0	1
56	*Senecio glabellus*	-19	-21	-20.0	2
57	*Sesbania exaltata*	-30	-30	-30.0	1
58	*Solidago spp.*	-6	-36	-26.3	4
59	*Spirodela spp.*	80	-6	44.8	70
60	*Typha domingensis*	70	-15	28.6	47
61	*Utricularia spp.*	36	36	36.0	1
62	*Wolffia spp.*	80	25	44.0	6
63	*Wolffiella gladiata*	88	-6	51.7	97

* Positive numbers indicate depth of water above soil surface
Negative numbers indicate depth to water table below soil surface.

Table 10. Maximum, minimum, and mean water depth for 20 most common species on all sampling events

Sp. Num	Species	Number of Occurrences	Water Depth (cm) Max	Min	Mean
14	*Eichhornia crassipes*	151	163	-15	44.4
52	*Salvinia rotundifolia*	151	163	-15	46.5
28	*Lemna spp.*	133	163	-15	46.8
21	*Hydrocotyle ranunculoides*	125	163	-29	40.7
63	*Wolffiella gladiata*	97	88	-6	51.7
59	*Spirodela spp.*	70	80	-6	44.8
60	*Typha domingensis*	47	70	-15	28.6
29	*Limnobium spongia*	37	80	1	47.4
4	*Azolla caroliniana*	19	70	1	29.9
24	*Juncus effusus*	16	90	-30	23.9
46	*Pontederia cordata*	16	71	1	25.9
13	*Eclipta alba*	13	37	-30	-1.5
40	*Panicum hemitomon*	12	70	0	31.4
1	*Alternanthera philoxeroides*	11	70	3	37.0
16	*Eupatorium capillifolium*	11	3	-36	-25.0
33	*Ludwigia spp.*	10	41	15	29.0
6	*Cassia obtusifolia*	8	19	-36	-8.1
7	*Commelina diffusa*	8	37	5	27.3
31	*Ludwigia leptocarpa*	8	48	-30	18.8
51	*Sagittaria latifolia*	8	70	-2	20.5

Table 11. Range of water depths for 20 species having deepest mean depths* (All sampling trips combined)

Sp. Num	Species	Number of Occurrences	Water Depth (cm) Max	Min	Mean
45	*Polygonum spp.*	6	163	22	52.8
63	*Wolffiella gladiata*	97	88	-6	51.7
22	*Hydrocotyle umbellata*	4	71	35	47.5
29	*Limnobium spongia*	37	80	1	47.4
28	*Lemna spp.*	133	163	-15	46.8
52	*Salvinia rotundifolia*	151	163	-15	46.5
59	*Spirodela spp.*	70	80	-6	44.8
14	*Eichhornia crassipes*	151	163	-15	44.4
62	*Wolffia spp.*	6	80	25	44.0
21	*Hydrocotyle ranunculoides*	125	163	-29	40.7
43	*Polygonum densiflorum*	4	70	26	40.3
1	*Alternanthera philoxeroides*	11	70	3	37.0
10	*Cyperus strigosus*	4	65	3	35.0
40	*Panicum hemitomon*	12	70	0	31.4
4	*Azolla caroliniana*	19	70	1	29.9
9	*Cyperus spp.*	5	37	15	29.8
42	*Panicum spp.*	4	35	20	29.0
33	*Ludwigia spp.*	10	41	15	29.0
60	*Typha domingensis*	47	70	-15	28.6
7	*Commelina diffusa*	8	37	5	27.3

* Species having only one occurrence are not included

Table 12. Species richness on all transects, all sampling dates.

TOTAL SPECIES

Transect	Species Richness (date)		
	9/89	5/90	9/90
Transect #1	10	14	15
Transect #2	20	28	27
Transect #3	24	*	*
Transect #4	*	12	19
Transect #5	*	14	12
Transect #6			
Tree Species	*	8	*
Herbaceous Species	*	9	*

*Not sampled

PER 10 PLOTS

Transect	Species Richness (date)		
	9/89	5/90	9/90
Transect #1	6	8	11
Transect #2[2]	6/17	8/23	11/23[1]
Transect #3	13	*	*
Transect #4	*	11	17
Transect #5	*	13	10
Transect #6			
Tree Species	*	8	*
Herbaceous Species	*	9	*

* Not sampled
[1] Five plots
[2] First number represents marsh plots; second number represents upland plots.

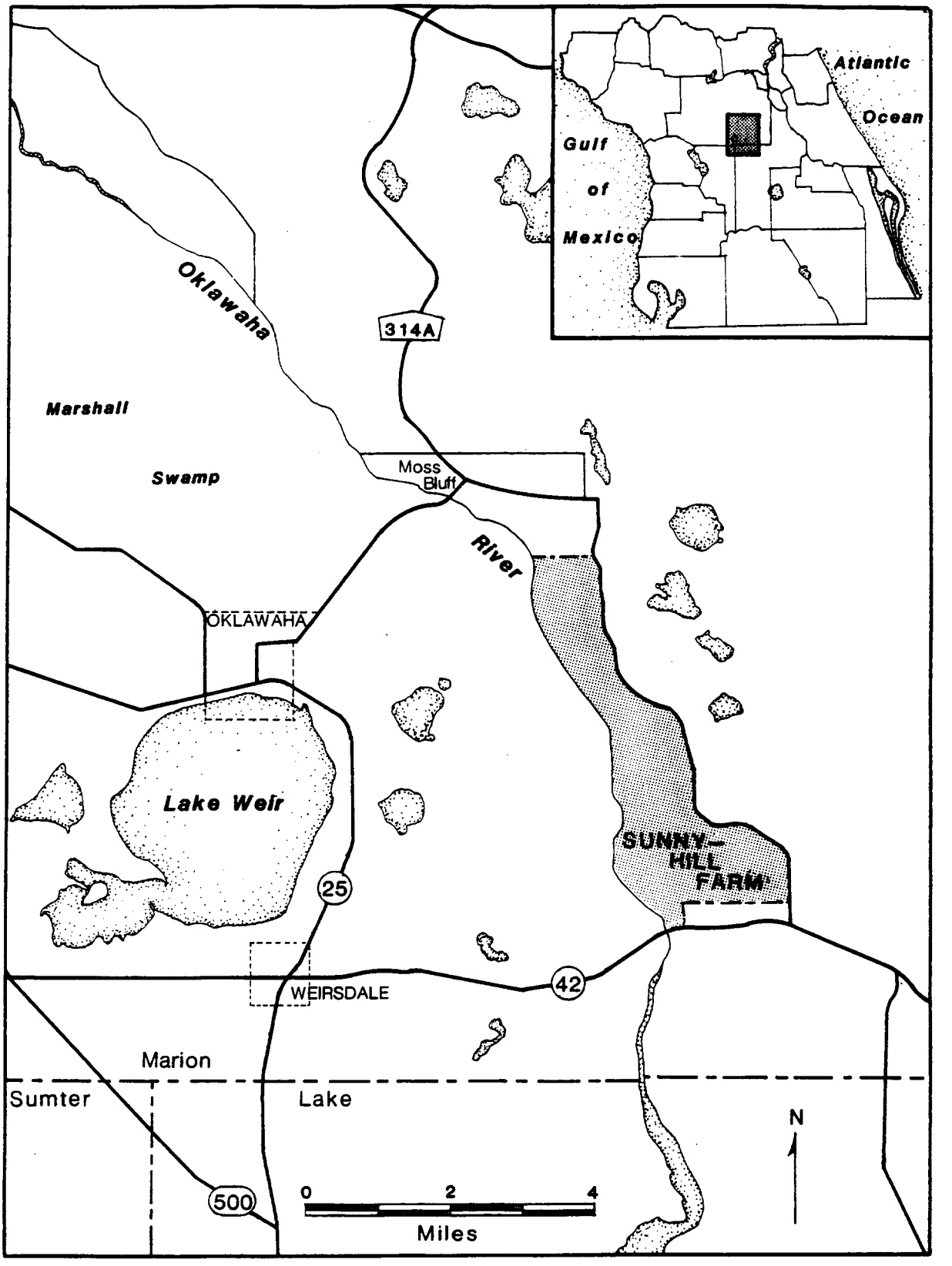

Figure 1. Location of Sunnyhill Farm.

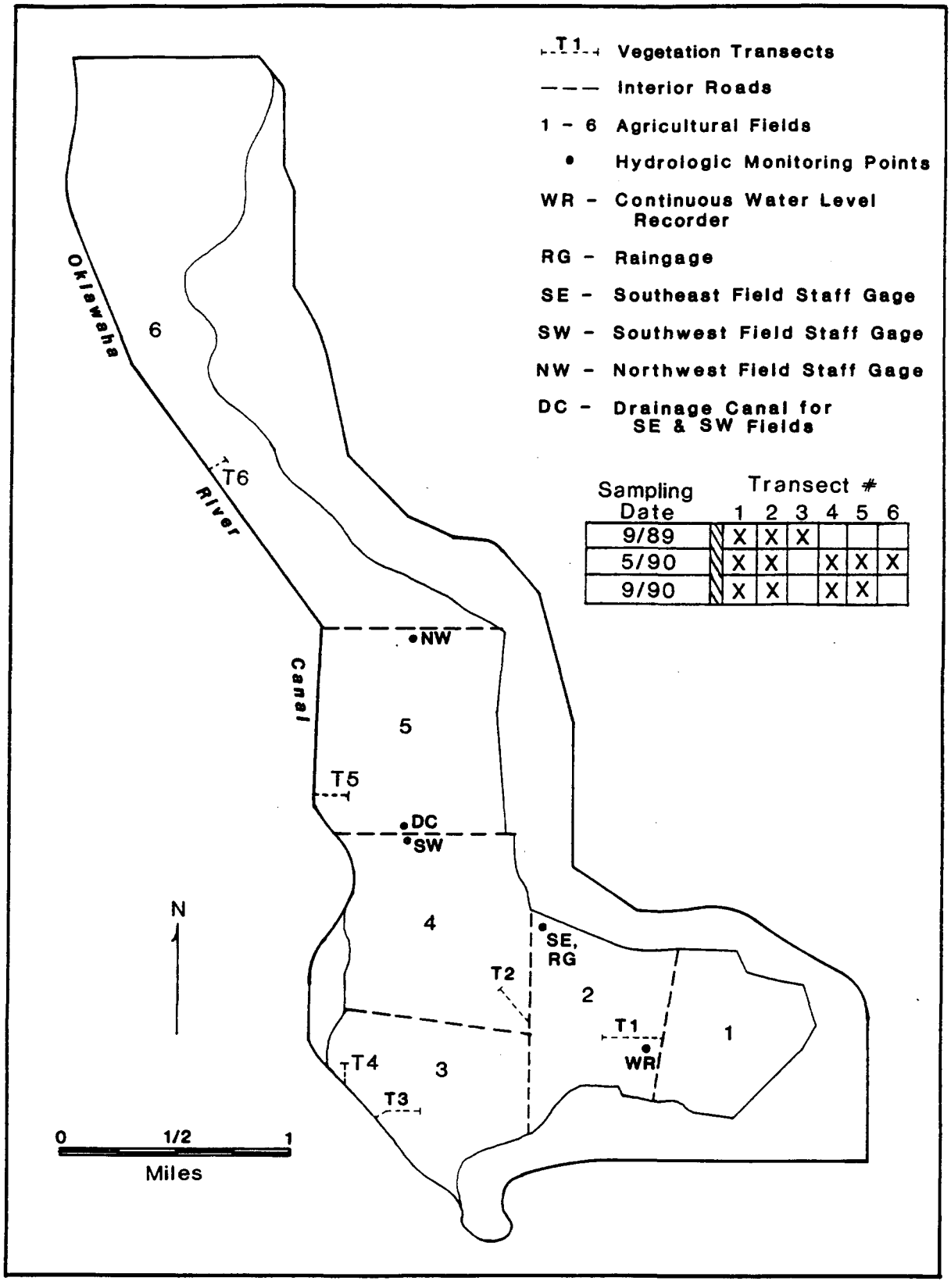

Figure 2. Sunnyhill Farm property boundary showing division into agricultural fields, locations of vegetation transects, and hydrologic monitoring stations.

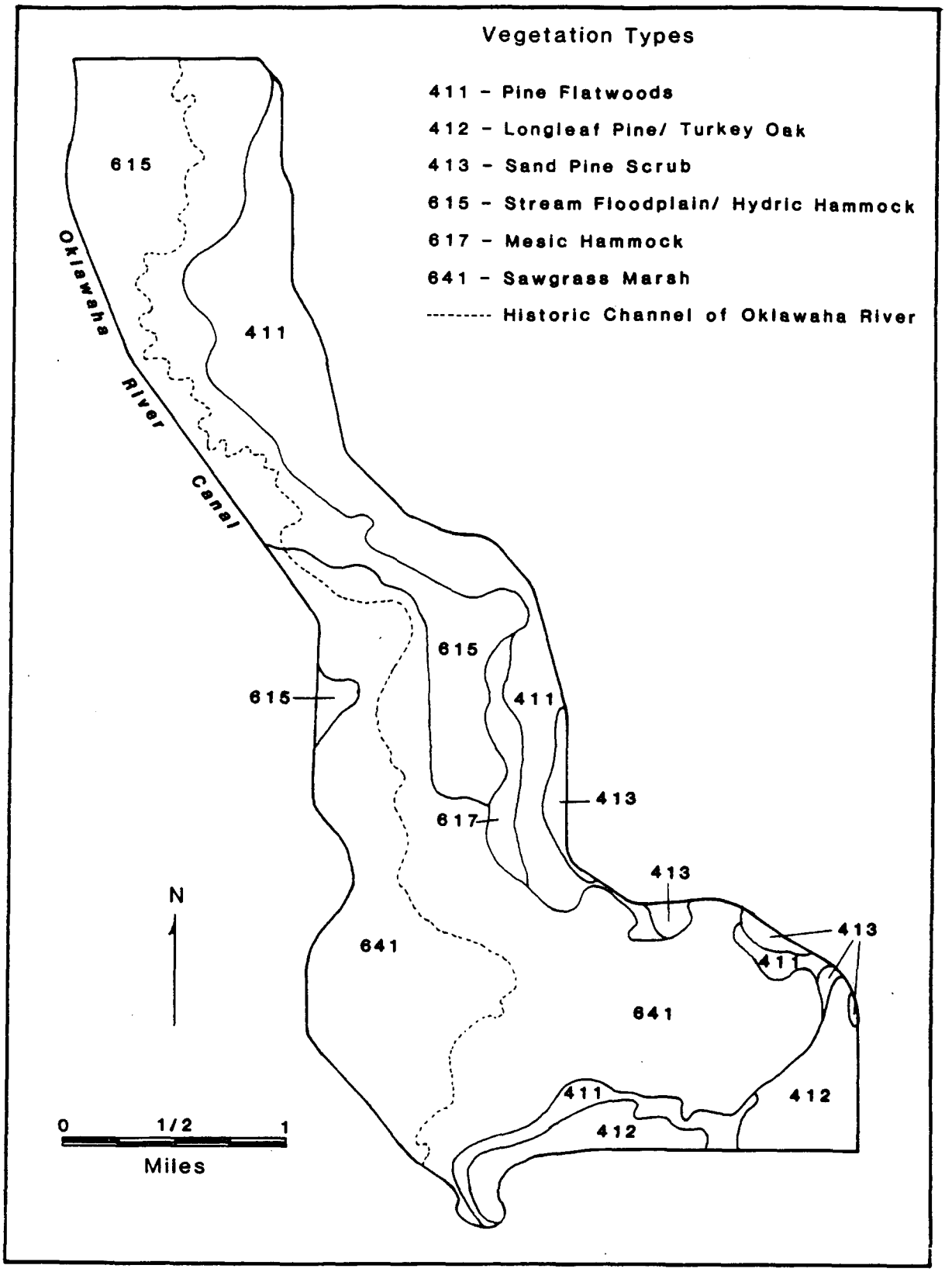

Figure 3. Hypothesized historic vegetation communities of Sunnyhill Farm site, and approximate location of historic channel of the Oklawaha River. Numeric codes refer to FDOT (1985) classification.

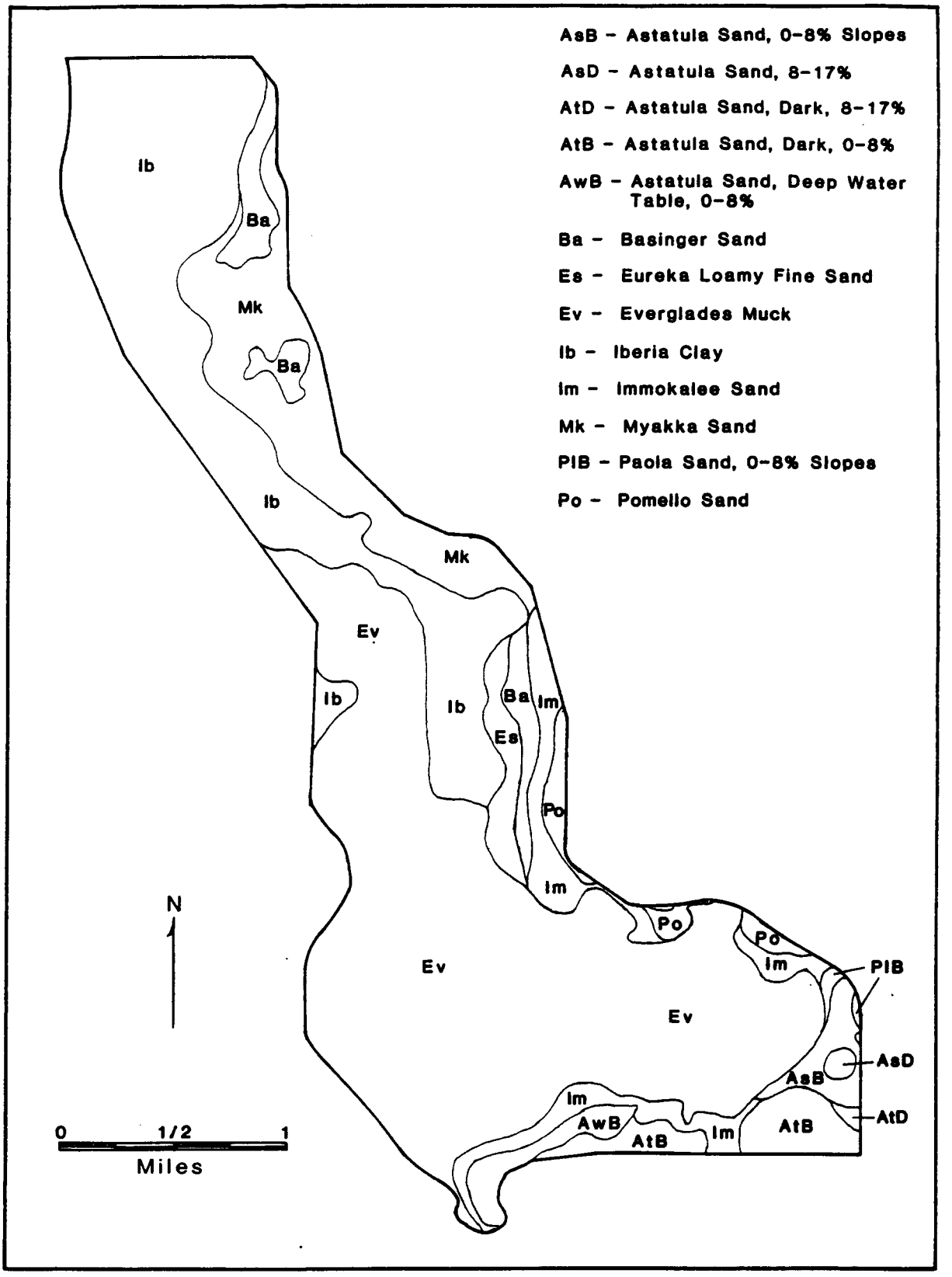

Figure 4. Soil mapping units at Sunnyhill Farm. (Source: Aydelott et al., 1975).

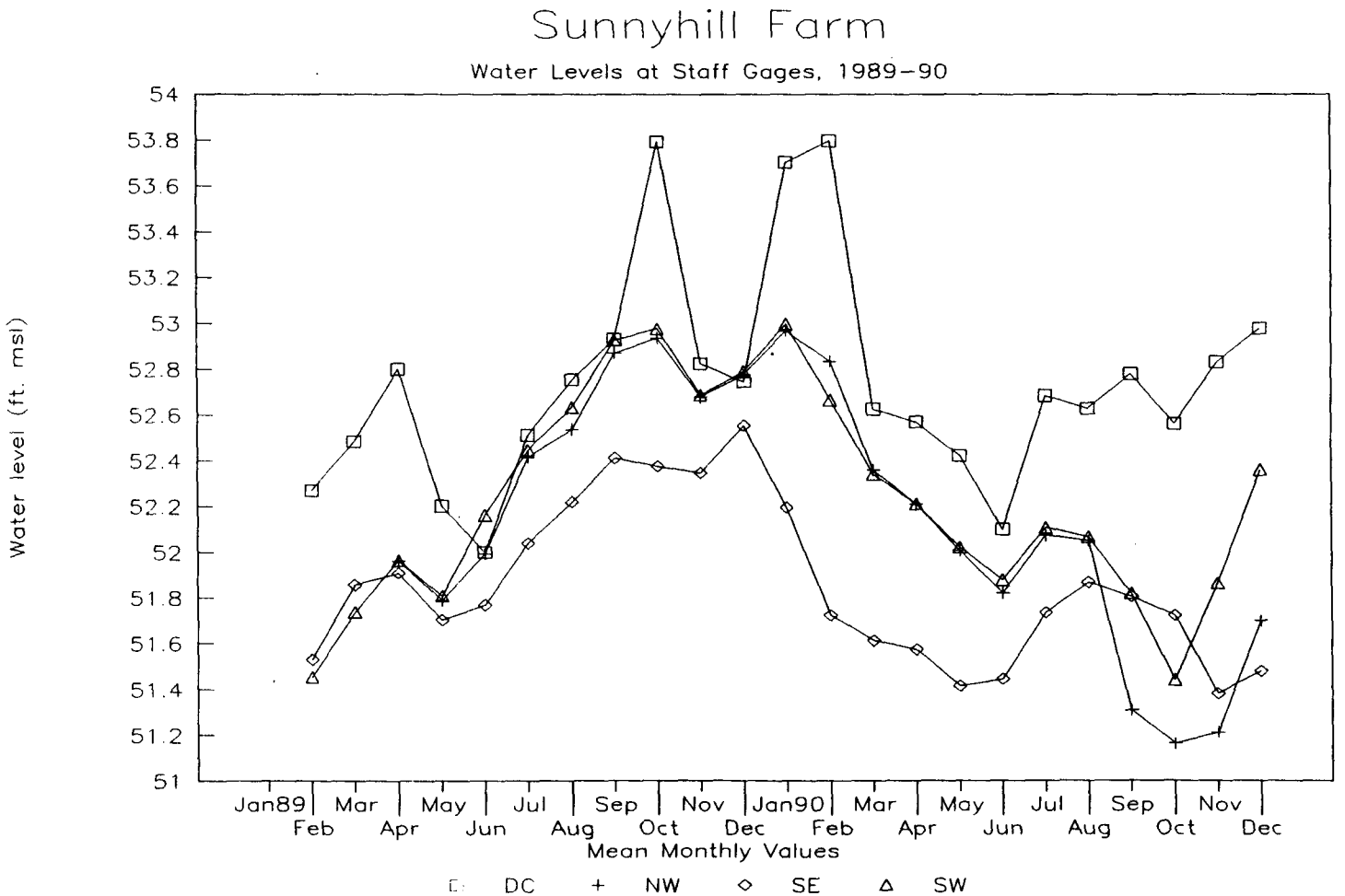

Figure 5. **Water levels at three locations within Sunnyhill Farm for the Period of Record.**

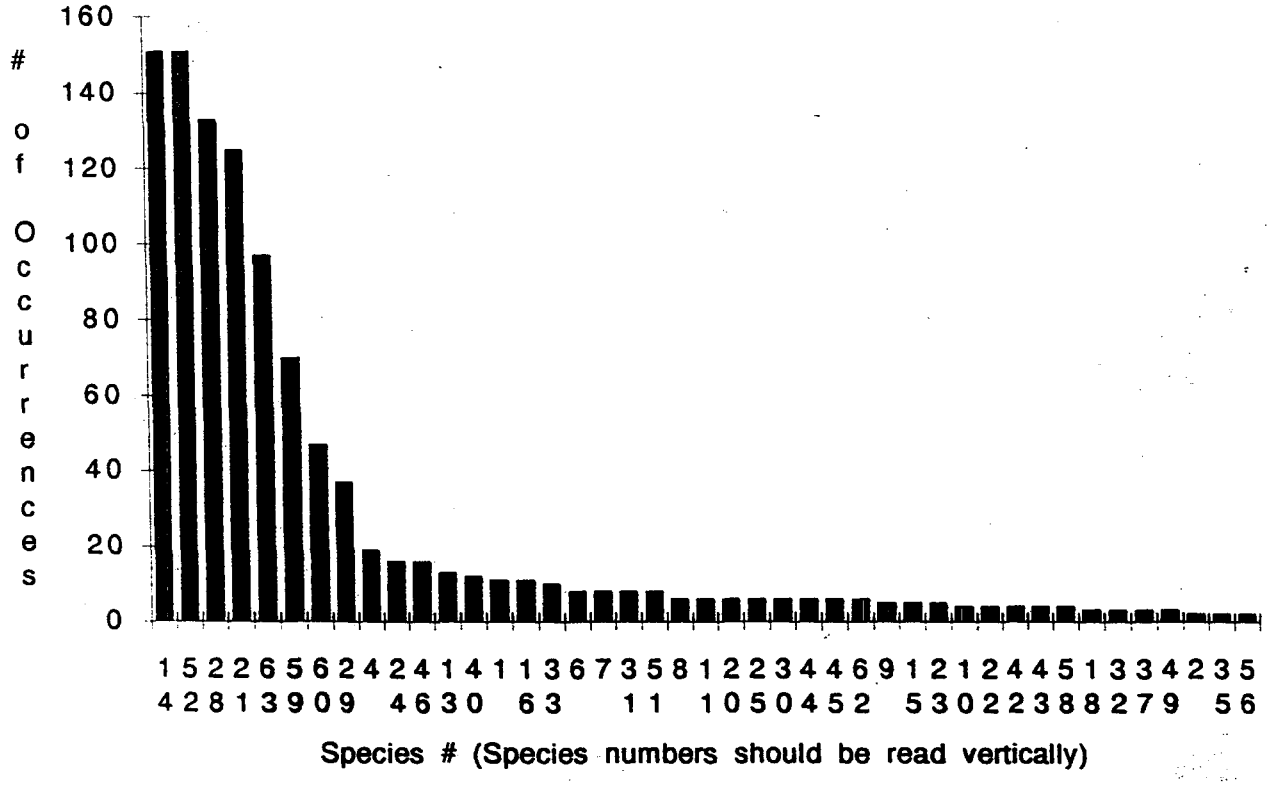

Figure 6. Species frequency (all sampling events combined). See Table 9 for species names referred to here by number.

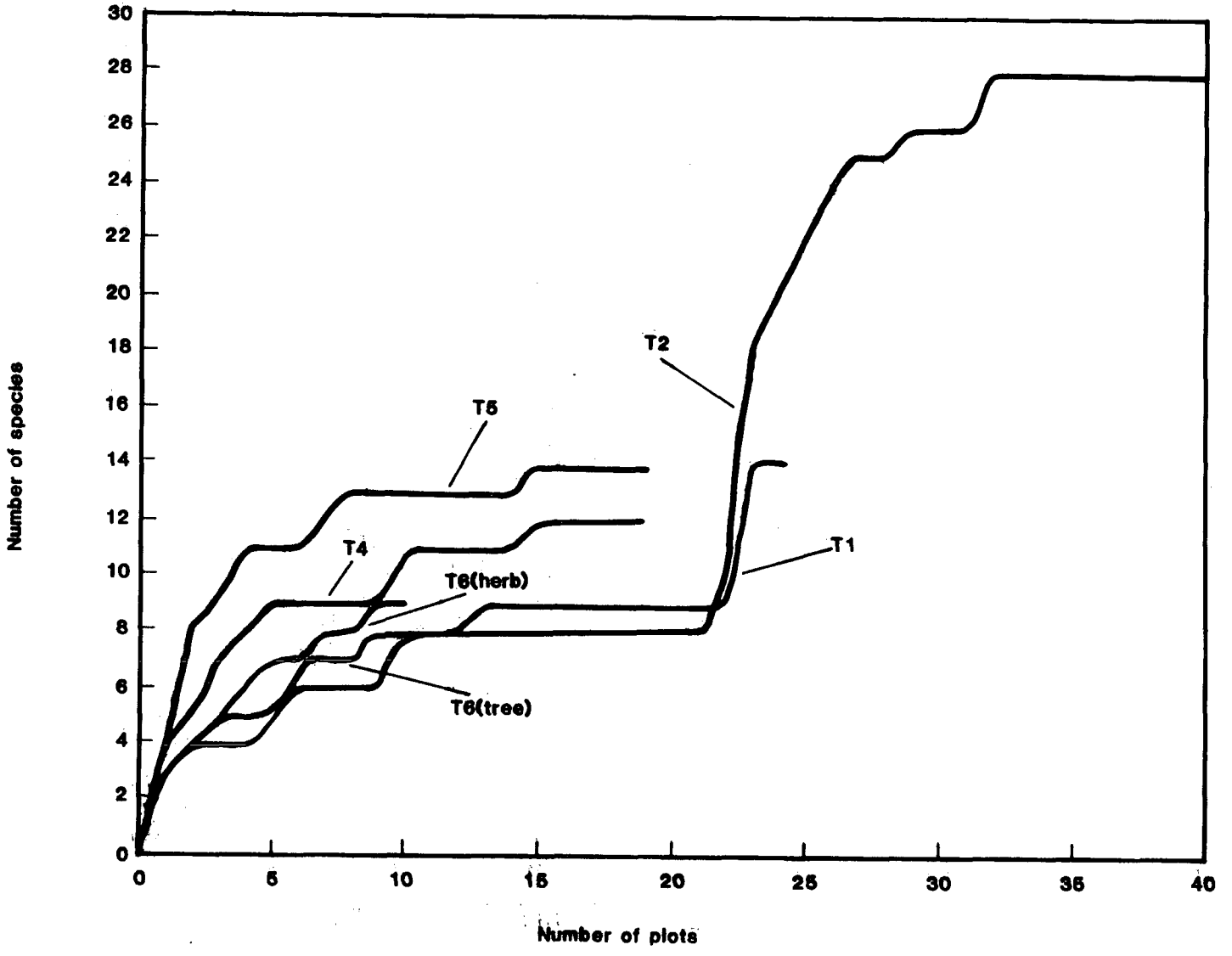

Figure 7. Cumulative species richness as a function of number of quadrats for transects sampled at Sunnyhill Farm, May 1990.

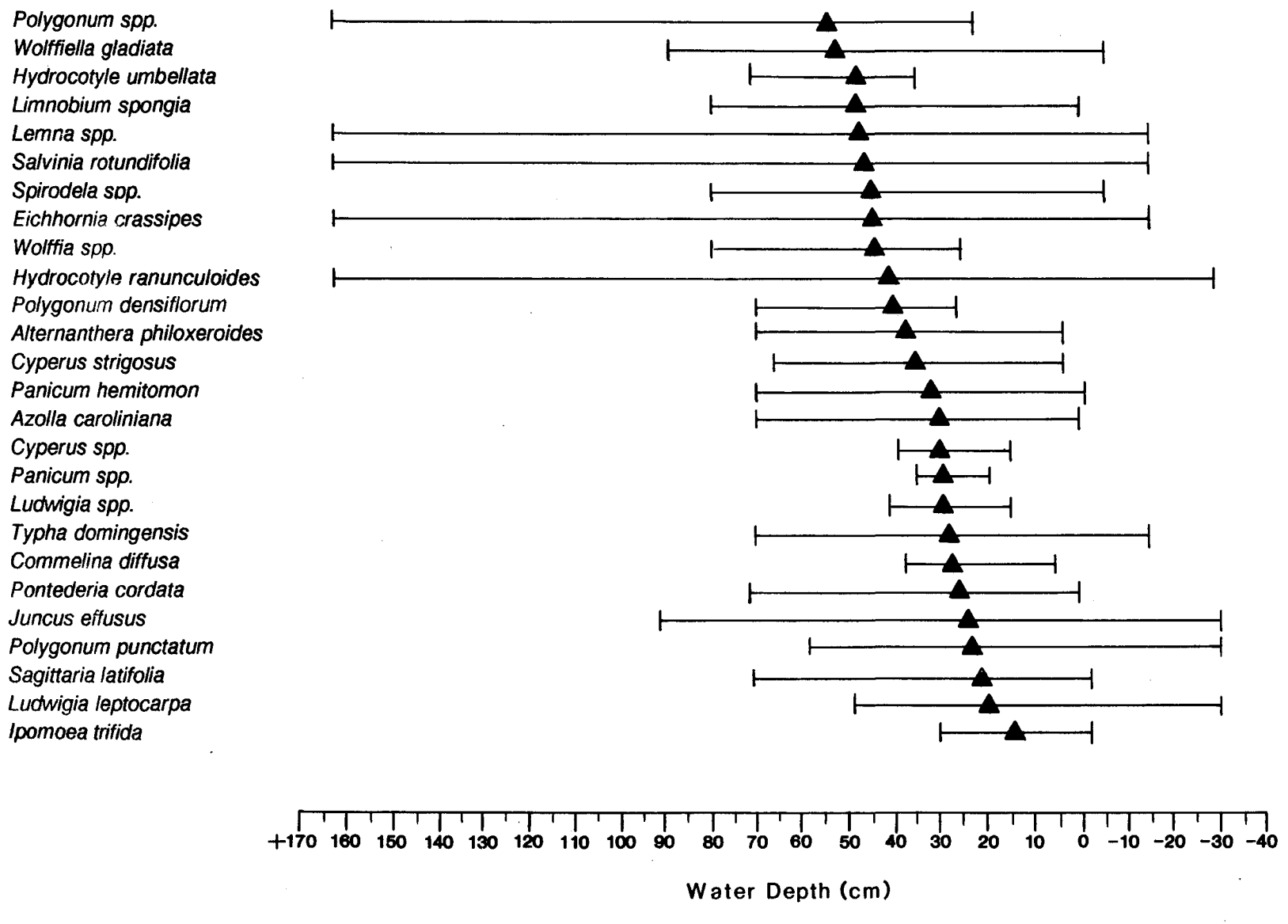

Figure 8. Ranges of inundation and mean depths (▲) greater than 10 cm for 26 species occurring at more than three quadrats.

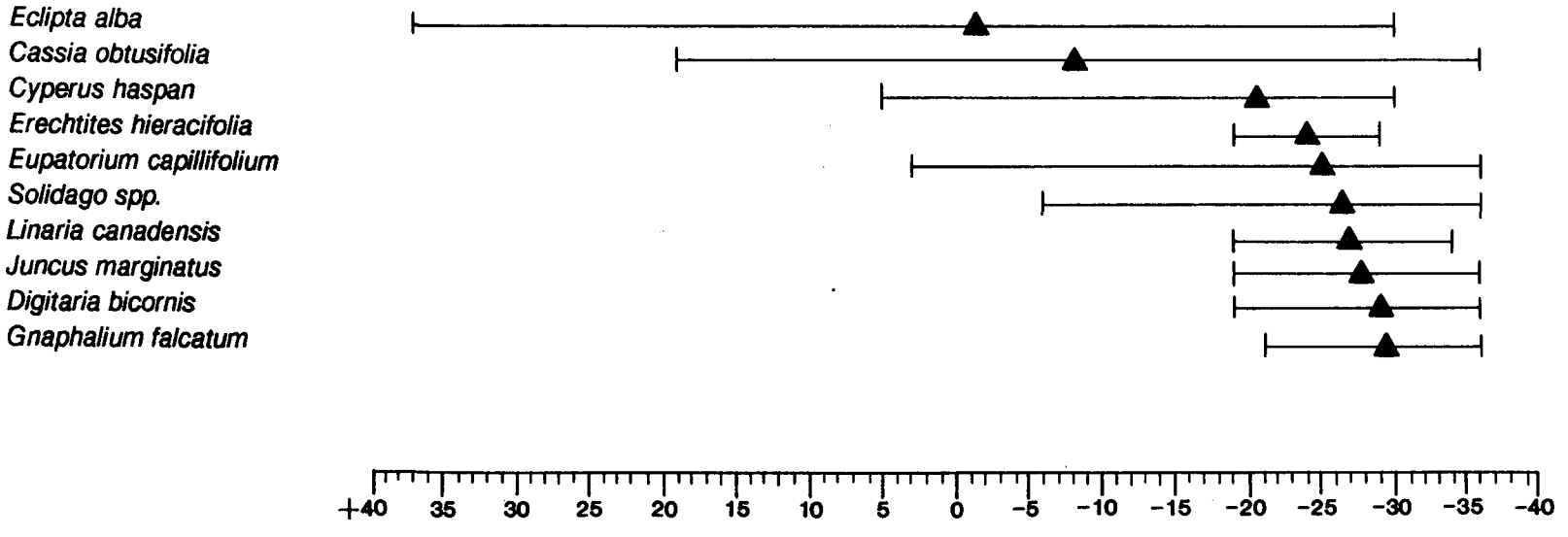

Figure 9. Ranges of inundation and mean depths (▲) less than 0 cm for 10 species occurring on more than three quadrats.

Appendix A

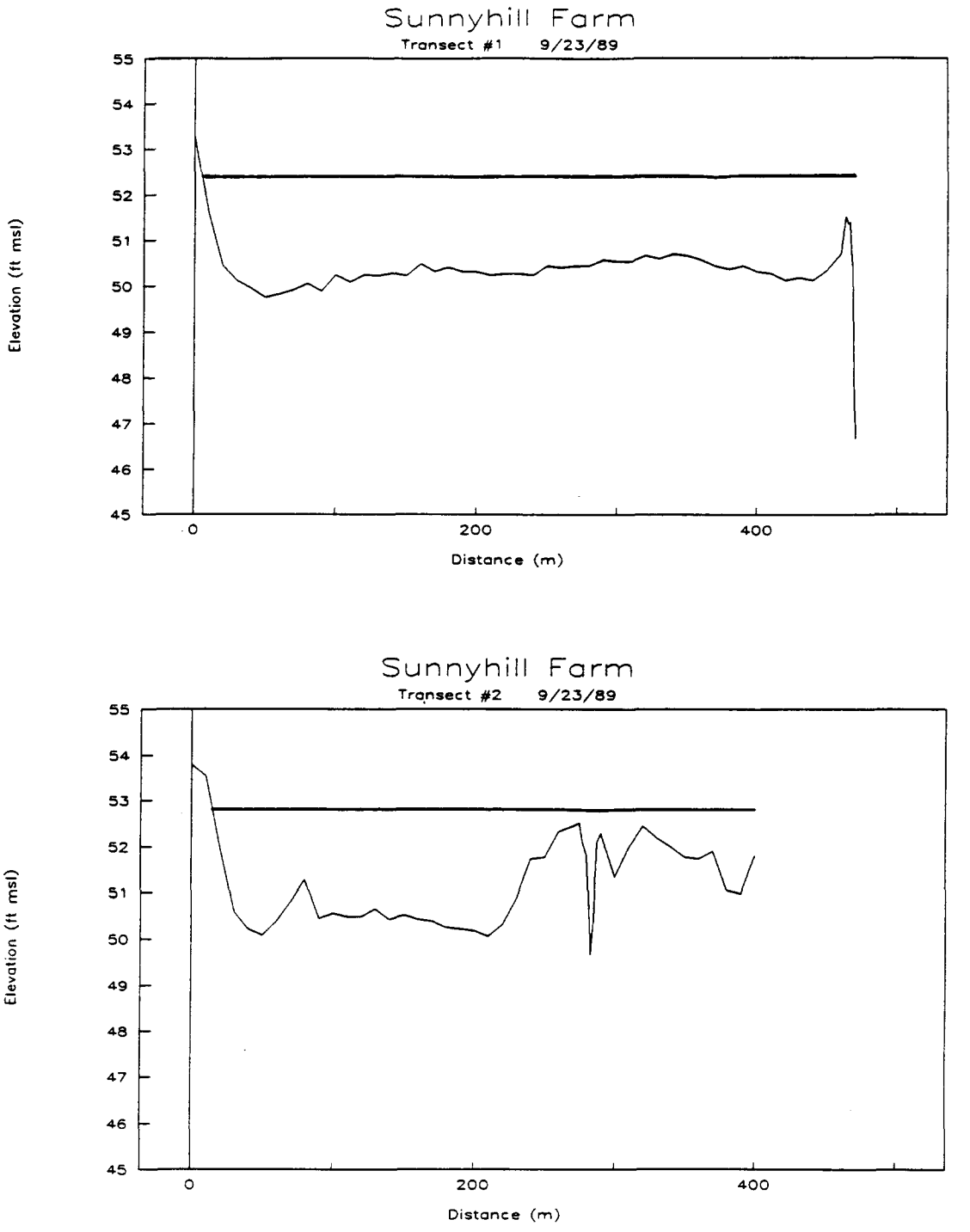

Figure A1. Elevation profile and surface water level for transects #1 (top) and #2 (bottom), September 23, 1989.

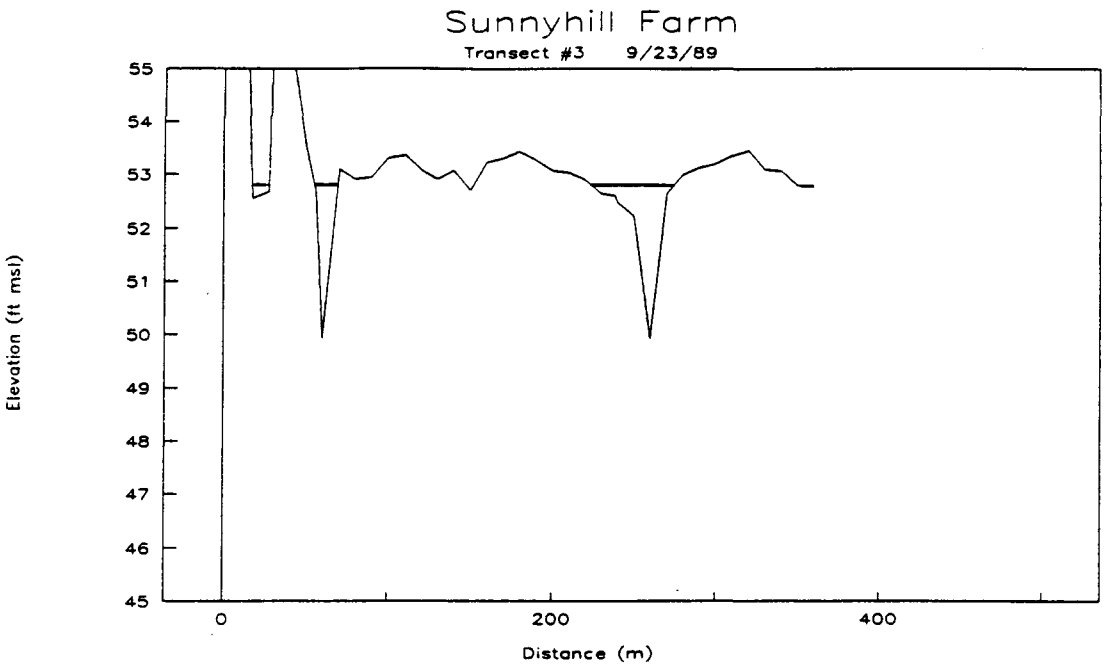

Figure A2. Elevation profile and surface water level for transect #3, September 23, 1989.

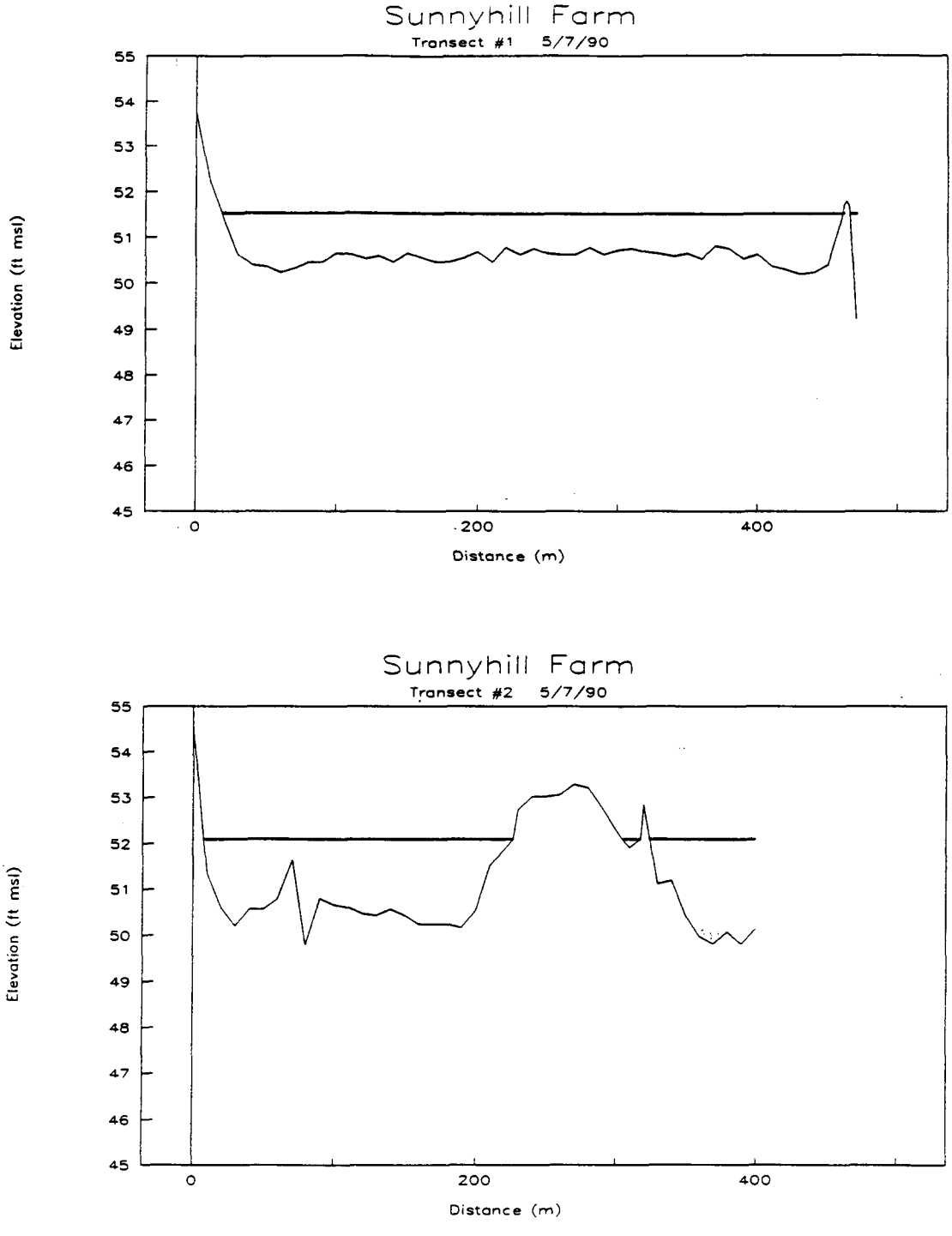

Figure A3. Elevation profile and surface water level for transects #1 (top) and #2 (bottom), May 7, 1990.

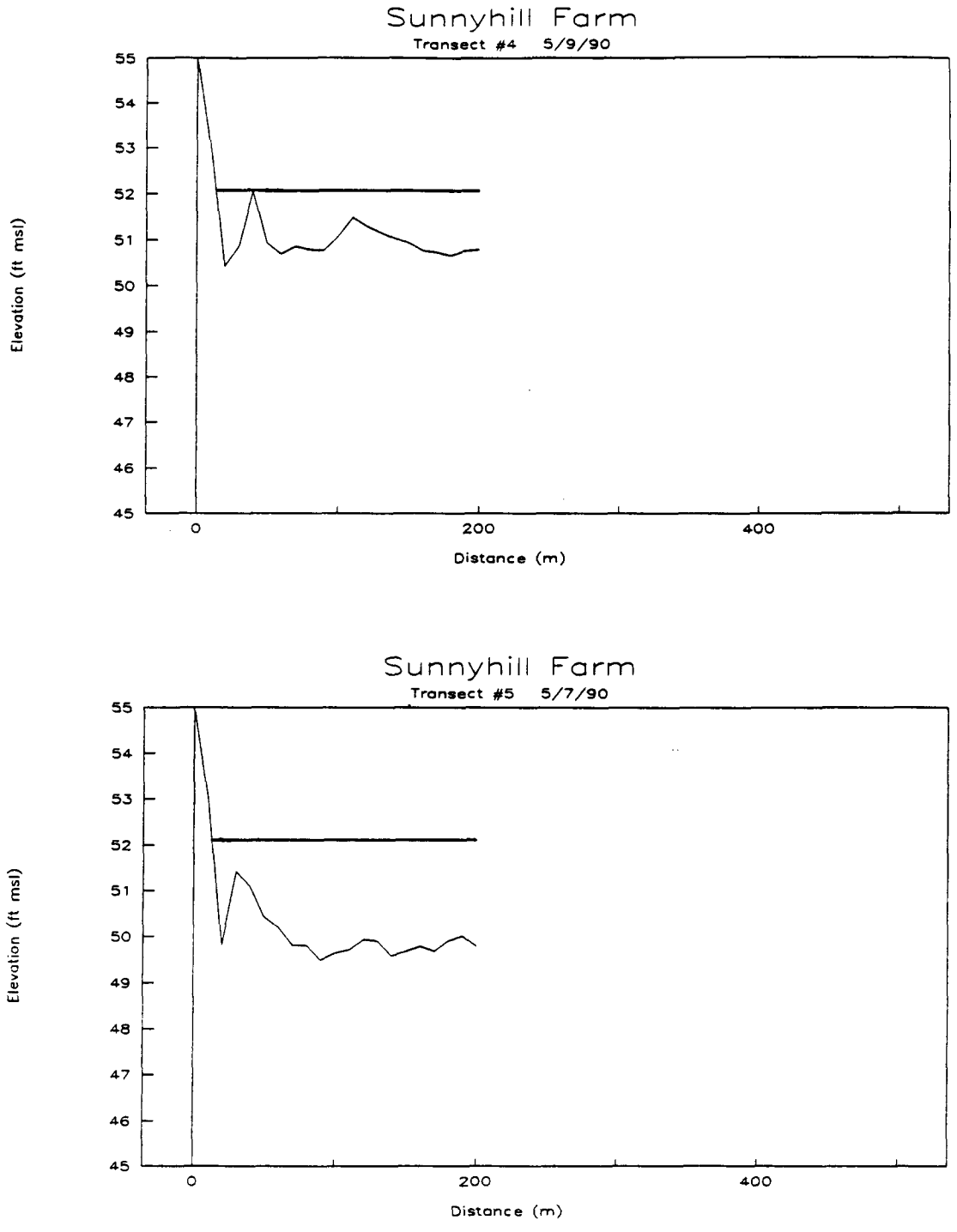

Figure A4. Elevation profile and surface water level for transects #4 (top) and #5 (bottom), May 7, 1990.

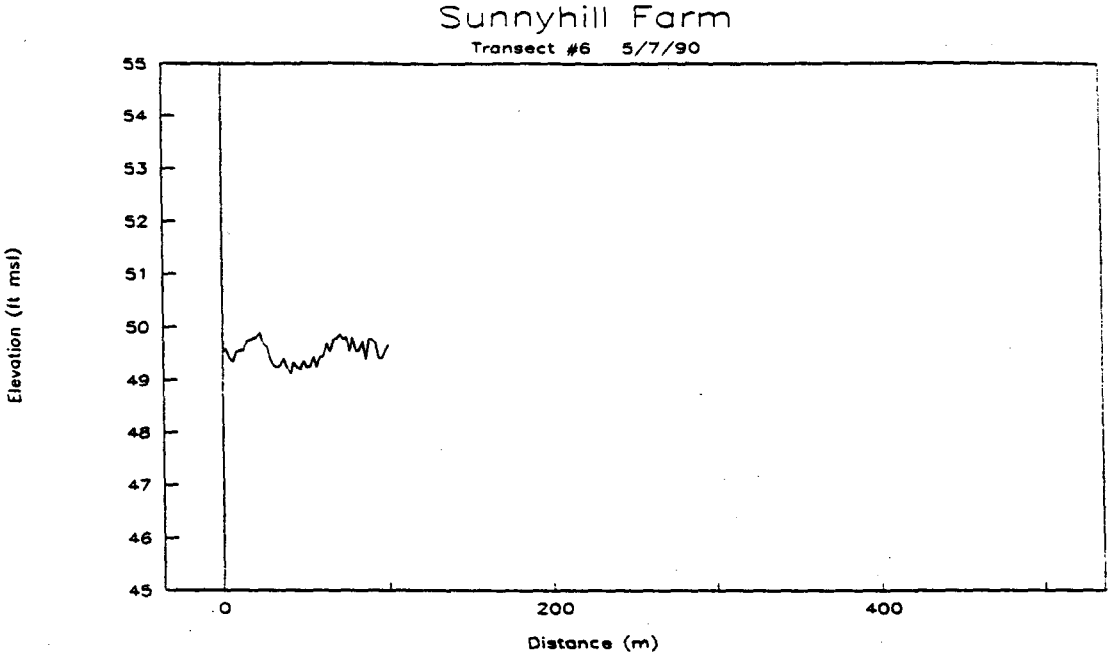

Figure A5. Elevation profile and surface water level for transect #6, May 7, 1990.

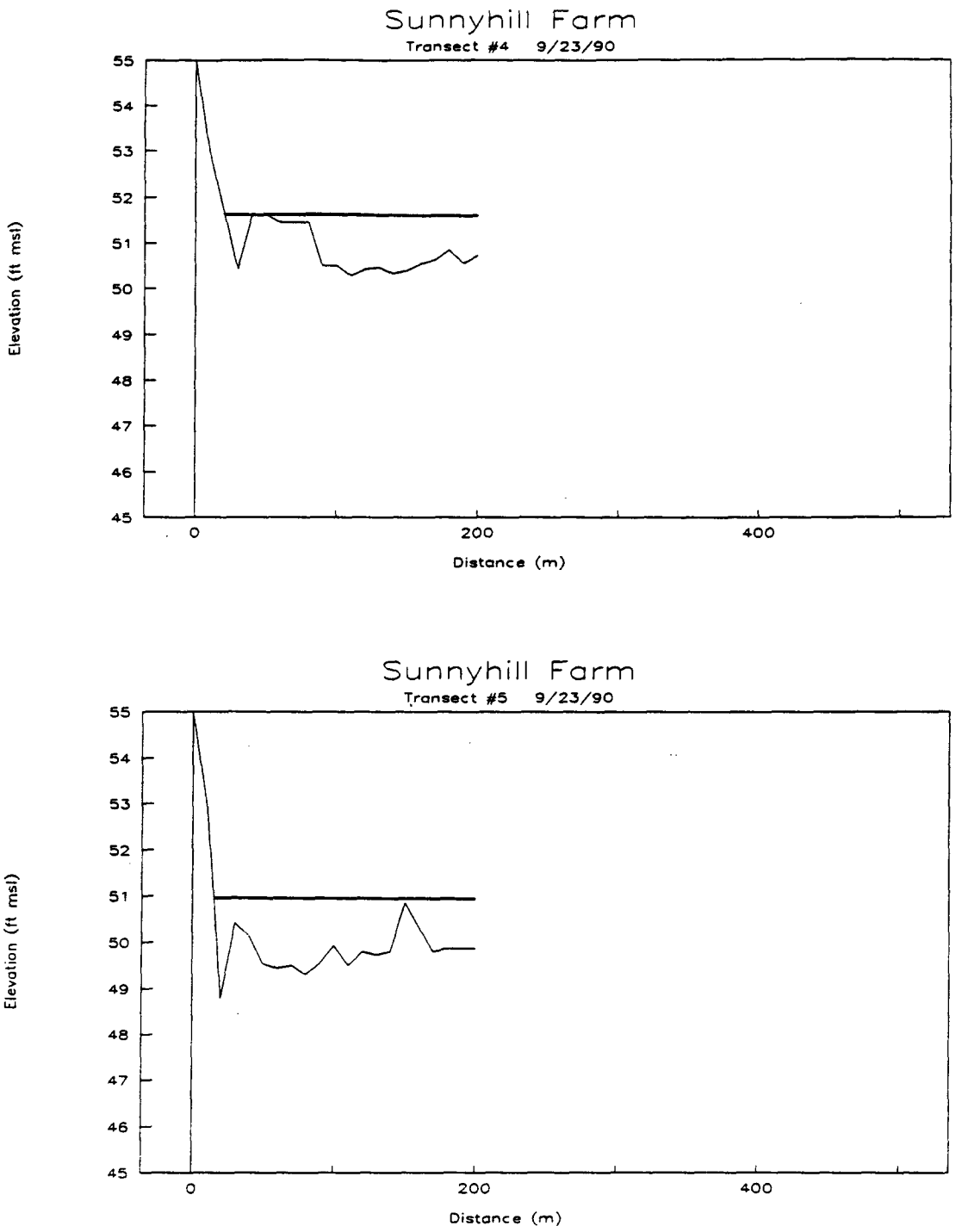

Figure A6. Elevation profile and surface water level for transects #4 (top) and #5 (bottom), September 23, 1990.

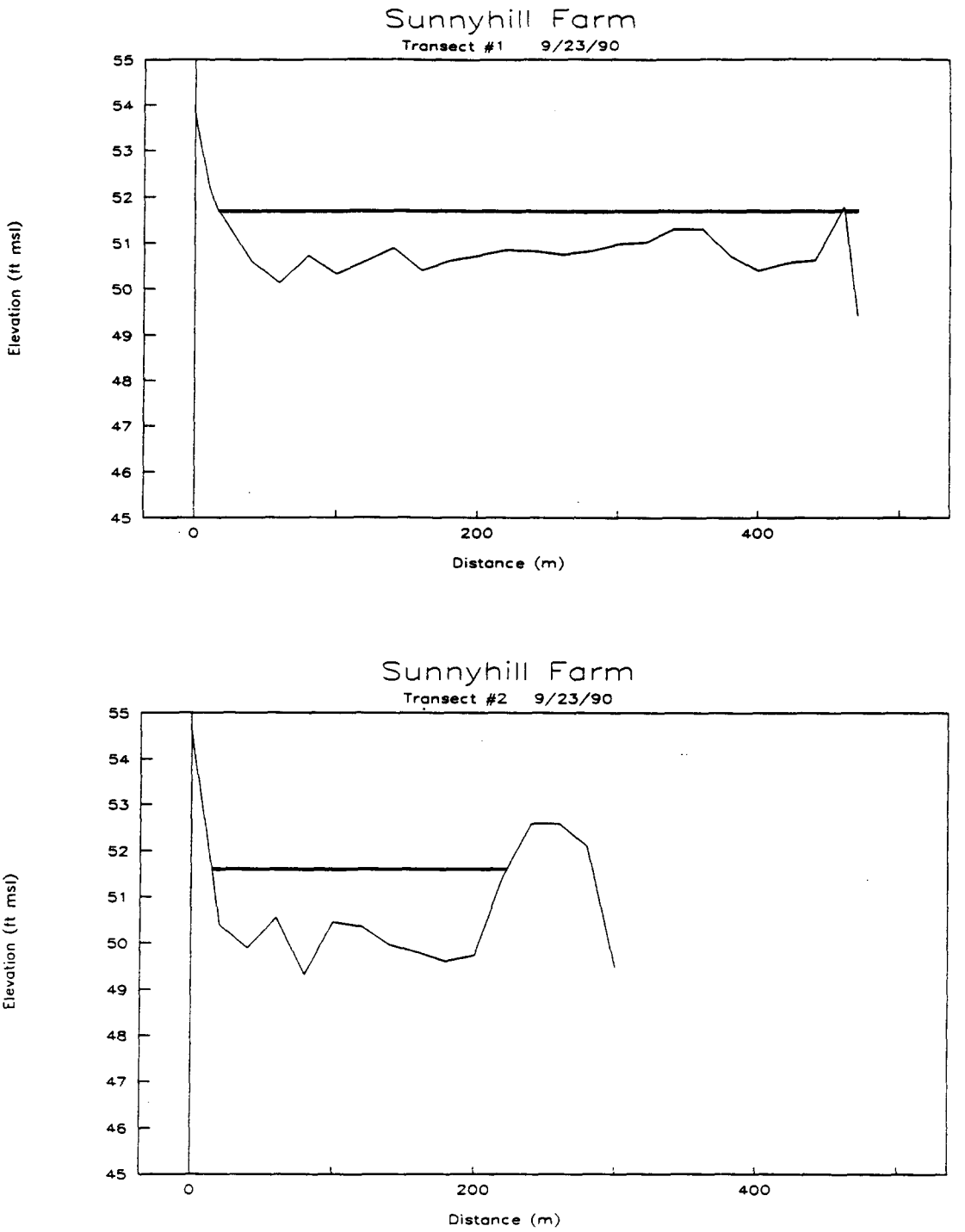

Figure A7. Elevation profile and surface water level for transects #1 (top) and #2 (bottom), September 23, 1990.

Appendix B

Table B1a. Percent cover of species in plots along transect #1, September 1989.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Eichhornia crassipes		100	100	100	80	5	100	100	50	40	20	100	100	90	90	90	100	90	95	100	100	100	100	50	90
Lemna spp.		60	90	90	80	80	90	75	40	90	2	70	90	90	90	80	90	80	80	80	45	80	70	30	80
Salvinia rotundifolia		80	10	50	70	60	50	50	25	80	5	60	40	70	60	3		40	50	50	25	40	30	5	60
Wolffiella gladiata				80	20	90	70	45	35	80	30	20	80	80	70	15	80	50	50	40	45			1	
Hydrocotyle ranunculoides			20	20	10		20	15	5	20	2		10	5	10	10		2	50	5	20		2		10
Typha spp.					10	100				100				20											
Wolffia spp.																		70	80						
Polygonum densiflorum															10										20
Ludwigia leptocarpa																								50	
Sagittaria latifolia																								10	
Total species per plot:		3	4	5	6	5	5	5	5	6	5	4	5	6	6	5	3	6	6	5	5	3	4	6	5

Table B1b. Pielou value of species in plots along transect #1, September 1989.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Eichhornia crassipes		3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Lemna spp.		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Salvinia rotundifolia		3	2	3	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3	3	3	3	2	3
Wolffiella gladiata				3	3	3	1	2	3	1	2	3	3	3	3	3	1	2	2	2	2			1	
Hydrocotyle ranunculoides			2	3	2		3	2	2	2	1		2	2	2	2		1	3	3	3		2		2
Typha spp.					2	3				3				2											
Wolffia spp.																		2	2						
Polygonum densiflorum															2										2
Ludwigia leptocarpa																								3	
Sagittaria latifolia																								2	

Table B2a. Percent cover of species in plots along transect #2, September 1989.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Lemna spp.		70	30	2	30	100	99	95	100	100	99	99	30	20	50	10	20	60	50	50	30
Wolffiella gladiata		70	50	10	25	100	99	80	100	100	99	99	80	40	60	50	60	100	100	100	100
Eichhornia crassipes		25	95	95	98	10	95	95		10			100	90	100	100	100	10	30	5	45
Salvinia rotundifolia		40	50	50	10	2			3	10	70	60	90	70	70	80	90	90	90	90	95
Typha spp.								30													
Ludwigia spp.		15																			
Juncus effusus																					
Hydrocotyle ranunculoides		2					5	25	15												
Commelina diffusa																					
Panicum spp.		10																			
Cyperus spp.		30																			
Cassia obtusifolia																					
Pontederia cordata		35																			
Eclipta alba																					
Eupatorium spp.		3																			
Ipomoea trifida		2																			
Sambucus canadensis																					
Aster subulatus		10																			
Scirpus spp.																					
Wolffia spp.																					
Polygonum lapathifolium																					
Total species per plot:		12	4	4	4	4	4	5	4	4	3	3	4	4	4	4	4	4	4	4	4

Table B2a. cont'd.

Species	Plot #:	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Lemna spp.		35	30	85	80	2	2	100	50	10	15	1	2	80	80	80	50	80	99	90
Wolffiella gladiata		90	20	80	10	2	2	5	5	20					30	30		99	99	99
Eichhornia crassipes		55	75											10	10	50	50	90		10
Salvinia rotundifolia		30	85	45						100							10		5	15
Typha spp.			80	30						100				60	90	80	30			
Ludwigia spp.				50	5	20	10				50		5	50			5			
Juncus effusus			15	70	90	10	5							30	20					
Hydrocotyle ranunculoides		50				10										5	5			
Commelina diffusa				20	15	5					10		70			2	15			
Panicum spp.								55	85								40			
Cyperus spp.				20	80		1										5			
Cassia obtusifolia						2	85					80								
Pontederia cordata																		10		90
Eclipta alba						10					50		5	5						
Eupatorium spp.						15								10						
Ipomoea trifada											1	10								
Sambucus canadensis									90											
Aster subulatus																				
Scirpus spp.						4														
Wolffia spp.		2																		
Polygonum lapathifolium																	1			
Total species per plot:		6	6	8	6	10	6	3	4	4	5	3	4	7	5	6	10	4	3	5

Table B2b. Pielou value of species in plots along transect #2, September 1989.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Lemna spp.		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Wolffiella gladiata		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Eichhornia crassipes		1	3	3	3	3	3	3		3			3	3	3	3	3	2	3	2	3
Salvinia rotundifolia		3	3	3	3	3			3	3	3	3	3	3	3	3	3	3	3	3	3
Typha spp.								3													
Ludwigia spp.		2																			
Juncus effusus																					
Hydrocotyle ranunculoides		2					3	3	3												
Commelina diffusa																					
Panicum spp.		2																			
Cyperus spp.		3																			
Cassia obtusifolia																					
Pontederia cordata		3																			
Eclipta alba																					
Eupatorium spp.		1																			
Ipomoea trifida		1																			
Sambucus canadensis																					
Aster subulatus		1																			
Scirpus spp.																					
Wolffia spp.																					
Polygonum lapathifolium																					

Table B2b. cont'd.

Species	Plot #:	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Lemna spp.		3	3	3	3	1	3	3	3	3	2	2	2	3	3	3	3	3	3	3
Wolffiella gladiata		3	3	3	3	1	3	3	3	3					3	3		3	3	3
Eichhornia crassipes		3	3											2	2	3	3	3		2
Salvinia rotundifolia		3	3	3						3							2		2	2
Typha spp.			3	3						3				3	3	3	3			
Ludwigia spp.				3	3	3	3				3		2				1			
Juncus effusus			3	3	3	3	1							2	2					
Hydrocotyle ranunculoides		3				3										2	2			
Commelina diffusa				3	3	3					2		3			2	3			
Panicum spp.								3	3								3			
Cyperus spp.				3	3		1										2			
Cassia obtusifolia						3	3					3								
Pontederia cordata																		2		3
Eclipta alba						2					3		2	2						
Eupatorium spp.						2								2						
Ipomoea trifida											1	2								
Sambucus canadensis									3											
Aster subulatus																				
Scirpus spp.						1														
Wolffia spp.			2																	
Polygonum lapathifolium																	1			

Table B3a. Percent cover species in plots along transect #3, September 1989.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cassia obtusifolia			4	90	30	10	100	50	20	80	99	100	100	90	100	100	100	100	90		80
Commelina diffusa				70	5														10	10	60
Verbena scabra		80	40	3		20	20	90		15											
Ludwigia spp.						10			5									10	25	20	30
Eupatorium spp.						80		15			15									5	
Sedge spp.															1	50		3	10		
Zizaniopsis miliacea		20	5	3	25																
Hydrocotyle ranunculoides		5	20						5											15	
Murdannia nudiflora																				5	
Cyperus spp.																	25	5		5	
Oxalis spp.									1						1	5	10				
Sorghum halepense												2	1	50							
Phyllanthus urinaria			1	1	1	2															
Juncus effusus																		5	5	25	
Salvinia rotundifolia																				95	
Panicum hemitomon									40	10											
Melothria pendula						30	5														
Rubus argutus									25	10											
Digitaria ciliaris																					
Eclipta alba																					
Ipomoea trifida					15																
Lemna spp.																				10	
Fimbristylis autumnalis																					
Wolffiella spp.																				5	
Total species per plot		3	5	5	5	6	3	3	6	4	2	2	2	2	3	3	3	5	6	9	3

Table B3a. cont'd.

Species	Plot #:	21	22	23	24	25	26	27	28	29
Cassia obtusifolia		99	99	99	10	80	90	90	90	30
Commelina diffusa		25	90	70	90	80	50	70	80	70
Verbena scabra										
Ludwigia spp.					10					70
Eupatorium spp.										
Sedge spp.				3						
Zizaniopsis miliacea										
Hydrocotyle ranunculoides										
Murdannia nudiflora						25		10		1
Cyperus spp.									5	
Oxalis spp.										
Sorghum halepense										
Phyllanthus urinaria										
Juncus effusus										
Salvinia rotundifolia										
Panicum hemitomon										
Melothria pendula										
Rubus argutus										
Digitaria ciliarsis				10	10					
Eclipta alba									2	5
Ipomoea trifida										
Lemna spp.										
Fimbristylis autumnalis								5		
Wolffiella spp.										
Total species per plot		2	2	3	4	4	2	4	4	5

Table B3b. Pielou value of species in plots along transect #3, September 1989.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cassia obtusifolia			3	3	3	2	3	3	2	3	3	3	3	3	3	3	3	3	3		3
Commelina diffusa				3	2														3	2	3
Verbena scabra		3	3	2		3	2	3		2											
Ludwigia spp.						2			2									2	3	2	3
Eupatorium spp.						3		2			2									2	
Sedge spp.															3	3		3	2		
Zizaniopsis miliacea		3	2	2	2																
Hydrocotyle ranunculoides		2	3						2											3	
Murdannia nudiflora																			2		
Cyperus spp.																	3	2		2	
Oxalis spp.									1						3	3	3				
Sorghum halepense												3	3	3							
Phyllanthus urinaria			1	1	1	2															
Juncus effusus																		1	2	3	
Salvinia rotundifolia																				3	
Panicum hemitomon									3	2											
Melothria pendula						3	2														
Rubus argutus									3	2											
Digitaria ciliaris																					
Eclipta alba																					
Ipomoea trifida					2																
Lemna spp.																				3	
Fimbristylis autumnalis																					
Wolffiella spp.																				2	

Table B3b. cont'd.

Species	Plot #	21	22	23	24	25	26	27	28	29
Cassia obtusifolia		3	3	3	2	3	3	3	3	3
Commelina diffusa		3	3	3	3	3	3	3	3	3
Verbena scabra										
Ludwigia spp.					2					3
Eupatorium										
Sedge spp.				2						
Zizaniopsis miliacea										
Hydrocotyle ranunculoides										
Murdannia nudiflora						2		2		1
Cyperus spp.									2	
Oxalis spp.										
Sorghum halepense										
Phyllanthus urinaria										
Juncus effusus										
Salvinia rotundifolia										
Panicum hemitomon										
Melothria pendula										
Rubus argutus										
Digitaria ciliaris					2	2				
Eclipta alba									2	2
Ipomoea trifida										
Lemna spp.										
Fimbristylis autumnalis								2		
Wolffiella spp.										

Appendix C

Table C1a. Percent cover of species along transect #1, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Amaranthus australis																								10	
Azolla caroliniana			2	3				20		25	25		2	25								2			
Cyperus strigosus																								25	
Eclipta alba																								30	
Eichhornia crassipes		95	99	99			30	80	15	99	50	95	90	90	75	70	90	99	99	99	99	20	90	30	
Eupatorium capillifolium																								5	
Hydrocotyle ranunculoides		10	30	5	5	10	15	50	93	15	90		70	25		5	5	5	20	40	15	99	30	70	99
Lemna spp.											2								5		5		2		
Polygonum spp.						5					40	15													
Rumex pulcher																								5	
Salvinia rotundifolia							2	5	5					2					5						
Spirodela spp.														2											
Typha spp.		20			99	80	75	5	50			60			99	60									
Wolffia spp.											5														
Total species per plot		3	3	3	2	3	4	5	4	3	6	3	3	5	3	3	2	2	4	2	3	3	3	7	2

Table C1b. Pielou value of species in plots along transect #1, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Amaranthus australis																								2	
Azolla caroliniana			2	2				2		2	2		2	3								1			
Cyperus strigosus																								2	
Eclipta alba																								3	
Eichhornia crassipes		3	3	3			3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Eupatorium capillifolium																								1	
Hydrocotyle ranunculoides		2	3	2	2	2	2	3	3	2	3		3	3		2	2	2	3	3	3	3	3	3	3
Lemna spp.											1				2				2		1		2		
Polygonum spp.						2					3	2													
Rumex pulcher																								2	
Salvinia rotundifolia							2	2	2					2					2						
Spirodela spp.														1											
Typha spp.		3			3	3	3	2	3			.3			3	3									
Wolffia spp.											1														

Table C2a. Percent cover of species along transect #2, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Azolla caroliniana																					
Carex alba																					
Cassia obtusifolia																					
Cyperus haspan																					
Digitaria bicornis																					
Eclipta alba																					
Eichhornia crassipes			99	99	85	99	5		75	40	95	80	99	99	99	99	99	99	99	99	45
Erechtites hieracifolia																					
Eupatorium capillifolium																					
Eupatorium jucundum																					
Gnaphalium falcatum																					
Hydrocotyle ranunculoides							15														
Juncus effusus																					
Juncus marginatus																					
Lemna spp.		10			2			10													
Linaria canadensis																					
Panicum anceps																					
Panicum distichum																					
Pontederia cordata		99																			
Rhynchospora spp.																					
Rubus argutus																					
Rumex pulcher																					
Salvinia rotundifolia		25			25		15		20	15	30	60	10				2	30		2	80
Senecio glabellus																					
Solidago spp.																					
Spirodela spp.						2	95	70	25	25	5	10	5								
Typha domingensis								90													
Wolffiella gladiata							10		5												
Total species per plot		3	1	1	3	2	5	3	4	3	3	3	3	1	1	1	2	2	1	2	2

Table C2a. cont'd.

Species	Plot #:	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Azolla caroliniana			40						1		70	40									
Carex alba										5											
Cassia obtusifolia						5		5	1	5											
Cyperus haspan				60	30		5			5											
Digitaria bicornis				20	50	80	50	40	50												
Eclipta alba				50	3	5	5														
Eichhornia crassipes																					
Erechtites hieracifolia				5	5		5			5			1								
Eupatorium capillifolium				20	35	15	60	30	60	10			5								
Eupatorium jucundum								3													
Gnaphalium falcatum					5		1	2	1	1											
Hydrocotyle ranunculoides			5	5		5	10				30			40	5	99	99	99	99	99	
Juncus effusus			50	15						90	20	70									
Juncus marginatus				10	30	3		75	30	20											
Lemna spp.		2																			
Linaria canadensis				1	1	5	15		1	1											
Panicum anceps													25	30	99						
Panicum distichum						5															
Pontederia cordata												15									
Rhynchospora spp.					5																
Rubus argutus													5								
Rumex pulcher							1	3													
Salvinia rotundifolia		99	25									40			5						2
Senecio glabellus				1						1											
Solidago spp.							5	5	5		1										
Spirodela spp.		1	80								30			99	5	20	20	5	5	30	30
Typha domingensis		80	50																		
Wolffiella gladiata											30	10		5	2		5			2	10
Total species per plot		4	6	10	9	8	10	8	8	10	6	5	4	4	5	2	3	2	2	3	3

Table C2b. Pielou value of species in plots along transect #2, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Azolla caroliniana																					
Carex alba																					
Cassia obtusifolia																					
Cyperus haspan																					
Digitaria bicornis																					
Eclipta alba																					
Eichhornia crassipes			3	3	3	3	2		3	3	3	3	3	3	3	3	3	3	3	3	3
Erechtites hieracifolia																					
Eupatorium capillifolium																					
Eupatorium jucundum																					
Gnaphalium falcatum																					
Hydrocotyle ranunculoides							2														
Juncus effusus																					
Juncus marginatus																					
Lemna spp.		2			2			3													
Linaria canadensis																					
Panicum anceps																					
Panicum distichum																					
Pontederia cordata		3																			
Rhynchospora spp.																					
Rubus argutus																					
Rumex pulcher																					
Salvinia rotundifolia		3			3		2		3	2	3	3	2				1	3		2	3
Senecio glabellus																					
Solidago spp.																					
Spirodela spp.						2	3	3	3	3	2	2	2								
Typha domingensis								3													
Wolffiella gladiata							2		2												

Table C2b. cont'd.

Species	Plot #:	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Azolla caroliniana			3						0		3	3									
Carex alba										0											
Cassia obtusifolia						2		2	1	2											
Cyperus haspan				3	3		2			2											
Digitaria bicornis				3	3	3	3	3	3												
Eclipta alba				3	2	2	2														
Eichhornia crassipes																					
Erechtites hieracifolia				2	2		2			2			1								
Eupatorium capillifolium				3	3	3	3	3	3	2			2								
Eupatorium jucundum								2													
Gnaphalium falcatum					2		1	2	0	1											
Hydrocotyle ranunculoides			2	2		2	2				3			3	2	3	3	3	3	3	
Juncus effusus			3	2						3	3	3									
Juncus marginatus				2	3	2		3	3	3											
Lemna spp.		1																			
Linaria canadensis				1	1	2	2		0	2											
Panicum anceps													3	3	3						
Panicum distichum						2															
Pontederia cordata												3									
Rhynchospora spp.					2																
Rubus argutus													2								
Rumex pulcher							0	2													
Salvinia rotundifolia		3	3									3			2						1
Senecio glabellus				0						1											
Solidago spp.							2	2	2		1										
Spirodela spp.		1	3								3			3	2	3	3	2	2	3	3
Typha domingensis		3	3																		
Wolffiella gladiata											3	2		2	0		1			0	2

Table C3a. Percent cover of species along transect #4, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Azolla caroliniana				10	10	15	2						5							
Eichhornia crassipes					99	99	99	99	99	99		50	99	99	99	99	99	99	99	99
Habenaria repens																5				
Hydrocotyle ranunculoides		80	70	45	5		5	5			5	5	2	5	2	1				
Hydrocotyle umbellata		45	25	25			20									3		2		
Juncus effusus		25		20																
Polygonum spp.						15		2												
Pontederia cordata			80	60					50											
Salvinia rotundifolia		40		2		10		2			2		2	2	2	2		1	2	2
Spirodela spp.				40			2													
Typha spp.											50	85								
Wolffiella gladiata											30									
Total species per plot		4	3	7	3	4	5	4	2	1	4	3	4	3	3	5	1	3	2	2

Table C3b. Pielou value of species in plots along transect #4, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Azolla caroliniana				2	3	3	2						2							
Eichhornia crassipes					3	3	3	3	3	3		3	3	3	3	3	3	3	3	3
Habenaria repens															3					
Hydrocotyle ranunculoides		3	3	3	2		3	3			2	2	2	2	2	3				
Hydrocotyle umbellata		3	3	3			3									3		2		
Juncus effusus		3		3																
Polygonum spp.						3		3												
Pontederia cordata			3	3					3											
Salvinia rotundifolia		3		1		2		2			2		2	2	2	2		2	2	2
Spirodela spp.				3			2													
Typha spp.											3	3								
Wolffiella gladiata											3									

Table C4a. Percent cover of species along transect #5, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Alternanthera philoxeroides								25												
Azolla caroliniana				45																
Eichhornia crassipes					50		50													5
Hydrocotyle ranunculoides			5				10	40	5	30		5	5	40	5	5	10	5	5	10
Hydrocotyle umbellata																15				
Lemna spp.			5		1	1		5	80	90	70	90	75	80	50	70	80	70	70	50
Limnobium spongia		20		40	50	99	50	90	30	30	5	10		20	5	70	5	2		
Panicum hemitomon		60	80																	
Pontederia cordata			30	50												15				
Salvinia rotundifolia		70	20	5	20	25	30	5		5		10	2		5	30	10	25	10	10
Scirpus cyperanus		20																		
Spirodela spp.					5			5	5	20	30	10	25	20	50	40	20	40	30	50
Typha spp.			50	90																
Wolffiella gladiata									5		5		5	5	5	5	5	5	5	5
Total species per plot		4	6	5	5	3	4	6	5	5	4	5	5	5	6	8	6	6	5	6

Table C4b. Pielou value of species in plots along transect #5, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Alternanthera philoxeroides								3												
Azolla caroliniana				3																
Eichhornia crassipes					3		3													3
Hydrocotyle ranunculoides			2				3	3	2	3		2	2	3	3	2	3	2	3	1
Hydrocotyle umbellata																3				
Lemna spp.			2		1	1		2	3	3	3	3	3	3	3	3	3	3	3	3
Limnobium spongia		3		3	3	3	3	3	3	3	2	2		3	3	3	2	3		
Panicum hemitomon		3	3																	
Pontederia cordata			3	3												2				
Salvinia rotundifolia		3	3	2	3	3	3	2		2		2	2		2	3	3	3	3	3
Scirpus cyperanus		2																		
Spirodela spp.					2			2	3	3	3	2	3	3	3	3	3	3	3	3
Typha spp.			3	3																
Wolffiella gladiata									2		2		2	2	2	2	2	2	2	2

Table C5. DBH (cm) measurements for tree species on transect #6, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10
Acer rubrum		44.5	7.8	45.8	4.0	9.0	4.8	15.5	6.5	7.5	4.5
		9.8	51.5	26.8	25.0	27.5	2.5	9.0	7.2	42.5	1.8
		22.2	5.5		14.2	18.0	6.8	9.0	7.0	2.3	19.5
		3.5			7.0	31.5	34.0	15.2	6.8	30.5	22.0
		5.8			6.5	53.0	27.5			23.0	20.0
					35.5	6.5	11.5			7.2	
					6.5						
					5.0						
					26.5						
					14.0						
					17.0						
Camphor spp.							3.0				
Cephalanthus occidentalis							3.5				
Ilex cassine				3.3		2.5					
				6.5		8.5					
						3.3					
Magnolia virginiana			1.0								
Myrica cerifera		2.5	3.8	2.6	2.5	1.5	4.2			2.3	1.7
		4.8	1.0	2.3		1.7	3.5				2.2
		2.6	1.7			1.8	1.8				1.4
		4.4	2.3			1.9	2.0				
		1.9	1.8			2.0					
			1.7			2.6					
			1.6								
Nyssa sylvatica		54.3	17.0					16.0	31.0		
Quercus spp.										10.2	

Table C6. Percent cover for herbaceous plots on Transect #6, May 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10
Ampelopsis spp.					5	10					
Myrica cerifera			10								
Osmunda cinnamomea				30	10	99		20			
Osmunda regalis		20	75		35	25	99		65		
Rubus argutus										15	20
Parthenocissus quinquefolia		1									
Saururus cernuus						5		80		10	5
Smilax spp.		1									
Vitus spp.								20			5

Appendix D

Table D1a. Percent cover of species along transect #1, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Amaranthus australis																								40	
Azolla caroliniana												1													
Cyperus strigosus																							15		
Eichhornia crassipes	40	99	99	90	90	80	99	50	99	90	99	90	99	80	90	99	70	90	90	80	80	70		50
Hydrocotyle ranunculoides		5	5		50		5	70	10	1	20		3	40	10		5	15	80	60	70	99		20
Ipomoea trifida																							10		
Lemna spp.					50	40			1	10				40	2	2	5	15	5	15	70	80	20	10
Limnobium spongia						5								2							5			
Ludwigia leptocarpa			1														70	5	15	50		3		
Polygonum densiflorum										20	1										25			70
Sagittaria latifolia	60							40															40	30
Salvinia rotundifolia		10	10	50	25	5	30	60	3	15	5	60	30	90	2		2	60		5	1		40	70
Spirodela spp.					5	5			2		1		2	25	1					15	30	50		
Typha domingensis	70		2	25	30	50						10		5	50		40	40		5	60			
Wolffiella gladiata						40								25							2			
Total species per plot	3	3	5	3	6	6	3	4	5	5	6	3	4	7	6	2	6	6	4	7	8	6	5	6

Table D1b. Pielou value of species in plots along transect #1, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Amaranthus australis																								3	
Azolla caroliniana												1													
Cyperus strigosus																							2		
Eichhornia crassipes		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		3
Hydrocotyle ranunculoides			2	2		3		2	3	2	2	3		2	3	2		2	3	3	3	3	3		3
Ipomoea trifida																								2	
Lemna spp.						3	3			2	2				3	2	2	2	3	2	2	3	3	2	2
Limnobium spongia							2								2							2			
Ludwigia leptocarpa				2														3	2	2	3		3		
Polygonum densiflorum											2	2										3			3
Sagittaria latifolia		3							3															3	2
Salvinia rotundifolia			2	2	3	3	2	3	3	2	2	2	3	3	3	2		2	3		2	1		3	3
Spirodela spp.						2	2			2		1		2	3	2					2	3	3		
Typha domingensis		3		2	3	3	3						2		2	3		3	3		2	3			
Wolffiella gladiata							3								3							2			

Table D2a. Percent cover of species along transect #2, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cassia obtusifolia												5				
Commelina diffusa												1				
Cyperus haspan												5	5			
Cyperus strigosus																5
Digitaria ciliaris														15		
Eclipta alba		10											5	30		
Eichhornia crassipes		90	99	15		90	99	99	99	99	99				15	
Eupatorium capillifolium													5			
Eupatorium compositifolium																15
Fuirena pumila														10		
Gnaphalium falcatum													2			
Hydrocotyle ranunculoides				70	30		1				10	5				70
Juncus effusus													99		70	
Juncus megacephelus													10			
Leersia hexandra														30		
Lemna spp.				15			3			1	1	10			60	50
Ludwigia leptocarpa												20		5		
Ludwigia peruviana		20														
Luziola fluitans													10			
Mikania scandens														3	1	
Polygonum punctatum											1	25		2		
Salvinia rotundifolia			99	90	90	90	90	3		90	99	80			1	
Sesbania exaltata														1		
Spirodela spp.			1	30	5	5	2	1	2	1						50
Typha domingensis				70	15							80			30	
Wolffiella gladiata				30	10					1	5					
Wolfia spp.						5	1									
Total species per plot		3	3	7	5	4	6	3	2	5	6	9	7	9	6	4

Table D2b. Pielou value of species in plots along transect #2, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cassia obtusifolia												2				
Commelina diffusa												1				
Cyperus haspan												2	2			
Cyperus strigosus																2
Digitaria ciliaris														3		
Eclipta alba		2											2	3		
Eichhornia crassipes		3	3	2		3	3	3	3	3	3				2	
Eupatorium capillifolium													2			
Eupatorium compositifolium														2		
Fuirena pumila														2		
Gnaphalium falcatum													2			
Hydrocotyle ranunculoides				3	3		2				2	2				3
Juncus effusus													3		3	
Juncus megacephelus													2			
Leersia hexandra														3		
Lemna spp.				2			2			2	2	3			3	3
Ludwigia leptocarpa												2		0		
Ludwigia peruviana		3														
Luziola fluitans													2			
Mikania scandens														0	2	
Polygonum punctatum											2	3		2		
Salvinia rotundifolia			3	3	3	3	3	2		3	3	3			2	
Sesbania exaltata														0		
Spirodela spp.			2	3	2	2	2	2	2	2						3
Typha domingensis				3	2							3			3	
Wolffiella gladiata				3	2					2	2					
Wolffia spp.						2	2									

Table D3a. Percent cover of species along transect #4, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Cyperus strigosus													5						
Eclipta alba					2														
Eichhornia crassipes								99	99	90	99	99	70	99	99	99	20	99	99
Hydrocotyle ranunculoides		80					10												
Ipomoea trifida				20															
Juncus effusus					70														
Lemna spp.							10												
Ludwigia peruviana			1	80															
Mollugo verticillata					5														
Panicum dichotimoflorum				5															
Panicum hemitomon		90	99	10					2	40			50				80	10	
Polygonum punctatum												10						1	
Pontederia cordata					40	40	90												
Sacciolepis striata										20									
Sagittaria latifolia				25		90	10												
Salvinia rotundifolia		80			30	70	50						50		1				
Typha domingensis					50	70	10												
Utricularia spp.		50																	
Wolffiella gladiata		80				50	50												
Total species per plot		2	2	4	3	0	2	1	2	2	1	2	3	1	1	1	2	3	1

Table D3b. Pielou value of species in plots along transect #4, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Cyperus strigosus													2						
Eclipta alba					1														
Eichhornia crassipes								3	3	3	3	3	3	3	3	3	3	3	3
Hydrocotyle ranunculoides		3					2												
Ipomoea trifida				3															
Juncus effusus					3														
Lemna spp.							2												
Ludwigia peruviana			2	3															
Mollugo verticillata					2														
Panicum dichotimoflorum				2															
Panicum hemitomon		3	3	2					2	3			3				3	2	
Polygonum punctatum												2						2	
Pontederia cordata					3	3	3												
Sacciolepis striata										3									
Sagittaria latifolia				3		3	2												
Salvinia rotundifolia		3			3	3	3						3		1				
Typha domingensis					3	3	2												
Utricularia spp.		3																	
Wolffiella gladiata		3				3	3												

Table D4a. Percent cover of species along transect #5, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alternanthera philoxeroides					50		25			10	15	30	70	25	60	50			40
Hydrocotyle ranunculoides		1	20	10	40	25	15	40	20	15	10	5	30	5	5	50	80	80	70
Hydrocotyle umbellata										5						5			
Juncus effusus															10				
Lemna spp.		2	5							40		20	10		10	5	10	70	70
Limnobium spongia		99	60	99	80	90	99	99	99	80	90	90	80		60	75	85	90	99
Panicum repens		5																	
Polygonum punctatum												10							
Pontederia cordata										25				99					
Salvinia rotundifolia		99	60	99	80	90	80	99	99	99	90	90	70		40	50	80	80	30
Spirodela spp.			15	40	20	60	30	15	30	30	10	10	1		1		2	40	10
Wolffiella gladiata			15	10	20	90	80	80	90	80	70	5	10				10	30	70
Total species per plot		5	6	5	6	5	6	5	5	9	6	8	7	3	7	6	6	6	7

Table D4b. Pielou value of species in plots along transect #5, September 1990.

Species	Plot #:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alternanthera philoxeroides					3		3			3	3	3	3	3	3	3			3
Hydrocotyle ranunculoides		2	3	2	3	3	3	3	3	2	2	2	3	2	2	3	3	3	3
Hydrocotyle umbellata										2						2			
Juncus effusus															2				
Lemna spp.		2	2							3		3	3		2	3	2	3	3
Limnobium spongia		3	3	3	3	3	3	3	3	3	3	3	3		3	3	3	3	3
Panicum repens		2																	
Polygonum punctatum												2							
Pontederia cordata										3				3					
Salvinia rotundifolia		3	3	3	3	3	3	3	3	3	3	3	3		3	3	3	3	3
Spirodela spp.			3	3	3	3	3	2	3	3	2	2	1		1		2	3	3
Wolffiella gladiata			3	2	3	3	3	3	3	3	3	2	3				2	3	3

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