

Defining nest site microhabitats and preferences to aid in the recovery of the Cape Sable
seaside sparrow.

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Abstract. Protecting habitats that provide suitable breeding habitat is critical for the recovery of endangered birds. Thus far, managers have been inhibited in protecting appropriate habitats for the endangered Cape Sable seaside sparrow because most of the sparrow's range lies within inaccessible regions of the everglades ecosystem. From 1997-1999 we collected microhabitat variables around 110 sparrow nests located across the sub-species' range. We can identify only two microhabitat variables that differ between nest sites located in spatially distinct regions of the sparrow's range, or sub-populations. These are a decrease in dominance of muhly grass outside of the most accessible sub-population (B) and a decrease in the degree of vegetative clumping within the western-most sub-population (A). This indicates that Cape Sable seaside sparrows have a relatively 'fixed' preference for nest site vegetative structure. When we compared nest site microhabitats to available, but unused, microhabitats within territories we identified a suite of vegetative cues sparrows use for nest placement. In particular, this includes a moderately high dominance of sawgrass. The presence of sawgrass (dead and alive) contribute preferred structural characteristics such as high ground cover, high vegetation heights (used as perching substrate), moderately high coverage of dead vegetation and vegetative clumping. These results provide managers with a better understanding of the habitat requirements of breeding Cape Sable seaside sparrows. What remains to be tested, however, is how variations in these preferred habitat characters influence nest predation and thus annual productivity.

Keywords: Cape Sable seaside sparrow, endangered birds, everglades, grasslands, microhabitats, nesting preferences.

Introduction

A manager's inability to ensure suitable nesting habitat can spell disaster for avian species living perilously close to the edge of extinction (Vickery et al. 1992, Martin 1993). The nesting season can be critical to the maintenance of bird populations (Martin and Roper 1988, Brittingham and Temple 1996, Burhans 1997). The choice of nest site can substantially reduce the rate at which nests are lost to predation (Holway 1991, Rohrbaugh and Yahner 1997, Howlett and Stutchbury 1996, Tarvin and Smith 1995, Ricklefs 1969, Angelstam 1986). Nest site choice can also reduce the negative effects of unfavorable microclimatic variables on eggs or nestlings (With and Webb 1993, Salzman 1982). The availability of preferred nest sites can thereby increase substantially the number of fledged young per nest and thus annual productivity. Further, any preferences for nest sites may be fixed for a given species through their evolutionary history making them extremely vulnerable to habitat degradation (Martin 1993). One such species may be the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*); a federally endangered sub-species that exists exclusively within the everglades of south Florida.

Currently, the Cape Sable seaside sparrow is restricted to freshwater prairies of Everglades National Park and Big Cypress National Preserve. However, even a national park the size of Everglades is insufficient to protect this species from human alterations of ecosystem processes (Mayer and Pimm 1999). Curnutt et al. (1998) and Nott et al. (1998) implicated an altered hydrology and elevated fire frequency, both under resource management, as contributing to the decline of the Cape Sable seaside sparrow within this decade. These altered ecosystem processes have converted formerly productive sparrow

habitat into marginal or unusable states. Thus, a central goal of recovery plans is the acquisition and restoration of critical breeding habitat (USFWS 1998). However, the inaccessibility of Cape Sable seaside sparrow breeding habitat has long limited the detailed characterization of nest sites, leaving recovery efforts difficult to implement.

Historically, investigators have detailed breeding habitat within one study plot (Werner 1975, Werner and Woolfenden 1983, Lockwood et al. 1997) or given a coarse-scale description of the entire range (Kushlan and Bass 1983, O'Meara and Marion 1985, Curnutt et al. 1998, Nott et al. 1998, Werner and Woolfenden 1983). In the most detailed effort to characterize sparrow breeding habitat to date, H. Werner worked almost exclusively within his Taylor Slough study plot (now called 'sub-population C', see Figure 1). As well crafted and detailed as Werner's observations were, we are reluctant to extrapolate his results as a range-wide measure of suitable nesting habitat for two reasons.

First, the Taylor Slough sub-population Werner studied is now extirpated (Curnutt et al. 1998). No birds have been recorded in this area since 1981 (Nott et al. 1998). A lengthened hydroperiod has favored vegetation unsuitable for sparrow breeding (Armentano et al. 1995, Nott et al. 1998). Second, coarse-scale investigations indicate that sparrows can persist within two habitat types that are floristically and structurally different from the Taylor Slough site (Werner and Woolfenden 1983, Kushlan and Bass 1983, Bass and Kushlan 1982). Historically, sparrows have been found in *Spartina bakeri* and sparse sawgrass prairies (Werner and Woolfenden 1983, Kushlan and Bass 1981). These prairies typically have slightly higher average stand heights, may have

more dispersed grasses (i.e. they are unclumped) and support much higher biomass levels than the prairies of muhly grass (*Muhlenbergia filipes*) found in Taylor Slough in the early 1970's (Werner and Woolfenden 1983).

To bridge the gap between existing fine and coarse-scale breeding habitat information, we gathered nest-site microhabitat data collected across the sub-species' current range. We make a special effort to integrate our results with those of Werner (1975) as his report is by far the most comprehensive study to date but is not readily accessible. In doing so, we provide two tools for management: 1) a suite of vegetative cues Cape Sable seaside sparrows use for determining nest placement within their territory and 2) a broadly applicable set of vegetative characteristics that can be used to distinguish between breeding and non-breeding habitats.

Methods

Study Area

The entire population of Cape Sable seaside sparrows now live within six distinct regions (sub-populations A through F) of Everglades National Park and Big Cypress National Preserve (Curnutt et al. 1998). Each sub-population has demonstrated a unique population trajectory over the past seven years (Curnutt et al. 1998). Three of these sub-populations, A, B and E (Figure 1), were censused for nests from 1997-1999.

Sub-population B is considered the 'core' as it has consistently held large numbers of sparrows since an initial survey conducted in 1981 (Curnutt et al. 1998, Kushlan and Bass 1983). We have seven study plots (each approximately 0.5km²) within

this sub-population (Figure 1) and include microhabitat information from 74 nests (out of 218 monitored). The western sub-population (A) experienced an 85% loss of individuals between 1992 and 1993 and continues to slowly decline (Nott et al. 1998). This sub-population may have formerly been a second 'core' with higher numbers of sparrows in 1981 than sub-population B (Curnutt et al. 1998). Nott et al. (1998) proposed that the presence of excessive water between 1994-96 severely limited breeding opportunities and precipitated a change in vegetative composition making many sites unsuitable for sparrow occupation (Nott et al. 1998). In 1997, we established a study plot (0.5km²) within a pocket of the remaining suitable vegetation to annually monitor nests. Due to low sparrow densities and the large distances between occupied patches, we found only nine nests in this sub-population and collected microhabitat data around each. In 1998, we established a plot within sub-population E along the eastern boundary of ENP (1.5km²). Overall this sub-population has declined since 1993 as a result of loss of habitat from over-drying and too frequent fires (Curnutt et al. 1998). The southern portion of this sub-population has persisted at 1981 levels (Curnutt et al. 1998) however, and it is here that we placed our study site. We include information from 27 (out of 31 monitored) nests within this sub-population.

Data Collection

Between 1997 and 1999, we collected microhabitat variables around 110 Cape Sable seaside sparrow nests. We measured vegetation characteristics within 1m² quadrats placed at three locations. Several days after fledging or failure, we first took

measurements at the nest-site (NS) by centering a quadrat over the nest itself. Second, we took measurements at random points located 5m from each nest (5RM). These points were chosen by randomly selecting a cardinal direction and placing a 1m² quadrat at 5m from each nest. Finally, we took measurements at random sites located within 5 to 50m from each nest (<50RM). We randomly selected (from a random number table) a cardinal direction and three numbers between 5 and 50. We used these numbers to guide us to a point within 50m of each nest site. These random measurements were taken well within a typical territory (200m diameter: Curnutt and Pimm 1984, Werner 1975) and represent available, but unused, microhabitats for nest placement.

Within each quadrat, we identified and recorded percent cover of all live plants following the Braun-Blanquet scale (Bullock 1996). Percent cover estimates were practical as we were easily able to look down on the vegetation (Bullock 1996). We also recorded various structural microhabitat variables. Effective cover and maximum vegetation height were measured to the nearest cm. The former we estimated by placing a notebook near the ground and within the vegetation layer. The upper limit of effective cover was measured as the maximum height at which 5% of the notebook was visible. This crudely estimates the degree of camouflage and shelter a habitat provides (Wiens 1973). We also estimated the percent cover of any dead vegetation using the same methods used for live vegetation.

Since O'Meara and Marion (1985) suggested that the presence of vegetative clumps characterize Cape Sable seaside sparrow nesting habitat, we included a measure of the degree of vegetative clumping. This was done by creating a scale based on the

O'Meara and Marion (1985) definition of clumps (i.e., bunchgrass type growth form with a basal diameter of >5cm). This scale included four categories: (1) vegetation present as all single stems, with no clumping, (2) vegetation present with mostly single stems, and a few clumps, (3) vegetation present as mostly clumps, with few single stems, (4) vegetation present as all clumps, with no single stems.

Statistical analysis

We made two comparisons. The first analysis compared nest-site (NS) microhabitat variables between sub-populations A, B and E. The second analysis compared nest-site (NS) microhabitat variables with random microhabitats at 5 and <50m points (5RM and <50RM). There were two statistical differences in floristic and structural composition between sub-populations (see below). Thus, for these two parameters, we compared random microhabitat variables to nest-site variables only within sub-populations. We combined all remaining microhabitat information (i.e., 5m, <50m and NS quadrats) regardless of sub-population for the remaining comparisons.

We also looked for simple linear correlations among the nest-site (NS) microhabitat variables using Spearman rank correlations (Zar 1984). Because we are making 28 independent comparisons, we judged statistical significance of associated *z*-values using a sequential Bonferroni adjustment of critical values (Rice 1989). Several of the variables were correlated (see below). A possible avenue for investigation is to utilize MANOVA or factor analysis for our remaining statistical analyses. However, we have purposefully avoided the use of these statistics because 1) they are particularly data

'hungry' and we do often do not have (and are not likely to ever obtain) adequate sample sizes in certain instances and 2) it is often difficult to tease apart resultant conglomerate variables. The latter point is especially relevant given our goal of providing managers with tangible 'tools' for identifying important components of sparrow breeding habitat. We thus proceed with univariate statistical comparisons while explicitly recognizing that these correlated variables will tend to show the same patterns.

For continuous and normally distributed variables, we used two-way ANOVA to test for overall differences between microhabitat variables (i.e. between sub-populations and between random vs. nest-sites). If this test was significant ($P < 0.05$), we then tested for differences between all possible pairs using a Fisher's Protected Least Squares Difference (PLSD) test. As percent cover variables are not normally distributed, they were compared using a Kruskal-Wallis rank sum test (Bullock 1996). Categories of vegetative clumping were compared using Chi-square contingency tests. All results presented below are means $\pm$ standard deviation.

Results

We typically found from seven to ten plant species per nest-site (NS) quadrat. A list of all species found at nest sites is included in the appendix. We found only four species to be dominant (i.e. consistently ranked highest in cover class) and we included only these in the following statistical comparisons. These species were sawgrass (*Cladium jamaicanse*), muhly grass, *Rhynchospora spp. (tracyi or microcarpa)*, and *Schizachyrium rhizomatum*. Nest-site quadrats (NS) invariably contained sawgrass and sparrows almost

exclusively (93%) wove nests into sawgrass tussocks. *Schizachyrium rhizomatum* was found here, and in Werner (1975), to be dispersed ubiquitously throughout nesting habitat. This species was seldom incorporated into the nest structure itself however. The smaller leaves, or leaf-ends, of muhly grass (and potentially *Rhychospora spp.* and *Schizachyrium rhizomatum*) were commonly incorporated into the nest structure as cup lining.

Ten of the 28 linear correlations between the microhabitat variables were significant (Table 1). Effective vegetation height, maximum vegetation height, degree of clumping and percent cover of sawgrass and dead vegetation all have positive correlation coefficients indicating that they are to some degree co-dependent. Thus, as one of these variables increases, the others will tend to increase as well. This intercorrelation can be viewed as a consequence of the sawgrass life form. When sawgrass matures, it produces long and thick-stemmed seedheads. These seedheads dwarf most vegetation within the immediate vicinity of the individual plant and provide most sparrow perching substrate. In addition, the broad evenly distributed leaves of live sawgrass provide ground level screening increasing effective cover and clumping estimates. Sawgrass retains its broad-leaved form and tends to lie slightly elevated off the ground when dead (Taylor 1975) providing most percent cover estimates of dead vegetation and effective cover. *Rhychospora spp.*, *Schizachyrium rhizomatum*, and muhly grass appear to grow in close association. When any of these species achieve high cover estimates, maximum vegetation height is reduced as they typically never grow to heights above 30 to 50cm in these prairies.

When Werner conducted his work (1974-75) he characterized the Taylor's slough site as a vast, homogenous freshwater prairie dominated by muhly grass. Werner randomly sampled microhabitats (1m² quadrats) at Taylor Slough and these sites were characterized by clumped, short grasses having an average stand height of 0.7m. Solution holes (i.e., limestone depressions) contained dense stands of sawgrass and graminoid species more typical of deeper parts of Taylor Slough (Werner 1975).

Sub-population B nest sites most closely resembled this description. Vegetative composition in sub-population B was typical of upland freshwater prairies, consisting of mostly graminoids, clumps of sawgrass and a few tree seedlings. Muhly grass provided much more cover within sub-population B nest-site (NS) microhabitats than those in sub-population A or E (Kruskal-Wallis $\chi^2_2 = 16.017$, $P = 0.001$). Nest sites within sub-populations A and E had 1 to 5% modal coverage of muhly grass whereas nest sites within sub-population B typically had 5 to 10% coverage.

Sub-population E may also be described as 'muhly grass prairie' *sensu* Werner's definition despite the lesser coverage of this species. These nest-sites also contain mostly upland freshwater grasses and graminoids and we found no other discernable differences with sub-population B nest sites. The sawgrass clumps in this study area are more distinctly dispersed (i.e. patchy) across the landscape and are present only where substantial solution holes exist. This is presumably because this area is considerably drier for longer periods than either sub-population A or B thus restricting the coverage of large sawgrass stands to areas that provide regular access to the water table. Nest are either placed within, or outside, of these sawgrass clumps. The coverage of sawgrass

within these nest sites is thus more variable scoring from 1 to 5% coverage up to 75% or more coverage. Nest sites in the other sub-populations tended to vary by only one step up or down the Braun-Blanquet scale. Similarly, *Schizachyrium rhizomatum*, a grass more typical of drier areas, had a modal coverage of 5 to 10% and varied by two steps or more between nest site microhabitats within sub-population E. However, in the other sub-populations (A and B) the coverage of this species rarely strayed from a 1 to 5%.

Sub-population A nest-site (NS) microhabitats contained limited amounts of muhly grass and may be most similar to what Werner (1975) refers to as sparse sawgrass prairies. Our results show that sub-population A nest sites lacked several plant species typical of the other sub-populations including sweet bay (*Magnolia virginiana*) and black-top sedge (*Schoenus nigra*). Muhly grass was very rarely noted in nest-site (NS) quadrats. Nest-site (NS) vegetation within sub-population A was much less likely to be characterized as 'clumped' ($X^2_2 = 23.43$, $P = 0.0028$). Nest-site vegetation within sub-populations A and E were commonly characterized as 'mostly clumps', or 'all clumps' whereas nest-sites (NS) in sub-population A were more likely to be characterized as 'all singles'.

Despite these two differences between sub-population nest sites, we detected no other structural or compositional differences. The maximum vegetation height, effective cover height, and the percent coverage of dead vegetation, *Rhynchospora* spp., sawgrass and *Schizachyrium rhizomatum* did not differ between sub-populations.

Several differences were observed between nest site and random microhabitats indicating that sparrows place their nests in very specific locations within a territory.

With the exception of effective vegetation height, all 5RM and <50RM microhabitat characteristics were statistically indistinguishable from each other. However, the nest-site (NS) microhabitat characteristics were unique from either set of random points (Figure 2). Maximum vegetation height ($F_{2,310} = 27.66$, $P < 0.0001$) is higher within the nest site quadrat. Mean maximum vegetation height within nest-site (NS) quadrats was $13.8\text{cm} \pm 3.7$ whereas mean maximum vegetation height within random quadrats was $11.0\text{cm} \pm 2.7$. Effective cover height ($F_{2,310} = 31.84$, $P < 0.0001$) decreases significantly as one moves away from the nest-site (NS). Mean effective cover height was $3.3\text{cm} \pm 1.3$ at the nest, $1.6\text{cm} \pm 1.5$ at 5m from the nest, and $2.3\text{cm} \pm 1.7$ at <50m from the nest. The degree of vegetative clumping is higher within the nest-site (NS) quadrat as well ($\chi^2_6 = 36.07$, $P < 0.0001$) averaging a score of 3 (i.e., mostly clumps with few single stems). Vegetative clumping within random quadrats averaged a score of 1 (i.e., mostly single stems, with no clumps).

Sawgrass (Kruskal-Wallis $\chi^2_2 = 22.07$, $P < 0.0001$) and dead vegetation (Kruskal-Wallis $\chi^2_2 = 33.68$, $P < 0.0001$) covered significantly more area within the nest-site (NS) quadrats. The modal percent cover of sawgrass within a nest-site (NS) quadrat was 25 to 50% and for dead vegetation cover was 50 to 75%. Percent cover of sawgrass within random quadrats was 5% to 25% and for dead vegetation cover was 25% to 50%. There was no difference between the various quadrat locations in the percent cover of the remaining dominant grasses.

Discussion

As do other races of Seaside Sparrows (Post and Greenlaw 1994), the Cape Sable seaside sparrow shows a strong preference for nest sites that provide specific vegetative characteristics. Nests are selectively placed within sites that provide 3 to 4cm vertical ground cover (i.e. effective vegetation height) and where 1 to 1.5m high vegetation is available as perching substrate. The nest microhabitat typically provides twice as much effective cover, and perches that are 3 to 4 cm higher, than the microhabitats available within the territory. Sawgrass and dead vegetation cover must be moderately high at around 25 and 75% in the nest vicinity; this is in contrast to the territory vegetation that typically contains 5 to 25% sawgrass cover. Also, sparrows prefer to place nests in vegetation that is moderately to highly clumped.

Several of these vegetative variables are inter-correlated probably as a result of the sawgrass life-form. This suggests that the abiotic conditions that drive sawgrass demographic parameters (e.g., recruitment and survival) may be central to producing suitable sparrow breeding habitat. This is not terribly surprising as sawgrass is the dominant vegetative component of the everglades ecosystem (Olmstead and Armentano 1997). However, our results in conjunction with investigations conducted at broader spatial scales (see Mayer et al. 1998, Werner 1975 and Taylor 1982) indicate that Cape Sable seaside sparrows can exist within a limited range of potential sawgrass configurations. For example, although sparrows may prefer nest sites with sawgrass that is 1 to 1.5m in height, they will avoid using habitats where the sawgrass is even half a meter higher (Werner 1975, Mayer et al. 1998). These habitats are typically densely packed with sawgrass and are flooded nearly year round (Olmstead and Armentano 1997). This dense

sawgrass cover likely prevents adult sparrows from foraging, entering the nest, and placing nests at appropriate heights off the ground (Werner 1975). The same may be true of the availability of dead vegetative cover. Werner (1975) suggested that sparrows will avoid sites where the dead biomass becomes more dominant in ground cover than live vegetation. In his Taylor Slough study site this occurred after four years. However, the accumulation of dead vegetation is dependent on soil depth (Taylor 1983) and no clear range-wide maximum ratio of dead to live vegetation has yet been identified. Such range-wide stereotypy in Cape Sable seaside sparrow nest placement could result in poor reproductive success in some habitats and even select against occupation of those habitats (Martin 1988, Martin 1992).

There were some differences in floristic composition between the nest sites present in the different sub-populations. Particularly telling is the paucity of muhly grass and other vegetation typical of drier prairies within sub-population A nest-sites. Our study site within this sub-population appears to have survived the worst of the flooding of 1994-95 (see Nott et al. 1998 for details of effects) as it is situated on a high elevation ridge. However, we found notable amounts of dead muhly grass and most *Rhychospora* spp. appeared to be new (i.e., within two years) growth. This is consistent with the assertion of Nott et al. (1998) that expansive periphyton mats, which detach and float free during high water events, selectively crush muhly grass and other thin-stemmed vegetation. The new, and more exclusive coverage of *Rhychospora* spp., is indicative of a longer hydroperiod (Olmstead and Armentano 1997). This may also explain why sub-population B nest-sites show lower values of vegetative clumping. The bunchgrasses,

muhly grass and black-top sedge, are more common in the other sub-populations. However, they are largely absent in sub-population B. It is also possible that these bunchgrasses never grew well in this portion of the everglades as Werner (1975) makes no mention of these grasses having existed in high numbers in this area.

The general decrease in dominance of muhly grass in regions inaccessible to biologists (e.g., sub-populations A and E) warns against managing exclusively for this species. Cape Sable seaside sparrows can successfully nest within prairies with slightly different floristic compositions (Werner 1975, Kushlan and Bass 1983, Mayer 1998) as long as the structural characters that appear as important cues for nest placement (see above) do not substantially vary. What remains unanswered is the degree to which annual reproduction is effected by the degree of variation observed in these structural variables. The principle threat to Cape Sable seaside sparrow nests is predation; particularly predation by snakes and rats (Lockwood et al. 1997). Variation in structural components of the nest site such as effective cover, maximum vegetation height, and degree of vegetative clumping likely influence the fate of nests (Martin 1993, 1992; Howlett and Stutchberry 1996) and these are directly related to the degree of sawgrass dominance. Habitat patterns at broader spatial scales may supercede, or interact with, the effect of these microhabitat variables producing substantial spatial variation in annual productivity (Rohrbaugh and Yahner 1997). Incorporating the preferred structural variables detailed here with habitat characteristics that prove useful at broader scales (Mayer 1998, Nott 1998), will allow managers to consistently identify suitable Cape Sable seaside sparrow breeding habitat. Restoring these habitat types, or the dispersal

corridors to what remains of these habitats, may prove vital in the recovery of this endangered sparrow.

Acknowledgments

We thank J. Duncan, D. Okines, C. Lagaye, S. Lavergne, P. Brotherton, and S. Descamps for considerable help in the field. H. Cooley, M. Rugge, B. Gamble and D. Jones assisted us in plant identification. A. Mayer and O.L. Bass Jr. provided expert opinions on habitat features and methodology. J. Curnutt and S. Pimm provided useful comments in early drafts. We were supported by grants to S. Pimm from the U.S. National Park Service, U.S. Fish and Wildlife Service, and the South Florida Water Management District. As many of our study sites are remote, we owe much to our helicopter pilots (especially D. Owens and R. Robbins) and the hydrology crew at Everglades National Park (especially B. Zepp and M. Stuart). JLL and KHF wish to dedicate this work to the memory of Reed Robbins.

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Table 1. Spearman correlation coefficients (Rho) for the 8 microhabitat variables collected around Cape Sable seaside-sparrow nests. Only correlations marked with * are significant at the $\alpha=0.05$ level after sequential Bonferroni correction. %SC = sawgrass cover, %MC = muhly grass cover, %RC = *Rhychospora spp.* cover, %SZC = *Schizachyrium rhizomatum* cover, %CDV = cover of dead vegetation, CLMP = clumpiness ranking, MVH = maximum vegetation height, EVH = effective vegetation height.

	CLMP	MVH	EVH	%SC	%MC	%CDV	%RC
CLMP	1.00						
MVH	0.509*	1.00					
EVH	0.408*	0.434*	1.00				
%SC	0.361*	0.393*	0.290*	1.00			
%MC	0.039	-0.421*	-0.148	-0.039	1.00		
%CDV	0.210	0.216	0.223	0.468*	0.043	1.00	
%RC	-0.085	-0.126	-0.013	0.039	0.181	0.193	1.00
%SZC	0.085	-0.243	-0.089	0.135	0.395*	0.211	0.356*

Figure Legend.

Figure 1. Location of the six extant Cape Sable seaside sparrow sub-populations, with our study sites indicated by black points.

Figure 2. Vegetative composition of the three microhabitat locations around each nest-site. Nest-sites (NS) vegetation and random potential nest site vegetation (5M and <50M) differ in maximum vegetation height, effective vegetation height, degree of vegetative clumping and percent cover of sawgrass.

Appendix. Plant species found at 110 Cape Sable seaside sparrow nest-sites (NS) categorized by sub-population. An 1 indicates presence in at least one nest-site and 0 absence in all.

Species	Sub-population		
	A	B	E
<i>Agalinis purpurea</i>	0	1	1
<i>Aster tenuifolium</i>	1	1	1
<i>Calpogon</i> spp.	0	1	0
<i>Centella asiatica</i>	1	1	1
<i>Cladium jamacienses</i>	1	1	1
<i>Crinum americanum</i>	1	1	1
<i>Cuscuta campestris</i>	1	1	1
<i>Taxodium ascendens</i>	0	1	0
<i>Dichromena colorata</i>	1	1	0
<i>Eleocharis cellulosa</i>	1	1	1
<i>Hellinium pinnatifidum</i>	1	1	1
<i>Hymenocalus palmeri</i>	1	1	1
<i>Ipomoea sagittata</i>	1	1	1
<i>Iva microcephala</i>	0	1	1
<i>Linum</i> spp.	0	1	0
<i>Magnolia virginiana</i>	0	1	1
<i>Sabatia</i> spp.	0	1	0
<i>Mikania scandens</i>	1	1	1
<i>Muhlenbergia filipes</i>	1	1	1
<i>Oxypolis filiformes</i>	1	1	1
<i>Panicum</i> spp.	1	1	1
<i>Peltandra virginica</i>	0	0	1
<i>Persea borbonia</i>	0	1	1
<i>Piriqueta caroliniana</i>	0	1	0
<i>Pluchea rosea</i>	1	1	1
<i>Polygala grandiflora</i>	0	1	0
<i>Rhynchospora tracyi</i>	1	1	1
<i>Rhyncospera microcarpa</i>	1	1	1
<i>Sagittaria lanciflora</i>	0	1	1
<i>Schizachyrium rhizomatum</i>	1	1	1
<i>Schoenus nigra</i>	0	1	1
<i>Setaria geniculata</i>	0	1	1
<i>Solidago</i> spp.	1	1	1
<i>Utricularia cornuta</i>	0	0	1
Total Species	19	32	27

