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A Comparison of Illinois Remnant Prairies, 1976 to 1988

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Abstract

At one time, 60% of Illinois' land area was covered with prairie, but 99% of that prairie has been lost. Currently, 2,300 acres (about 930 hectares) of remnant prairie is protected in the Illinois Nature Preserves System. Many of these sites were surveyed in the mid–1970s as part of the Illinois Natural Areas Inventory (INAI). I analyzed vegetation data as relative frequency of herbaceous species. Data were analyzed using Detrended Correspondence Analysis (DCA) to determine environmental influences on species composition. I also resampled 29 of the original sites in summer 1998. In addition to collecting data on relative frequency of prairie species, I collected soils and had them analyzed for texture and nutrient availability. In both the 1970s and 1998 samples, moisture availability as related to a topographic gradient was the major environmental factor affecting species distribution and abundance. For the 1998 samples, there were relationships between ordination axis scores and soil nutrients, but soil nutrients were not a major factor affecting species composition. When the 1970s and 1998 samples were compared, there were no major changes in species composition, but there were changes in species abundance. There was no conclusive evidence for loss of species from any sites, although there was an increase in abundance of introduced Eurasian weedy species between the 1970s and 1998.

Keywords: Illinois prairie, remnant prairie, moisture gradient, Detrended Correspondence Analysis, vegetation analysis

Introduction

In North America, tallgrass prairie is a threatened ecosystem. Continent-wide, more than 80% of the North American prairie has been converted to cropland (Engle and others 2003). On a state-wide basis, Illinois has lost 99% of its tallgrass prairie (Anderson 1991). Most Illinois remnant prairies are smaller than 12 acres (5 ha) (Bowles and others 2003). In addition to their small size, remnant prairies tend to be geographically isolated and lack the landscape-scale processes that once helped maintain them, such as fire and grazing (Robertson and others 1997). Remnant prairies are also at risk for invasion by agricultural weeds, herbicide drift, and nitrogen-enrichment eutrophication, as they are often surrounded by row-crop agriculture (IDENR 1994; Collins and others 1998). Prairies can be invaded by non-native plant species, and, as of 1994, 27.5% of the 2,853 vascular plant species in Illinois were classified as non-native species (IDENR 1994).

Currently, about 10% of Illinois remnant prairie is designated as Illinois Nature Preserves. However, close to 80% of Illinois remnant prairie is totally unprotected (IDENR 1994). Many of the protected sites have volunteer groups that are active in prairie maintenance (prescribed burns, removal of invasive species). In the 1970s, Illinois remnant prairies were surveyed as part of the Illinois Natural Areas Inventory. This survey collected data about the remaining natural areas in Illinois to promote their preservation (White 1978).

Illinois has a diversity of prairie types. Dry prairies in Illinois include sites on deep Pleistocene sand deposits with xerophytic species having a "more western" affiliation (Gleason 1922). Illinois also has many hill prairies, which tend to be dry and are located on west- or southwest-facing river bluffs. Most have a loess substrate, although there are also glacial drift, dry dolomite, and dry gravel hill prairies (IDENR 1994). Most of the mesic remnant sites in Illinois tend to be small—cemetery prairies and railroad rights-of-way—because most of the sites conducive to agriculture had long before been converted to row crops long. Illinois also has wet prairies, and several of the prairies in the original INAI survey are described as "wet dolomite" prairies, and several "sedge meadows" were included in the original survey (White 1978).

The locations and types of Illinois prairie reflect the glacial history of the state, with moisture availability as a function of topographic position having the major effect on the species composition and species abundance in prairies (Corbett 1999).

The remnant prairies surveyed in this study are currently protected as Illinois Nature Preserves. However, simply protecting sites may not be sufficient to prevent the prairies from degradation and species loss. Small remnant prairies do not experience the landscape-scale processes that once acted on them (IDENR 1994). For example, Leach and Givnish (1996) resampled Wisconsin prairies that had originally been sampled by Curtis in the 1950s. They determined that unmanaged sites tended to lose nitrogen-fixing species, short-

statured species, and small-seeded species. Bowles and his colleagues (2003) examined sand prairies in northwestern Illinois that had been sampled as part of the original INAI. Some of the sites were managed by burning and others were unmanaged. They found, over the 20-year span between sampling times, that non-native species decreased on burned sites and increased on unburned sites. The Illinois Natural Areas Inventory sites vary in level of management.

The Illinois Natural Areas Inventory was completed in the mid–1970s. I analyzed these data for my doctoral dissertation (Corbett 1999). In addition, in summer 1998, I resampled 29 of the sites and collected soil samples for analysis from them. In this paper, I compared species composition and abundance in the 1998 samples to those of the original INAI. I was particularly interested in answering these questions: (1) Do the sites change markedly over time? (2) Are certain species at greater risk of being lost from sites during the ~20 year span between sampling? (3) How has the abundance of non-prairie species (especially, agricultural weeds) changed over that time span?

Materials and Methods

The Illinois Natural Areas Inventory was conducted in the 1970s as a way of categorizing and identifying remaining natural areas in the state. By this time, a majority of prairie had already been converted to agricultural or developed land, and what was left were mainly small and scattered remnants. Remaining natural areas were located and surveyed by volunteers from universities, the Natural Land Institute, and the Natural History Survey. They compiled species lists for all sites and, for most prairie sites, collected species frequency data using 20 to 30 0.25-m circular quadrats. Basic geographic and locational information were collected about each site. However, detailed information (about slope, soil nutrient content, aspect, etc.) was not collected (White 1978).

I analyzed these data to determine what environmental factors influenced Illinois prairie. I resampled 29 of the 216 original INAI sites in summer 1998 (See Table 1 for list of sites). I sampled the vegetation using methods similar to those of the original INAI, although I used 20 to 30 1-m^2 circular quadrats per site. Three transects were established at each site, with each sample separated by either 5 or 10 meters, depending on site size. Additionally, about 1 kg of soil was collected from each site as a series of 2.5-cm by 15-cm cores, and sent to the University of Wisconsin Extension Agency for soil analysis. Soils were analyzed for texture (percent sand, silt, and clay), pH, phosphorus, potassium, calcium, magnesium, and organic matter.

Table 1: List of sites analyzed in this study. "Number" is the code number assigned to the site by the INAI. "Site type" is the type of prairie the site represented, as determined by INAI researchers.

Number	Name	County	Site type
12	Ayers Sand Prairie	Carroll	Dry sand prairie
14	Mississippi Palisades	Carroll	Loess hill prairie
38	Sand Ridge Nature Preserve	Cook	Dry-mesic sand prairie
44	Zander's Woods	Cook	Prairie
47	Wolf Road Prairie	Cook	Mesic prairie
48	Hetzler Cemetery Prairie	Bureau	Mesic cemetery prairie
51	Belmont Prairie	DuPage	Dry-mesic prairie
56	Prospect Cemetery Prairie	Ford	Mesic cemetery prairie
78	Munson Cemetery Prairie	Henry	Mesic cemetery prairie
100	Burlington Prairie	Kane	Mesic prairie
125	Temperance Hill Cemetery	Lee	Mesic cemetery prairie
129	Olin Tract	Madison	Loess hill prairie
140	Revis Hill Prairie	Mason	Loess hill prairie
141	Sand Prairie Scrub Oak	Mason	Dry sand prairie
148	Weston Cemetery Prairie	McLean	Mesic cemetery prairie
150	Bobtown Hill Prairie	Menard	Loess hill prairie
151	Brownlee Cemetery Prairie	Mercer	Mesic cemetery prairie
154	Fults Hill Prairie	Monroe	Loess hill prairie
160	NE Meredosia Hill Prairie	Morgan	Loess hill prairie
164	Beach Cemetery Prairie	Ogle	Dry gravel cemetery prairie
173	Robinson Park Hill Prairie	Peoria	Glacial drift hill prairie
206	Freeport Prairie	Stephenson	Dry dolomite prairie
207	Ft. Creve Coeur Hill Prairie	Tazewell	Glacial drift hill prairie
210	Windfall Prairie	Vermilion	Glacial drift hill prairie
211	Massasauga Prairie	Warren	Dry-mesic prairie
212	Spring Grove Cemtry. Prairie	Warren	Mesic cemetery prairie
223	Grant Creek Prairie	Will	Mesic prairie
227	Lockport Prairie North	Will	Wet-mesic dolomite prairie
232	Romeoville Prairie	Will	Wet-mesic dolomite prairie

Species and site data were analyzed using Detrended Correspondence Analysis (Gauch 1982). Ordination techniques use data about species abundance (for example, relative frequency) at sites to arrange the sites in ordination space. The sites are arranged based on similarities in species composition and abundance. As a result, the researcher can draw conclusions about the important environmental factors affecting sites (Gauch 1982). The 1998 samples and the original 1970s samples were analyzed alone and together. Detrended Correspondence Analysis was chosen as an analysis technique because it has generally given good results with field data (Peet and others 1988, Umbanhowar 1992). Also, it has previously been used on Illinois prairie data with good success (Corbett 1999, Corbett and Anderson 2001). The computer analysis package PC-Ord (McCune and Mefford 1997) was used for ordination analyses of the data. In addition to examining the pattern of sites on the ordination diagram, the "Overlay Main Matrix" function in PC-Ord performs Spearman and Kendall rank correlations between each species and the ordination axes, and allows for further interpretation. I also tested correlations between the ordination scores for the samples taken in the 1970s and in 1998, using JMP (SAS Institute 2002).

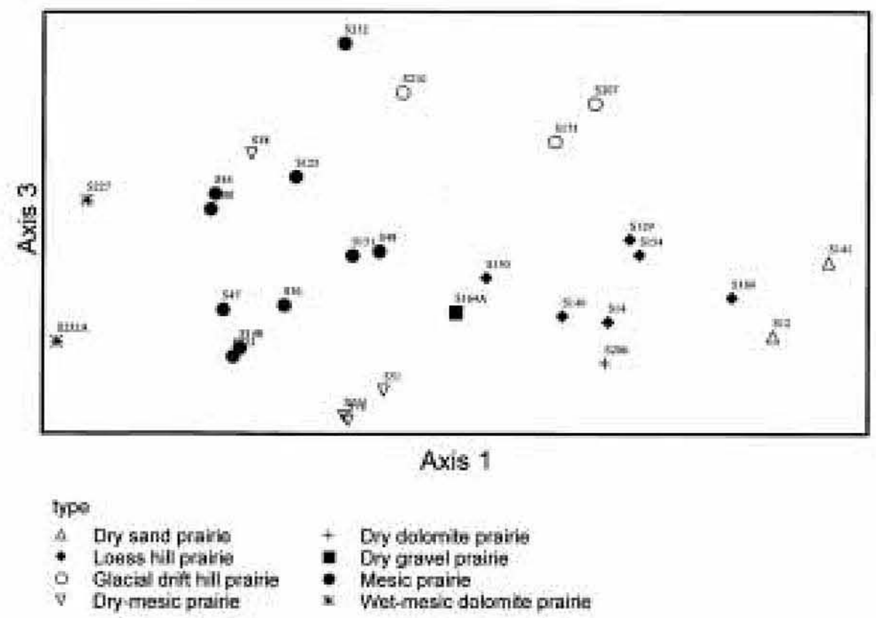

Figure 1. DCA analysis of 1970s INAI samples. Axes 1 and 3 of the ordination are shown. Default settings were used in PC-ORD (McCune and Mefford 1997). Site classifications are from the original INAI survey (White 1978).

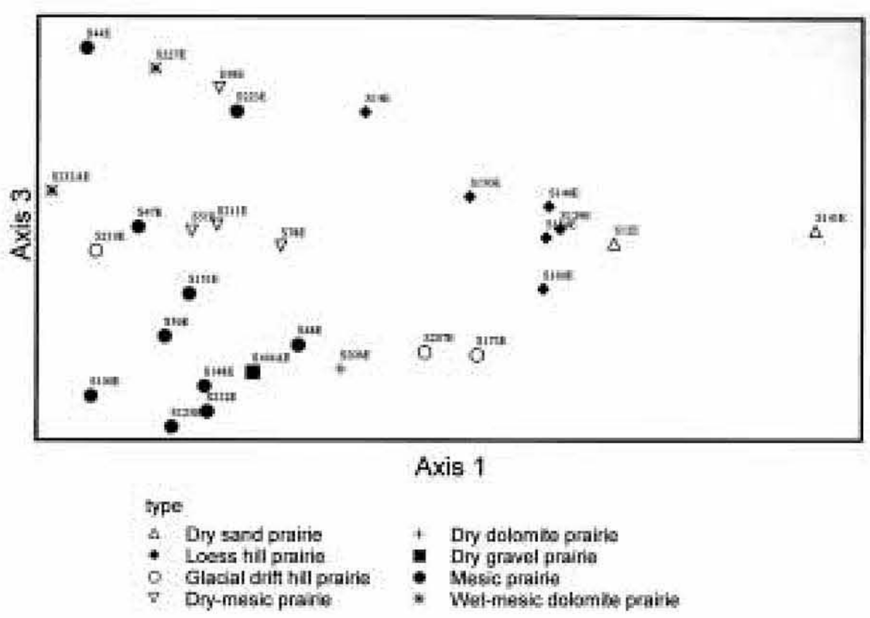

Figure 2. DCA analysis of 1998 INAI samples. Axes 1 and 3 of the ordination are shown. Default settings were used in PC-ORD (McCune and Mefford 1997). Site classifications are from the original INAI survey (White 1978).

In addition to the DCA, I also used Canonical Correspondence Analysis (CCA) to analyze site-soil nutrient relationships for the 1998 data. This ordination technique incorporates environmental data in the analysis to find correlations between ordination axes and environmental variables, rather than the researcher inferring environmental gradients from the arrangement of sites (ter Braak 1986).

To compare the species composition, especially changes in numbers of native and non-native species over time, I examined the data set and computed species richness values for native species and introduced species. I used JMP (SAS Institute 2002) compared number of native species, number of introduced species, and the ratio of introduced to native species in the 1970s and 1998 samples. Each analysis was done separately, and was performed as a Wilcoxon analysis (non-parametric analogue of the two-sample t test) because the data did not have equal variances.

Results

Ordination Analysis of the 1970s Samples

The 29 sites selected from the original INAI separated along a moisture gradient on ordination axis 1 (Figure 1). Dry sand sites received the highest axis 1 scores, followed by loess and glacial drift hill prairies. Dry-mesic and mesic sites showed less separation on the first ordination axis, and wet-mesic dolomite sites received the lowest axis 1 scores.

Table 2: Species correlations (r-values given) with axis 1 for 1970s and 1998 data.

Species	**1970s data**	**1998 data**
Ambrosia psilostachya	0.423	0.712
Andropogon gerardii	–0.211	0.057
Bouteloua curtipendula	0.579	0.472
Bouteloua hirsuta	0.440	0.307
Calamagrostis canadensis	–0.372	–.0250
Opuntia humifusa	0.409	0.508
Schizachyrium scoparium	0.815	0.868
Sorghastrum nutans	–0.380	–0.176
Spartina pectinata	–0.374	–0.335

Table 3: Intraset r-value correlations (*sensu* ter Braak 1986) for the CCA biplot axes.

Soil property	**Axis 1**	**Axis 2**	**Axis 3**
pH	–0.523	–0.607	0.168
Organic matter	0.709	–0.199	0.123
Phosphorus	0.030	0.666	–0.163
Potassium	0.557	–0.172	–0.659
Calcium	0.114	–0.662	0.395
Magnesium	0.580	–0.257	–0.004
Sand	–0.009	0.439	0.252
Silt	–0.050	–0.591	–0.366
Clay	0.273	–0.469	–0.060

The first ordination axis shows a pattern of correlation with several widespread prairie grasses, or species characteristic of particular site types. The r-values for Spearman correlations of selected species are shown in Table 2. Among the species with a strong positive relationship with axis 1 were three species—common ragweed (*Ambrosia psilostachya*), devil's tongue (*Opuntia humifusa*), and hairy grama grass (*Bouteloua hirsuta*)—listed by Gleason (1922) as species typical of dry sand prairies in Illinois. Little bluestem (*Schizachyrium scoparium*) was also most abundant in drier sites, as was sideoats grama grass (*Bouteloua curtipendula*), which is common in hill prairies (Evers 1955). Among species showing a negative relationship with the first ordination axis—that is, associated with wetter sites—were prairie cordgrass (*Spartina pectinata*) and bluejoint (*Calamagrostis canadensis*). Big bluestem (*Andropogon gerardii*), a more mesic species, was also more abundant in sites receiving lower axis 1 values.

The second and third ordination axes show little additional meaningful separation. The third ordination axis (shown in Figure 1) separates glacial drift and loess hill prairies. However, there are no clear-cut patterns of species differences between these sites. This is in contrast to Corbett (1999), where analysis of the entire INAI data set demonstrated a separation between dry sand sites and hill prairies. The lack of separation in this case may be the result of the data set being small.

Ordination Analysis of the 1998 Samples

The same sites, resampled approximately 20 years later, showed similar ordination results.

The first ordination axis once again corresponded to a moisture gradient (Figure 2), with dry sand sites receiving the highest axis 1 scores, followed by hill prairies and sites on shallow or stony soils. Mesic, dry-mesic, and wet-mesic dolomite sites received lower axis 1 scores. There appeared to be less separation at the wetter end of the gradient than there was among the 1970s samples. Pearson r-values for species with axis 1 scores showed a similar pattern to that for the 1970s samples (Table 2).

Again, the second and third ordination axes do not show separation clearly related to environmental factors. (Axis 3 is shown in Figure 2). This is likely a result of the small size of the data set.

I also ran a Canonical Correspondence Analysis (ter Braak 1986) on these data. For the 1998 samples, I had the following soils data available: pH, organic matter, sand, silt, clay, calcium, magnesium, phosphorus, and potassium. This analysis gave slightly different results to those of the DCA of the same data (Figure 3). The polarity of the first ordination axis is reversed as compared to the DCA; dry sites (sand prairies and hill prairies) received low axis 1 scores in the

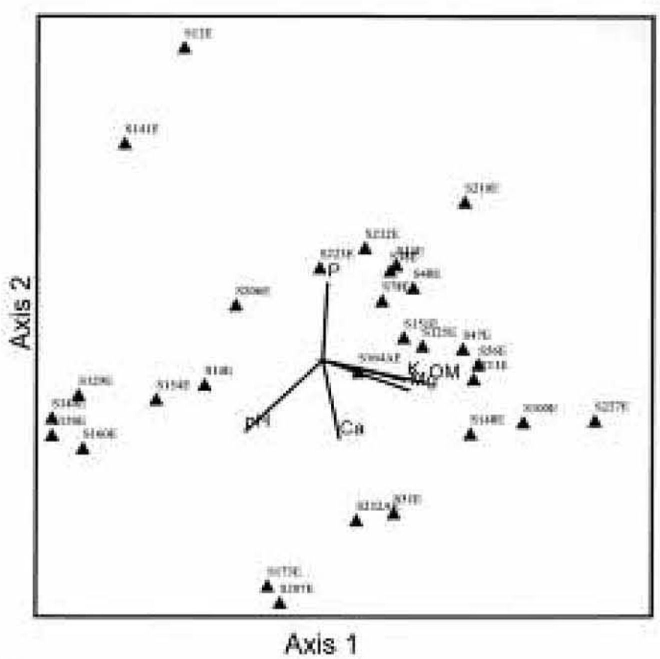

Figure 3. CCA analysis of the 1998 INAI samples. Axes 1 and 2 of the ordination are shown, with the correlated environmental variables. Default settings were used in PC-ORD (McCune and Mefford 1997).

Canonical Correspondence Analysis (CCA) ordination. Mesic to wet-mesic sites received high axis 1 scores. Of the environmental factors available, axis 1 was most closely correlated to pH, organic matter, potassium, and magnesium (Table 3). Potassium, magnesium, and organic matter content increased with axis 1 scores—these soil properties were all higher in wetter sites. The value of pH decreased with increasing axis 1 score; pH values were highest in the dry sites.

Table 4: Pearson correlation r-values for species with DCA ordination axis 1. Both 1970s and 1998 samples were included in the ordination. Positive r-values indicate species has high abundance in sites with high axis 1 values (dry sites) and negative r-values indicate species has high abundance in sites with low axis 1 values (mesic to wet sites). Nomenclature follows USDA PLANTS database (plants.usda.gov).

Species	r-value
Achillea millefolium	–0.346
Ambrosia psilostachya	0.543
Artemisia ludoviciana	0.300
Asclepias verticillata	0.349
Bouteloua curtipendula	0.521
Bouteloua hirsuta	0.372
Calamagrostis canadensis	–0.314
Callirhoe triangulata	0.301
Carex spp.	–0.562
Cirsium discolor	–0.352
Commelina erecta	0.373
Dalea purpurea	0.469
Dichanthelium oligosanthes	0.566
Echinacea pallida	0.375
Eragrostis spectabilis	0.335
Euthamia graminifolia var. *graminifolia*	–0.356
Fragaria virginiana	–0.501
Juncus spp.	–0.363
Liatris spicata	–0.302
Linum sulcatum	0.433
Lysimachia quadriflora	–0.301
Oligoneuron riddellii	–0.302
Opuntia humifusa	0.439
Parthenium integrifolium	–0.307
Phlox glaberrima	–0.348
Physalis virginiana	0.332
Potentilla simplex	–0.317
Psoralidium tenuiflorum	0.367
Pycnanthemum virginianum	–0.457
Rudbeckia hirta	–0.447
Schizachyrium scoparium	0.841
Solidago canadensis var. *scabra*	–0.382
Solidago juncea	–0.420
Solidago nemoralis	0.415
Spartina pectinata	–0.358
Symphyotrichum novae-angliae	–0.440
Symphyotrichum sericeum	0.329
Tephrosia virginiana	0.421
Viola sororia	–0.336

On the second ordination axis, dry sand sites (Ayers Sand Prairie and Sand Prairie Scrub Oak) separated from the other sites, receiving the highest axis 2 scores. Sites receiving low axis 2 scores included a wet-mesic dolomite prairie (Romeoville), two glacial drift hill prairies (Robinson Park and Fort Creve Coeur) and a dry-mesic prairie (Belmont). Axis 2 of the CCA showed strongest relationships with phosphorus (which increased with increasing axis 2 score) and calcium (which decreased with increasing axis 2 score). Thus, sand prairies are high in phosphorus whereas the various sites receiving low axis 2 scores are high in calcium.

1970s and 1998 Samples Analyzed Together

The first ordination axis corresponded to a moisture gradient. Sites with drier conditions received high axis 1 scores, while sites with wetter conditions received lower axis 1 scores (Figure 4). The highest axis 1 scores were received by dry sand prairies, followed by loess hill prairies, glacial drift hill prairies, and dry dolomite sites. There was less separation on the first axis among dry-mesic and mesic sites.

The correlations of species with the first ordination axis reinforces the moisture-gradient pattern (Table 4). Grass species showing a high positive r-value (most abundant in sites receiving high axis 1 scores) included little bluestem, side-oats grama grass, hairy grama grass, purple lovegrass (*Eragrostis spectabilis*), and Scribner's rosette grass (*Dichanthelium oligosanthes*). All of these are known to be species more typical of drier sites (Bazzaz and Parrish 1982). Among the species showing high negative r-values (more abundant in sites receiving low axis 1 scores) were bluejoint grass, sedges (*Carex* spp.), and prairie cordgrass.

Table 5. Pearson correlation r-values for species with DCA ordination axis 2. Both 1970s and 1998 samples were included in the ordination. Nomenclature follows USDA PLANTS database (plants.usda.gov).

Species	r-value
Achillea millefolium	–0.304
Ambrosia artemisiifolia	0.344
Asclepias verticillata	0.357
Bromus inermis	0.310
Clinopodium arkansanum	0.523
Conyza canadensis	0.679
Koeleria macrantha	0.351
Leucanthemum vulgare	0.503
Lobelia spicata	0.592
Lycopus americana	–0.369
Maianthemum stellatum	–0.335
Poa pratensis	0.613
Pycnanthemum virginianum	–0.396
Silphium terebinthinaceum	–0.313
Solidago gigantea	–0.300
Spartina pectinata	–0.375
Vitis riparia	0.505

When the individual ordinations of the 1970s data and the 1998 data were compared, the first ordination axis scores were similar but the second ordination axis scores differed. Spearman rank correlations comparing the ordination axis 1 scores for the 1970s samples to those for the 1998 samples had a significant correlation ($P < 0.0001$, $n = 29$) with a value of rho of 0.8946. Axis 1 scores were similar for both the 1970s and 1998 sites. However, the axis 2 scores showed much less relationship because while the Spearman correlation still showed a significant relationship ($P = 0.0483$, $n = 29$), the rho value was only 0.3699, showing much less correlation between axis 2 scores for sites in the 1970s and in 1998.

The second ordination axis for the analysis of the two time periods together shows a general separation between the 1970s and the 1998 samples (Figure 5). In general, the samples taken in 1998 received higher axis 2 scores than the 1970s samples. Examination of the relationship between species and this axis shows two general patterns (Table 5): (1) an increase in non-prairie species and (2) a decrease in some species present at wet sites. Most of these changes took place on the moister sites. Drier sites seemed to have fewer problems with the invasion of non-prairie species.

Species richness of the sites changed with time. The average number of introduced species per site also changed with time (Approximate 0.2 = 12.9, $P = 0.0003$, $n = 58$). The 1998 samples had a greater average number of introduced species (3.00 + 0.32, mean + standard error) than did the 1970s samples (1.10 + 0.34). However, the number of native species showed no significant difference between the 1970s and 1998 samples (1970s samples: 24.7 + 1.81; 1998 samples: 29.2 + 1.74).

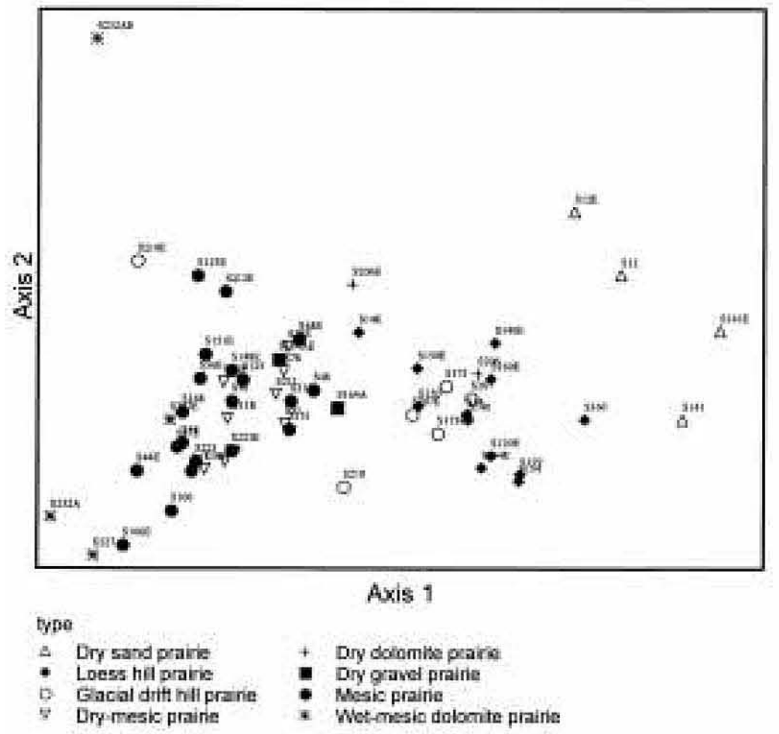

Figure 4. DCA analysis of the 1970s and 1998 INAI sample data together. Axes 1 and 2 of the ordination are shown. Default settings were used in PC-ORD (McCune and Mefford 1997). Site classifications are from the original INAI survey (White 1978).

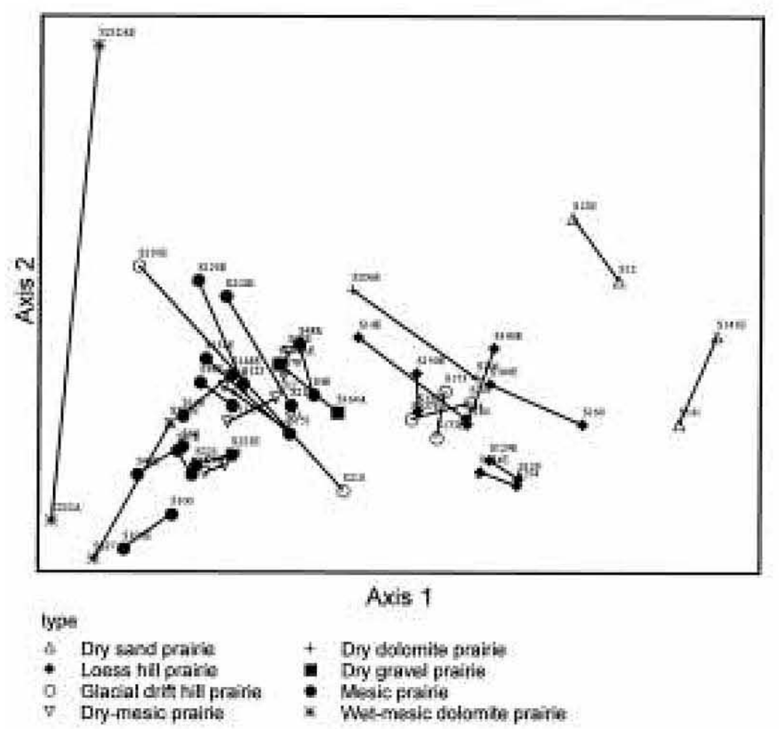

Figure 5. DCA analysis of the 1970s and 1998 INAI sample data together. Axes 1 and 2 of the ordination are shown. Samples of the same site at the two different times are connected with vectors.

Discussion

For all the data sets analyzed, the first ordination axis corresponded to a moisture gradient. This reflects patterns observed in prior studies of prairies in the eastern end of the Prairie Peninsula (Curtis 1959, Umbanhowar 1992, Corbett 1999). The pattern of species' relationship with the first ordination axis generally corresponded to that described by Bazzaz and Parrish (1982). However, soil nutrients can also play a role

in influencing species composition in prairie (Nelson and Anderson 1983). A Canonical Correspondence Analysis of the data revealed that as moisture availability increased, organic matter, potassium, and magnesium increased, while pH decreased. When the two data sets (1970s and 1998) are analyzed together, the first axis also corresponded to a moisture gradient, and, for individual sites, the 1970s and 1998 sampling generally received similar axis 1 scores.

Axes 2 and 3 showed relatively little meaningful separation for the data sets analyzed individually by DCA. However, a CCA analysis of the 1998 data revealed that there was separation among sites on the basis of high phosphorus compared to high calcium. Both high-phosphourus sites were sand prairies, while the high-calcium sites were from a variety of different site types including dolomite sites and hill prairies.

When the 1970s and 1998 samples were analyzed together using DCA, there was separation on the second ordination axis. The 1998 samples typically received higher axis 2 scores. An examination of the relationship between species and the second ordination axis shows that many non-prairie species including weedy native species, such as annual ragweed (*Ambrosia artemesiifolia*), and introduced species, such as smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*), are positively correlated with the second ordination axis, and some prairie species, especially species of wetter sites, such as water horehound (*Lycopus americanus*), Virginia mountain-mint (*Pycnanthemum virginianum*) and prairie cordgrass, are negatively correlated with the second ordination axis. This pattern suggests that there has been an increase in the abundance of "weedy" species over time, and a decrease in abundance of some prairie species, especially of moister sites. The drier sites seemed to show fewer changes.

Bowles and his colleagues (2003) studied sand prairies in Illinois that had been part of the original INAI. They found relatively few changes, even in unburned sites, although species richness did remain more stable, and there was less species loss in sites that were burned. It may be that drier sites are more resistant to invasion or population growth of non-prairie species, either because of site conditions or because of distance from propagule sources (most of the dry sites in this study were in a matrix of forest or savanna rather than an agricultural matrix).

Species richness changed with time. The number of native species did not change between the 1970s and 1998 sampling, but the number of species classified as "introduced" by either Curtis (1959) or the USDA PLANTS Database (USDA, NRCS 2004) increased significantly between the 1970s and 1998. Bowles and his colleagues (2003) found that species richness for native species remained "stable" in sand prairies that were burned, and either remained stable or declined in unburned sites. Most of the INAI sites studied here have maintenance that includes burning, so it seems reasonable that number of native species has not changed with time. However, because of difficulties in objectively determining what qualified as a "good" native prairie species and a "native but weedy" species, some species, such as the ragweeds and Canadian horseweed (*Conyza canadensis*), were included in the list of native species.

The prairie sites changed with time, but not markedly. The ordination axis 1 scores, which related to moisture availability, were very similar between the 1970s and 1998 samples. The second ordination axis scores, which seem to be related to amount of non-prairie species, were less similar. The major changes were an increase in the abundance (and in some cases, the presence) of non-native or native but "non-prairie" species and a decrease in the abundance, mostly in wetter sites, of some prairie species. There was no evidence for losses of prairie species over time, and no clear pattern of species characteristics that would make a species more susceptible to loss from Illinois remnant prairies. This may be because, unlike the prairies studied by Leach and Givnish (1996), the remnant prairies examined in this study are regularly burned. However, despite management, there is an increase in the abundance of non-prairie species over time.

This study compared two data sets, collected about twenty years apart by different researchers. There is always concern in comparing data collected at different times. Questions can be raised concerning whether the techniques used to collect the data were sufficiently similar, whether identifications or taxonomy are similar, and whether samples were taken at the same point in the growing season. Nilsson and Nilsson (1985) compared the results of sampling 41 islands in a Swedish lake at different points in time and using different teams of researchers. They determined that "pseudoturnover" (the apparent local extinctions of species or populations that were actually still present) was fairly high, with pseudoturnover being a greater problem when different surveyors were involved. Their results suggest that there is a possible danger in ascribing too much importance to the sudden appearance or disappearance of a species from a sample of a single site. However, the only way to monitor populations over time is by using samples that may be collected by different researchers, so the only thing that can be done is to keep these caveats in mind and try to replicate the sampling methods as much as possible.

In comparing the 1970s and 1998 samples of vegetation, I found evidence for increase of several species that are typically considered undesirable "weeds" in prairie. Most strikingly, it appears that annual ragweed was not present in any of the prairies examined in this study in the 1970s sample, but is present in many of the 1998 samples. This raises the question of whether this species was truly absent (or present in such low densities that it was not sampled) or if it was ignored during the original sampling because it was known not to "belong" in prairie. However, other species that might be considered "weeds" in prairie—Kentucky bluegrass and wild parsnip (*Pastinaca sativa*), for example—were both recorded as being present in the 1970s samples. It seems that even with management practices, Illinois remnant prairie is suffering from invasion of species commonly found in agricultural lands and "waste places."

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