ABSTRACT

WALL, WADE ALAN. Characterization of a North Carolina Lower Coastal Plain Wet Pine Savanna. (Under the direction of Thomas R. Wentworth and William A. Hoffmann.)

Savannas in the southeastern United States formerly occurred from East Texas to southern Virginia. Logging, conversion to agriculture, and fire suppression have reduced their area and extent, and there is an urgent need to catalogue and classify the remaining savannas for both restoration and resource management purposes. The Big Savannah was a unique wet savanna on a geographically-limited Inceptisol in North Carolina that was studied and described by B.W. Wells during the 1920s. Unfortunately, the site underwent agricultural conversion and the unique community it supported was believed to have been eliminated from the North Carolina landscape. Subsequent savanna classifications have either not included this type of community or placed it with savannas occurring on Ultisols. During the late 1990s, vegetation reminiscent of that described for the Big Savannah was discovered 8 km north of the original site in two power line corridors. Shelingoski (2005) used the Carolina Vegetation Survey protocol to survey 13 100 m^2 quadrats at Wells Savannah, the name given to the newly-discovered savanna. During summer 2005, we surveyed an additional 56 100 m^2 quadrats on the Taylor Tract, private property adjacent to Wells Savannah. We compiled a data set from existing quadrat data inventoried from other lower coastal plain savannas to compare to the natural community at Wells Savannah and the Taylor Tract and to determine the relationship of this community to those found on other savannas in the region. We combined 12 of the Wells Savannah quadrats, 26 of the Taylor Tract quadrats, 6 quadrats from Holly Shelter Game Lands, and 27 quadrats from the Carolina Vegetation Survey (CVS) database. Quadrats from Holly Shelter Game Land and the CVS database were selected because of their similarities to the Wells Savannah and

Taylor Tract quadrats, in terms of vegetation and topography, as well as geographical proximity. We used a variety of multivariate techniques to analyze the data. Multi-response permutation procedure (MRPP) results suggested significant vegetation and soil differences between the Wells Savannah/ Taylor Tract and surrounding savannas. Non-metric multidimensional scaling (NMDS), indicator species analysis (ISA), linear discriminant analysis (LDA), and classification tree modeling (CART) also clearly separated Wells Savannah and the Taylor Tract quadrats from other regional wet savannas. Species identified as indicators of Wells Savannah and the Taylor Tract tended to be either obligate or facultative wetland species, while the other wet savannas in the outer coastal plain of North Carolina contained a number of species, such as *Aristida stricta,* typically associated with areas experiencing shorter hydroperiods. NMDS ordination based on vegetation data separated Wells Savannah and the Taylor Tract from the other wet savannas, and discriminant analysis using soil characteristics correctly identified quadrats as either from Wells Savannah/ Taylor Tract or other wet savannas 76% of the time. Important distinguishing soil characteristics separating Wells Savannah and the Taylor Tract from the other wet savannas are the combination of higher clay percentage, higher calcium (ppm), and higher phosphorus. Recognition of a separate community type for Wells Savannah and the Taylor Tract is warranted, based on differences in vegetation and soil characteristics. Further exploration of the area is necessary in order to identify other remaining sites similar to the Big Savannah that may warrant preservation.

CHARACTERIZATION OF A NORTH CAROLINA LOWER COASTAL PLAIN WET PINE SAVANNA

by
WADE WALL

A thesis submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of
the requirements for the degree of
Master of Science

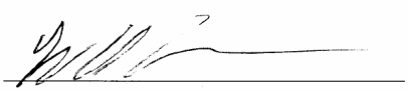
BOTANY

Raleigh, North Carolina

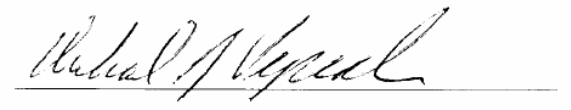
2007

APPROVED BY

Thomas R. Wentworth
Co-Chair



William A. Hoffmann
Co-Chair



Michael J. Vepraskas

BIOGRAPHY

I was born in Asheville, North Carolina and my family moved to Salt Lake City, Utah when I was three years old. They took me with them. I lived in Salt Lake City until the age of twelve, at which time my father retired, and we moved to Marion, a small town in western North Carolina. It was in Marion that I truly gained an appreciation for the beauty of nature through walks in the woods with my uncle Carl. Carl was a true botanist and "watcher of nature" who learned from experience, not from books. I owe my interest in nature to Carl and my father, who always had the time to take me hiking and camping.

After high school I attended the University of North Carolina at Chapel Hill, obtaining a major in Anthropology and a minor in Chinese. Why my parents didn't stop me, I'll never know. Perhaps I am too stubborn and wouldn't have listened anyway. Of course, the degree in Anthropology prepared me for future occupations as a carpenter and landscaper. Other Anthropology majors went on to become waitresses and bartenders. Some of them are still doing it.

For several years after college I built treehouses in the Chapel Hill area. The feeling of accomplishing something every day was exhilarating. Now I miss that feeling sometimes, when all I have to show at the end of a day are some pixels on a computer screen. I spent some time in Seattle working on a bottling line, just like Laverne and Shirley, and landscaping, unlike Laverne and Shirley. The pay was horrendous, but there was free beer involved. I also spent six months in Taiwan teaching English. These were my years of wondering, both internally and externally.

Eventually, I drifted back to my hometown, Marion, and started working as a social worker. Marion was much smaller than I had remembered it as a teenager, and so I moved to the nearby city of Asheville. It was at this time that I met Katie Coyle, my wonderful wife. We lived in Asheville for several years until Katie decided she wanted to attend law school at the University of North Carolina at Chapel Hill.

I continued working as a social worker in Durham North Carolina for some unknown reason. I still can't believe that I continued to toil in such a frustrating line of work. I guess someone has to do it. I was taking computer science courses at night to learn "something useful", but it dawned on me that I was going down the wrong road. I loved being outside observing nature, birds, rocks. I wasn't really that fond of computers and electricity and bits and bytes. Maybe it was the fact that it was spring. Spring causes those kinds of feelings. Anyway, I decided I wanted to return to school to dedicate myself to the study of Botany.

An interesting side to this is that around this time I heard Ken Moore, former assistant director of the North Carolina Botanical Garden, talking on the radio about the re-issue of a famous work, The Natural Gardens of North Carolina. It was written by an early North Carolina ecologist, B.W. Wells. I was so enthralled that I purchased the book and began reading it. Little did I know that a few years later I would be working in the same natural community, the pine savannas of North Carolina, which were so special to B.W. Wells.

Eventually, I took Introduction to Ecology with Dr. Wentworth at North Carolina State University. I think Dr. Wentworth felt sorry for me and let me into the Department of Botany to work on a master of science degree. So here I am, at the end of a long process. Why I wrote all this I have no idea. Perhaps, some day, when future archeologists are excavating North Carolina State University, they will come across this manuscript. Also, it's a requirement.

ACKNOWLEDGMENTS

I wish to thank my wife, Katie Coyle, for all her support and encouragement. If it weren't for Katie, I would have never been able to decide to switch careers. Also, I owe a debt of gratitude to my parents, Louis and Edna Wall, for providing me the opportunities in life that others may not get.

Dr. Wentworth and Dr. Hoffmann have been wonderful mentors, and I thank them for their guidance through this process. Dr. Wentworth also granted me the opportunity to return to academia, and I am forever in his debt. You can teach an old dog new tricks.

My lab mates, Kristen Rosenfeld, Brenda Wichmann and Alexa McKerrow, have provided support, and also a lot of comic relief. Kristen has been a great role model, Alexa helped me with GIS work, and Brenda, well, what can I say. I look forward to many years of friendship and collaboration.

Andy Walker helped to keep my eyes focused on the ground; there are many years of botanizing ahead of us.

I wish to thank Dr. Alexander Krings and Dr. Jon Stucky for all of their botanical expertise and assistance with plant identification. I would not have been able to identify a single *Dichanthelium* without them.

Dr. Michael Vepraskas and Chris Niewoehner provided soil expertise and advice. Any mistakes in this manuscript are there because I wouldn't listen. Dr. Gerig provided statitistical advice for the use of discriminant analysis. Michael Schafale and Richard LeBlond granted me their time to discuss savanna community classification and plant identification, and they provided useful insights into the structuring of the longleaf pine ecosystem. This work would not have been possible without the assistance of Dr. Robert Peet, both for his insights into savanna classification and the use of previously-collected data.

Joe Taylor allowed me to sample the wonderfully unique vegetation of the Taylor Tract and I am forever grateful. Also, a debt of gratitude goes to Zack Hill for "sticking with it" as a field assistant. I hope you are doing well and still botanizing.

Last, but not least, I wish to thank Sue Vitello and the Botany Department staff for all their assistance. None of us could do it without you. To anyone I have forgotten, I apologize in advance.

TABLE OF CONTENTS

LIST OF TABLES

Page

Chapter 1

LIST OF FIGURES

Page

Chapter 1

LIST OF FIGURES (continued)

Introduction

Savannas formerly covered large expanses of the southeastern United States. Pre-European settlement estimates set coverage of longleaf pine, the main overstory component of southeastern savannas, at 37 million hectares, with most of this area occupied by savannas (Frost 1993). Longleaf pine savannas were found from east Texas to central Florida and north into Virginia, and similar community types existed as far north as New Jersey (Taggart 1990). Savannas were not only geographically widespread, but occurred under a range of hydrologic regimes, from subxeric to hydric, the latter typically saturated through the winter and early spring.

Although savannas were once dominant across the southeastern landscape, anthropogenic activities such as fire suppression, agriculture, and timber operations have destroyed most of the savannas in the southeastern United States (Frost *et al*. 1986). The remaining savannas are on both public and private lands and receive a variety of different management regimes, including burning, grazing and mowing (Taggart 1990). Many savannas are not receiving active management of any type, especially those on private lands. Different management regimes have led to a range of conditions for extant savannas, from fire-suppressed savannas with woody encroachment to annually-burned sites with a dense herbaceous layer and an open canopy.

B.W. Wells was among the early ecologists who pioneered efforts to understand southeastern savannas, (or savannahs, in early 20th century spelling). A 607 hectare site 8 km north of Burgaw, North Carolina, locally known as the Big Savannah, was especially influential to Wells' understanding of savannas. B.W. Wells originally became aware of the Big Savannah on a 1920 train trip to Wilmington from Raleigh. The railway ran through the

middle of the site, and Wells was impressed by the remarkable floral display. He spent several field seasons during the 1920s collecting soil and vegetation data in order to characterize the site, culminating in a classic 1928 work, written with his collaborator I. V. Shunk, "A Southern Upland Grass-Sedge Bog: An Ecological Study" (Wells and Shunk, 1928b).

Wells detailed a community at the Big Savannah that he described as a xeric grass-sedge bog, or "savannah land" (Wells and Shunk 1928a). It occurred on a silty soil with a long hydroperiod, and Wells identified three distinct associes (Wells and Shunk 1928a). Local residents burned the Big Savannah every winter and grazed the site during the spring. It was essentially treeless, although Wells found woody sprouts such as *Nyssa biflora* that were over 50 years old. Big Savannah contained a remarkable number of *Rhynchospora* species, as well as most of the carnivorous taxa represented in North Carolina.

Unfortunately, the site was privately owned and despite efforts by Wells and others to preserve it for future generations, it was sold in the 1950s to a new owner. Many erroneously believed the site was too wet for agriculture and that preservation was unnecessary; however, new technology allowed the owner to convert the Big Savannah into agricultural fields. Wells and others at the time believed that this unique community type had been extirpated from the North Carolina landscape.

Until recently, the savanna concept included all southeastern U.S. communities with a relatively open pine canopy, sparse shrub layer, and a dense herbaceous layer. In the past two decades, the savanna concept as applied to the southeastern United States has narrowed somewhat, used in reference to areas with fine-textured soils that are seasonally saturated (Peet 2006). The canopy can be dominated by either *Pinus palustris* or *Pinus serotina*, with

the latter increasing in dominance in wetter sites. This concept excludes many flatwoods that share a similar physiognomy and hydroperiod but have coarser-textured soils. Species richness in savannas tends to be high, especially at small scales (Walker and Peet 1983). Savannas include a number of orchids and carnivorous plants, and legumes tend to be absent in the more mesic savanna sites (Wells and Shunk 1931).

Because landscape-scale classification of savanna types has only begun in the last 20 years, the Big Savannah has either been included with other extant community types in recent classifications, or ignored completely. Taggart (1990) presented the first classification of savanna community types in the Carolinas based on vegetation and soil characteristics from inventory plots. The area covered included all of North Carolina and South Carolina north of the Congaree River. Taggart recognized five savanna categories, naming them based on the hydrologic regime and the associated soil order: dry, mesic and wet Ultisols, and dry and wet Spodosols. Recently, Robert Peet presented a classification that covers the entire range of southeastern U.S. savannas (Peet 2006). He divided the southeastern U.S. into five geographic regions, with further classification of savannas within each of the regions based on soil texture and hydroperiod. Most of the extant savannas in North Carolina are included in the Atlantic Coastal Plain region. In these and other classifications, the Big Savannah is either classified as a wet Ultisol variant (e.g., Taggart 1990), or only mentioned cursorily, if at all, due to the lack of quantitative data from this site.

In the 1990s an unexpected opportunity arose to revisit the Big Savannah and its reportedly unique vegetation type. On numerous trips to Pender County, Richard LeBlond of the North Carolina Natural Heritage Program noticed vegetation in two power line corridors that was reminiscent of that described by B.W. Wells for the Big Savannah. LeBlond's 1997

Natural Heritage Program Inventory of Pender County briefly described this plant community, noting its similarity to the former Big Savannah in terms of vegetation, hydrology, and soil (LeBlond 2000). Shelingoski *et al.* (2004) described this savanna subtype in greater detail using vegetation and soil data, comparing the site to the Big Savannah as desribed by B.W. Wells and other savanna sites at Holly Shelter Game Land. Wells Savannah, as the site has become known, was purchased by the Coastal Land Trust in 2002 (Shelingoski 2004).

Private land surrounding Wells Savannah shares the same topography and soil series. In contrast to other nearby savannas that are on either Ultisols or Spodosols, Wells Savannah and the surrounding area are included in the Liddell soil series, an Inceptisol, with poorly defined horizons and high silt content. The geographically-limited Liddell soil series occurs on large flats mainly in northern Pender County, with isolated patches also found in Wayne and Duplin Counties. The Taylor Tract, a 243 ha privately-owned parcel adjacent to Wells Savannah, has vegetation and soil similar to those of Wells Savannah, but has been subject to different disturbance history.

Aerial photos from the late 1930s show a relatively open savanna landscape on both the Wells Savannah site and the Taylor Tract (Figure 1). However, fire suppression since that time has resulted in development of a progressively denser canopy on the Taylor Tract, while parts of Wells Savannah remained relatively open due to frequent mowing of the two power line corridors. The Taylor Tract was clear cut in the late 1990s, once again opening up the site. At the present time the site has a mosaic of herbaceous and woody cover with numerous savanna species represented.

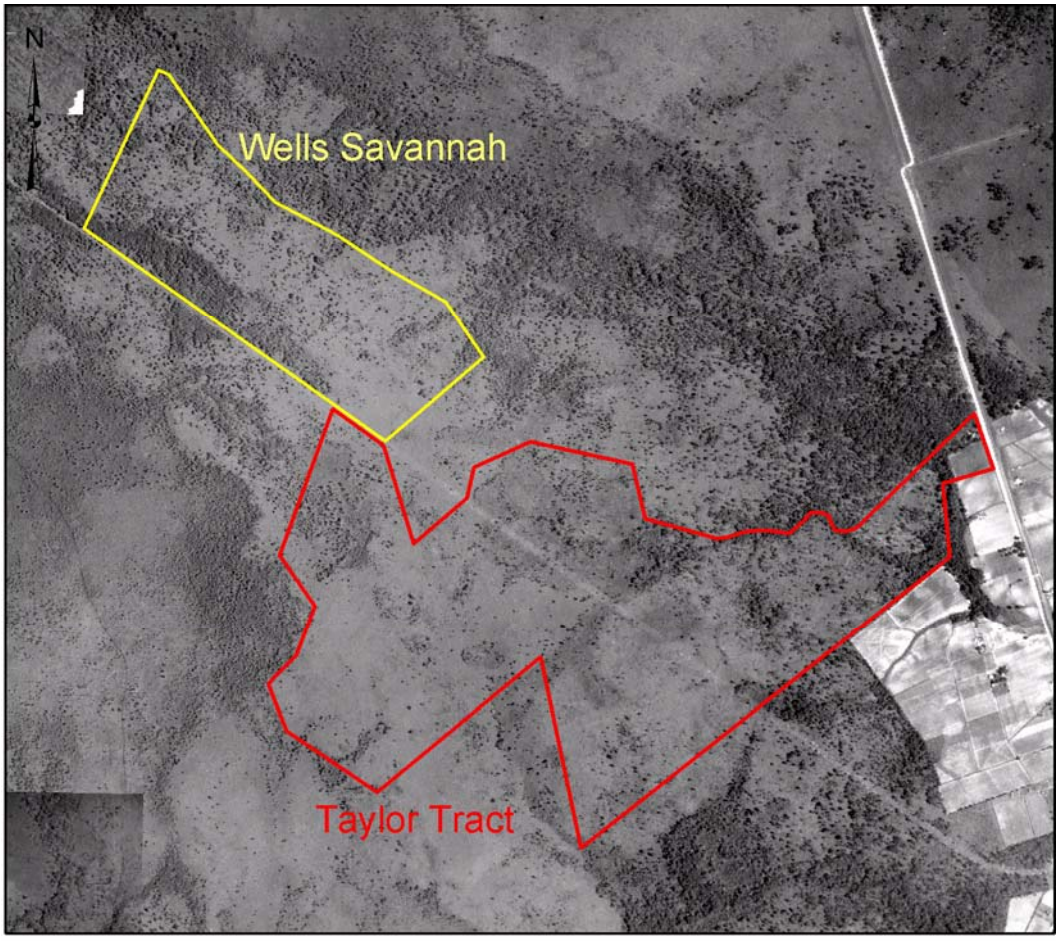


Figure 1. 1938 aerial photograph of Wells Savannah (yellow outline) and the Taylor Tract (red outline). Photograph reveals continuous herbaceous layer with a sparse, open canopy characteristic of southeastern savanna physiognomy.

Our objectives were to (1) explore the possibility that Wells Savannah and the Taylor Tract represent a unique savanna community type relative to surrounding lower coastal plain savannas, and, if so, (2) identify the vegetation and soil characteristics distinguishing the Wells Savannah and Taylor Tract from other coastal plain savannas. To this end we inventoried 56 100 m^2 quadrats on the Taylor Tract to augment the Wells Savannah quadrats as inventoried by Shelingoski *et al.* (2004). We compared the quadrats from these two sites to 6 quadrats from Holly Shelter Game Lands and 27 wet savanna quadrats extracted from

the Carolina Vegetation Survey (CVS) database. We selected quadrats from the CVS database based on their geographical proximity to Pender County and community classification (i.e., canopy dominance by *Pinus palustris*).

We employed a number of multivariate analyses to fulfill our objectives. First, we performed a multi-response permutation procedure (MRPP) on both the environmental and species data, using a previous classification of the 27 wet savannas by Dr. Robert Peet (unpublished data), verified with cluster analysis. For the species data, we performed indicator species analysis (ISA) and non-metric multidimensional scaling (NMDS) ordination. Linear discriminant analysis (LDA) was used to identify important environmental variables for discriminating between the different groups, and we performed individual t-tests on variables identified as important descriminators. Finally we used classification tree modeling (CART) to predict group membership, using the underlying environmental characteristics as predictor variables (Figure 2).

Methods

Originally, the present work was to provide baseline data for a project studying the effects of frequency and seasonality of fire on community composition. We divided the Taylor Tract into 30 different treatment units in a complete block design with five treatments and a control (Figure 3). The treatments were summer 1 and 2 year burns, winter 1, 2 and 4 year burns, and a control unit (Figure 3). The geographic coordinates of each treatment unit's centroid served as the center for placement of a 20x50 m (0.1 hectare) plot following a modified version of the CVS Protocol (Peet *et al*. 1998). We modified the CVS protocol by randomly selecting two quadrats for sampling, rather than the implementing standard intensive sampling of four pre-specified quadrats.

In this thesis, we will refer to sampling units at the 0.1 hectare scale, as specified by the CVS protocol, as plots. The term "quadrat" will refer to a 100 m^2 sampling unit, whether existing as a subplot of a 0.1 hectare CVS plot or sampled as an individual unit (e.g., the Wells Savannah/ Taylor Tract sampling units.

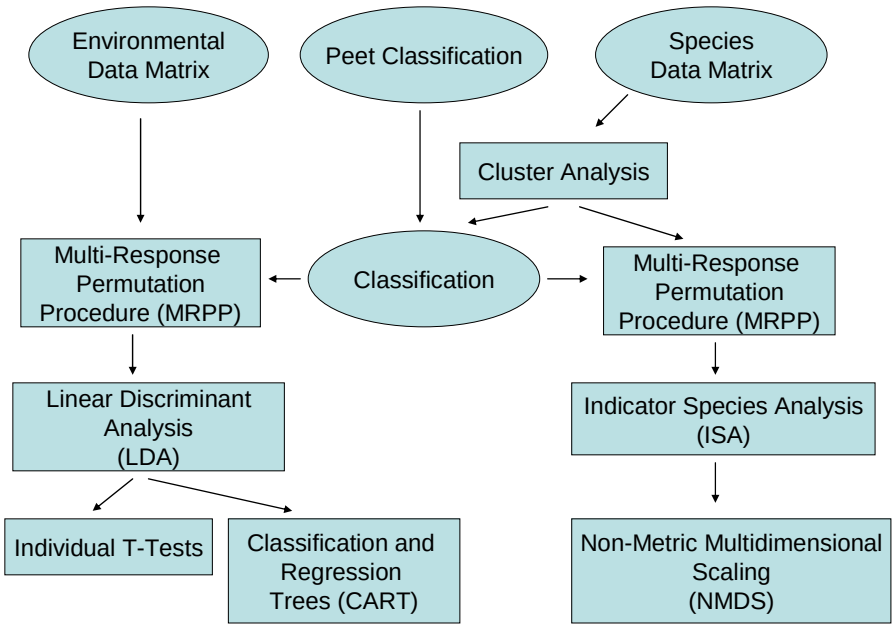


Figure 2: Workflow diagram of the multivariate analyses performed for the purpose of classifying the Wells Savannah/ Taylor Tract quadrats relative to surrounding North Carolina wet savannas. Ellipses represent input/output and rectangles represent procedures/analyses.

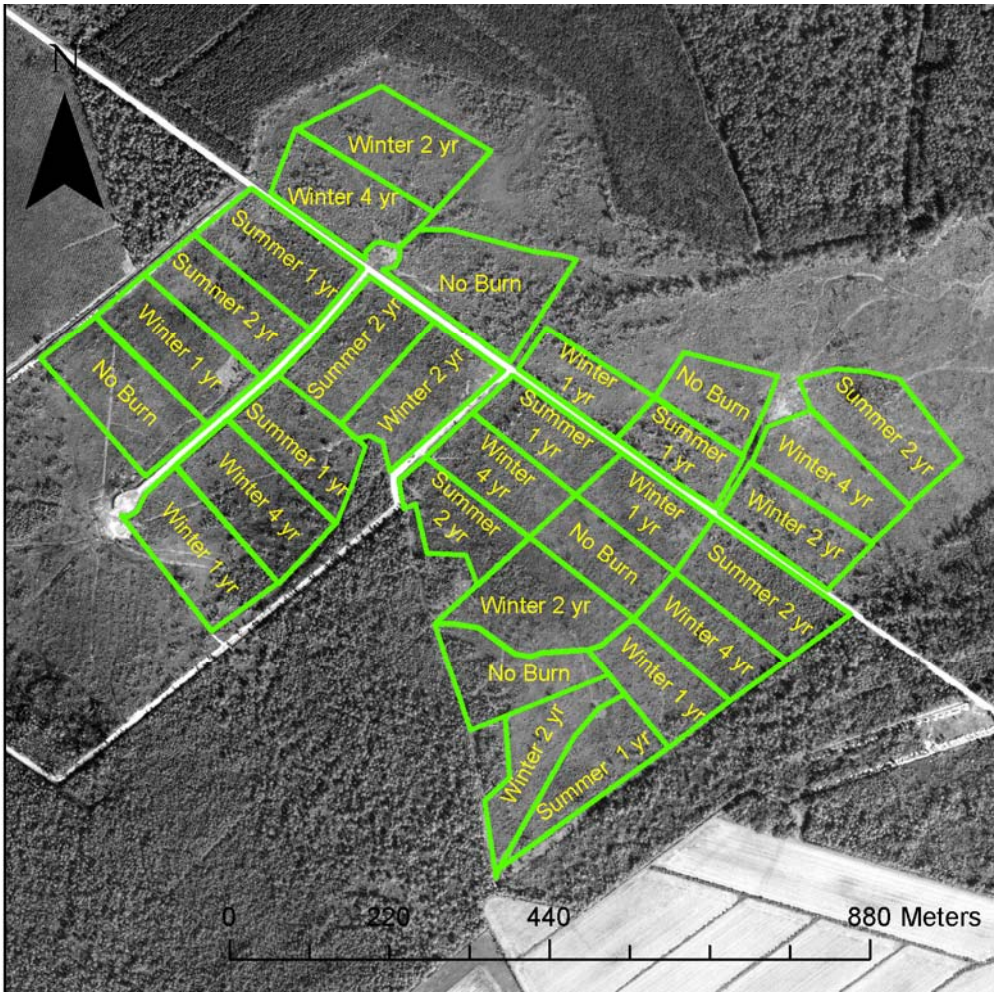


Figure 3. Proposed Taylor Tract treatment units. Treatments are annual winter burns, biennial winter burns, four-year interval winter burns, annual summer burns, biennial summer burns, and control (no burning).

Every 100 m^2 quadrat within a 0.1 hectare plot on the Taylor Tract was assigned to one of two classes, woody or herbaceous, based on its abundance of woody or herbaceous plant cover relative to the other quadrats within the plot. Assignment of quadrats to either woody or herbaceous class was based on visual examination of all quadrats within a plot, followed by a ranking of the quadrats from most herbaceous to most woody. Following ranking, the ten quadrats were divided into the two classes, using predominant cover (woody or herbaceous) as the criterion for class assignment. For each plot we randomly selected one

woody and one herbaceous quadrat for intensive sampling. On average, there were 4 herbaceous quadrats and 6 woody quadrats per plot. All plots contained a least one woody quadrat. However, in plots 15 and 25 there were no herbaceous quadrats. In all, we sampled 56 quadrats, 30 woody and 26 herbaceous, during the summer of 2005.

We sampled each of the two quadrat types within each of the Taylor Tract plots using the single quadrat protocol as outlined in the CVS protocol (Peet et al. 1998). We sampled all four corners of each quadrat at four different nested scales: 0.01 m^2, 0.1 m^2, 1 m^2, and 10 m^2. In each corner, we recorded all species occurring at each scale by assigning them codes indicating the finest scale at which they were first observed. For example, if *Ctenium aromaticum* occurred at the 0.01 m^2 scale, we assigned it a code of 5, if it occurred at the 0.1 m^2 but not at the .01 m^2 scale, it would be assigned a code of 4 and so on. Species that only occurred at the 100 m^2 scale (but not in any of the subquadrats within the quadrat) were assigned a code of 1 for all corners. We also recorded the cover value for all species occurring within the 100 m^2 quadrat by assigning a percentage value. Values were in 1% increments from 0-5% and 5% increments thereafter. CVS protocol calls for the assignment of ranks based on percentage ranges, so we converted our cover values to CVS ranks for analysis purposes. Nomenclature for all quadrats, including the CVS and Holly Shelter Game Land quadrats, follows Weakley (2005). Specimens were deposited at North Carolina State University Herbarium (NCSC).

Construction of Matrices

We combined the 26 quadrats classified as herbaceous from the Taylor Tract, 12 quadrats from Wells Savannah inventoried during the summer of 2002, and 6 quadrats

sampled at Holly Shelter (Shelingoski *et al.* 2002). Only the herbaceous Taylor Tract quadrats were included, because of their resemblance to area savannas; the Taylor Tract quadrats classified as woody more closely resembled pocosins than savannas. In addition, we extracted 120 plots from the CVS database that were identified as representative lower coastal plain savannas. The 120 CVS plots were selected based on previous recommendations by Shelingoski *et al.* (2002). Criteria for the selection of the CVS plots were (1) inclusion in the *Pinus palustris* community type and (2) location in the lower coastal plain of North Carolina. Geographically, all the plots and quadrats were located in six outer coastal plain counties: Brunswick, Carteret, Craven, New Hanover, Onslow, and Pender.

To compare Wells Savannah and the Taylor Tract to the savannas of similar vegetation and hydrology, we selected 27 of the 120 CVS plots, based on classification of each plot by Dr. Robert Peet (unpublished data) and preliminary multivariate analysis and cluster analysis (results not shown). The 27 plots and the quadrats randomly selected therefrom represent sites that have generally been described by those studying southeastern savannas as "wet savannas", experiencing longer hydroperiods and containing a number of obligate and facultative wetland species. Plots that were excluded from the analysis represent sites on xeric/subxeric sand ridges, silty uplands characteristic of the upper coastal plain, and sites that have historically been described as "flatwoods".

To use vegetation data from a consistent scale (100 m^2) and to avoid issues of spatial autocorrelation, we randomly selected one of the intensively-sampled 100 m^2 quadrats from each of the CVS plots when more than one intensive quadrat had been inventoried. Only species found in the selected 100 m^2 quadrat were included in subsequent analyses.

Our final matrix used for all subsequent analyses included the 12 quadrats from Wells Savannah, 6 quadrats from Holly Shelter Game Land, the 26 Taylor Tract quadrats designated as "herbaceous", and the 27 CVS savanna quadrats inventoried from surrounding savannas, for a total of 71 quadrats.

Soil Collection and Analysis

Soil sample collection followed the methods used for the CVS plots and the Wells Savannah quadrats. We collected A-horizon soil samples from three different locations within each quadrat during summer 2006, to a depth of 10 cm. Due to previous logging operations, a few of the plots had mixed A and B horizons (Ap), making differentiation of the horizons difficult. We attempted to avoid collecting soil from these areas; however this was not possible in all cases. In addition, we collected a B horizon sample at 25 cm (10 inches). This is within the B horizon as listed for the Liddell soil series (Barnhill 1990). The B horizon samples were not used in the present analyses.

Brookside Laboratories (308 South Main St. New Knoxville, OH 45871) had previously performed soil nutrient analyses for all soils collected from the 27 CVS savanna quadrats, as well as the Wells Savannah and Holly Shelter Game Land quadrats. For consistency we submitted A and B horizon samples from each of the Taylor Tract quadrats to Brookside Laboratories. The following attributes were either directly measured by Brookside Laboratories or calculated using their formulas, as specified by their S001B protocol: cation exchange capacity (meq/100 g) (calculated), pH (measured), percent organic material (measured), nitrogen ppm (measured), sulfur ppm (measured), phosphorus ppm (measured), calcium ppm (measured), magnesium ppm (measured), potassium ppm

(measured), sodium ppm (measured), boron ppm (measured), iron ppm (measured), manganese ppm (measured), copper ppm (measured), aluminum ppm (measured), zinc ppm (measured), percent calcium in sample (measured), percent magnesium in sample (measured), percent potassium in sample (measured), percent sodium in sample (measured), percent hydrogen in sample (measured), disturbed bulk density (measured), and percent base saturation (calculated). Brookside Laboratories also performed soil particle size analysis for the 27 CVS savanna quadrats. For the Wells Savannah and Taylor Tract quadrats, soil particle size was determined at the North Carolina State University soil laboratory using the methods of Gee and Bauder (1986).

Group Classification and Cluster Analysis

The 27 CVS quadrats were previously classified by Robert Peet (unpublished data) into four different communities based on vegetation: 6.1.1, 6.1.2, 6.1.5, and 6.1.8 (Table 1). In his numeric classification system, "6" refers to the region, in this case the Atlantic Coastal Plain, "1" refers to wet savannas, and the last digit is a finer classification based on vegetation. We renamed the numeric Peet categories by combining the common names of the two most abundant species for each community (Table 1). For example, the quadrats identified as belonging to 6.1.1 were renamed dropseed-wiregrass savannas because *Sporobolus pinetorum* and *Aristida stricta* were the two most common species. The Holly Shelter Game Land quadrats inventoried by Shelingoski *et al.* (2004) were not classified according to the above system, so were given their own classification in for the purposes of analysis (Table 1).

We first performed a cluster analysis on the 71 quadrat data set using a Sorenson distance measure. A Sorenson distance measure was used due to its space-conserving abilities and its performance based on empirical evidence when used with ecological data (McCune and Grace 2002). The linkage method that is compatible with the Sorenson distance measure is flexible beta (Lance and Williams 1967). The adjective "flexible" is attached to this linkage method because the user is able to decide on the amount of space distortion, or chaining, in the represented dendrogram. We selected a $\beta = -0.25$, because flexible beta then performs most like Ward's Method, which has performed well in past experiments with ecological data (McCune and Grace 2002).

Multivariate Analysis

We performed four multi-response permutation procedures (MRPP) to test the hypotheses that the Wells Savannah/ Taylor Tract quadrats differed from the CVS and Holly Shelter quadrats (as one group) in terms of vegetation and soil characteristics, and that the Wells Savannah/ Taylor Tract quadrats differed from the other savanna quadrats grouped according to the Peet classification, also in terms of vegetation and soil characteristics. MRPP is a distance-based, nonparametric method that tests for differences in either mean or variance of included variables between 2 or more groups (Mielke and Berry 2001). MRPP results include a measure of significance (p-value) and a measure of effect size, also known as the chance-correlated within-group agreement (A). The A statistic is basically a measure of within group homogeneity. For community data, A values are typically less than 0.1, and a value of 0.3 is considered high (McCune and Grace 2002). We used a Sorenson distance measure for both the soil and vegetation data, again due to its superior performance in

analyzing ecological data. All MRPPs were performed using using PC-Ord 4.41 (McCune and Mefford 1999).

For the vegetation data, we performed an indicator species analysis (ISA) (Dufrêne and Legendre 1997) to identify individual species associated with particular wet savanna community types (Table 1). ISA is a multivariate technique that allows one to identify species that are good "indicators" of *a priori* groups of sampling units, in our case, quadrats. Indicator values (IV) for all species are calculated for each group based on the frequency within the group, fidelity to the group, and the abundance value of the species when present within the group. Thus, individual species have unique IVs for each group. Significant differences in IV values by group for each species were assessed based on a permutation procedure. We only included those species that had both p-values less than 0.05 and indicator values greater than 25 (scale 0 to 100), following the recommendations of Collins *et al.* (2006). We ran two indicator species analyses with different *a priori* groupings: first, we compared Wells Savannah and the Taylor Tract to the Carolina Vegetation Survey and Holly Shelter quadrats grouped together, and second we analyzed the Wells Savannah/Taylor Tract quadrats (one group) and the CVS and Holly Shelter quadrats classified into five separate groups, again using Peet's classification codes. We used PC-Ord 4.41 for the ISA (McCune and Mefford 1999).

We then performed two NMDS ordinations, one with the full suite of species, and a second with the woody species removed. The second analysis was performed to eliminate possible bias due to the presence of woody species at the Taylor Tract and Wells Savannah. NMDS is an iterative optimization ordination technique that allows one to reduce multi-dimensional data structures into fewer dimensions for analytical purposes, in our case to

visualize the location of Wells Savannah and the Taylor Tract quadrats relative to the other quadrats in ordination space. For both NMDS ordinations, we used a Sorensen distance measure for the preliminary run and the final run. For the preliminary run a step-down from six dimensions to one with an instability criterion of 0.0005 was used. We selected 400 iterations and 20 runs with the real data, with a Monte Carlo test of 40 runs performed on each preliminary ordination. We selected the appropriate number of axes based on the final stress for each dimension from the preliminary ordination and output recommendation from PC-Ord. The final NMDS run consisted of the selected number of dimensions from the preliminary run with no step-down in dimensionality. We used the configuration file from the preliminary run and one real run.

For the soil data, we performed a linear discriminant analysis (LDA) to identify the soil variables most important for distinguishing between (1) the Wells Savannah/ Taylor Tract quadrats and the CVS/ Holly Shelter quadrats as a single group and (2) the Wells Savannah/ Taylor Tract quadrats compared to the CVS and Holly Shelter quadrats using the Peet classification for grouping. LDA is an eigenanalysis-based technique that seeks to maximize pre-defined group differences based on underlying variables and to identify which variables are best at predicting group membership. Soil variables were removed that were either (1) highly correlated with other variables, (2) non-normally distributed, or (3) calculated from other soil variables and not directly measured. We used the following soil variables for the LDA: pH, organic matter, sulfur, phosphorus, Ca (ppm), Mg (ppm), K (ppm), Na (ppm), percentage Ca, percentage Mg, percentage K, percentage Na, B (ppm), Fe (ppm), Zn (ppm), Al (ppm), percentage clay, and percentage silt.

Finally, we used classification tree modeling (CART) to predict group membership for the 71 savanna quadrats based on underlying soil characteristics. CART divides datasets with pre-assigned group membership into increasingly homogeneous subsets based on the included predictor variables. The end result is a dichotomous key that can be used for the prediction of group membership for either future or present sample units (in the present case, the quadrats). For the classification tree, all environmental variables were used and group membership was the same as described under "Group Classification and Cluster Analysis". Variables actually used by the algorithm to construct the classification tree were percentage sand, percentage silt, and Calcium (ppm). We used the `tree()` function in the MASS package in R (version 2.4.0) for the construction of the classification tree and the `lda()` function, also in the MASS package, for the linear discriminant analysis (Ihaka and Gentleman 1996).

Results

In general, the *a priori* savanna groups provided by Robert Peet were evident in the results of cluster analysis (Figure 4). Cluster analysis separated the Wells Savannah and the Taylor Tract quadrats from the 27 CVS wet savanna quadrats and the 6 Holly Shelter quadrats at the first bifurcation of the dendrogram, with the exception of quadrats Little06 and LanQua02 (Figure 4). These two quadrats represented sites that had been previously classified as switch cane-sweet gum savannas (Table 1).

The Wells Savannah quadrats, with a few exceptions, separated from the Taylor Tract quadrats within the dendrogram. The quadrats Wells18 and Wells19, surveyed by Shelingoski in the fire-suppressed woodland adjacent to Wells Savannah, clustered with the

Taylor Tract quadrats. Only one quadrat from the Taylor Tract site, P30_5, was associated with the Wells Savannah quadrats in the dendrogram (Figure 4).

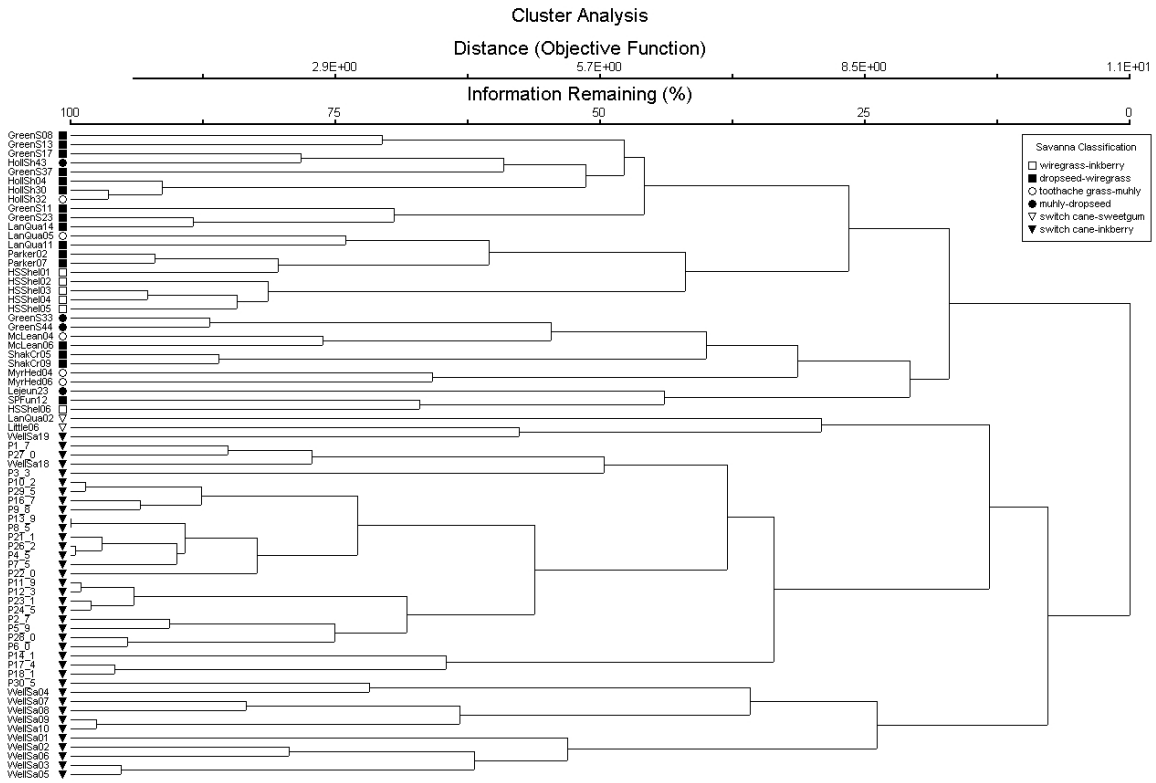


Figure 4: Cluster analysis of the 71 wet savanna quadrats classified *a priori* according to Peet classification (see legend). Results demonstrated separation of the Wells Savannah/ Taylor Tract quadrats from the CVS and Holly Shelter wet savanna quadrats.

Multi-response permutation procedure (MRPP) results for the vegetation data demonstrated significant vegetation and soil differences between the Wells Savannah/ Taylor Tract quadrats and the CVS/ Holly Shelter wet savanna quadrats. For the vegetation, the chance-corrected within-group agreement (A) was 0.11, with a p-value <0.0001. The chance-corrected within-group agreement for the soil data was 0.03, with a p-value of 0.003. MRPP results also demonstrated significant differences between the Wells Savannah/ Taylor Tract quadrats and the other wet savannas, grouped according to the Peet classification, for both vegetation and soil. Vegetation differences between the groups had an A value of 0.04,

with a p-value <0.0001. Using soil as the predictor variable again resulted in an A value of 0.04, with a p-value of 0.007.

Indicator species analysis comparing the Wells Savannah/ Taylor Tract quadrats to the CVS/ Holly Shelter wet savanna quadrats (as a single group) identified seventy species with indicator values (IV) greater than 25 and p-values less than .05 (Table 2). Indicator species found in the Wells Savannah/ Taylor Tract quadrats included a number of woody species such as *Morella cerifera* and *Clethra alnifolia*. Also included were a number of *Andropogon* species, including *A. mohrii* and *A. glaucopsis*. *Rhynchospora* spp. were also abundant in the Wells Savannah/ Taylor Tract quadrats, and *Rhychospora cephalantha, R. chalarocephala, R. gracilenta,* and *R. rariflora* were all indicators of the Wells Savannah/ Taylor Tract quadrats. *Scleria minor*, a species typically associated with wetter areas, was an indicator of the Wells Savannah/ Taylor Tract quadrats, while *Scleria ciliata* was an indicator of the other wet savannas. *Scleria ciliata*, compared to *Scleria minor,* is associated with shorter hydroperiods and drier sites. Indicators of the other wet savannas included a number of species with ranges well into drier areas, such as *Aristida stricta* and *Sporobolus pinetorum.* For the most part these species were absent from the Wells Savannah/ Taylor Tract quadrats. In addition, a large number of species in the family Asteraceae were indicators of the other wet savannas.

ISA comparing the Wells Savannah/ Taylor Tract quadrats to the CVS/ Holly Shelter quadrats as classified by Robert Peet (Table 1) demonstrated similar trends (Table 3). *Andropogon glaucopsis, Rhynchospora chalarocephala*, and *R. gracilenta* remained as indicators of the Wells Savannah/ Taylor Tract quadrats. *Acer rubrum* and *Arundinaria tecta* became indicators of the switch cane-sweetgum savanna quadrats (Table 1) that had clustered

with the Wells Savannah/ Taylor Tract quadrats in the cluster analysis. *Acer rubrum* and *Arundinaria tecta* had previously been indicators of the Wells Savannah/ Taylor Tract quadrats in the ISA comparing the Wells Savannah/ Taylor Tract quadrats to all other savannas as a single group. A number of species not typically considered "savanna" species, such as *Chionanthus virginicus, Liquidambar styraciflua,* and *Vitis rotundifolia,* also occurred in the two switch cane-sweetgum quadrats. These species also occurred in the Wells Savannah/ Taylor Tract quadrats, but had relatively low cover values. No species were identified as indicators of the dropseed-wiregrass savanna quadrats, although the community type contained the second largest number of quadrats.

Non-metric multidimensional scaling (NMDS) ordination with all species included demonstrated compositional trends similar to those elucidated in the cluster analysis, separating the Wells Savannah/ Taylor Tract quadrats from the other wet savannas in ordination space (Figure 5). As in the cluster analysis, LanQua02 and Little06, the two switch cane-sweetgum savanna quadrats, were closer to the Wells Savannah/ Taylor Tract quadrats than to other savanna quadrats. The dropseed-wiregrass, toothache grass-muhly, and muhly-dropseed savanna quadrats separated from the Wells Savannah/ Taylor Tract quadrats in ordination space; however there was little separation among quadrats representing the former three community types (Figure 5).

In the ordination, phosphorus decreased (r=-0.573) along axis 1, with the Wells Savannah/ Taylor Tract quadrats generally having higher phosphorus values. The correlation of organic matter with axis 1 was weak (r=-0.300) and was not included in the soil variable overlay (R cutoff = 0.22). Correlations of important environmental variables with axis 2 were pH, base saturation, and Ca percentage (Pearson's r = 0.484 for base saturation, 0.468

for pH, and 0.486 for Ca percentage). The vector for pH is not represented in the ordination (Figure 5).

A number of species exhibited significant changes in abundance along axes 1 and 2 of the NMDS ordination. *Acer rubrum* (r=-0.783) and *Arundinaria tecta* (r=-0.359) decreased in abundance along axis 1, while *Xyris caroliniana* (r=0.689), *Aristida stricta* (r=0.652), and *Scleria ciliata* (r=0.418) increased. As previously mentioned, the latter two species are typically associated with savannas experiencing shorter hydroperiods and all three are indicators of the other wet savannas (Table 2). Along axis 2, *Ctenium aromaticum* (r=.453), *Dichanthelium scabriusculum* (r = .461), and *Rhexia lutea* (r= .468) increased in abundance values. *Dichanthelium scabriusculum*, an obligate wetland species, is an indicator of the Wells Savannah/ Taylor Tract quadrats, with maximum abundance values at Wells Savannah, and also high abundance in several Taylor Tract quadrats.

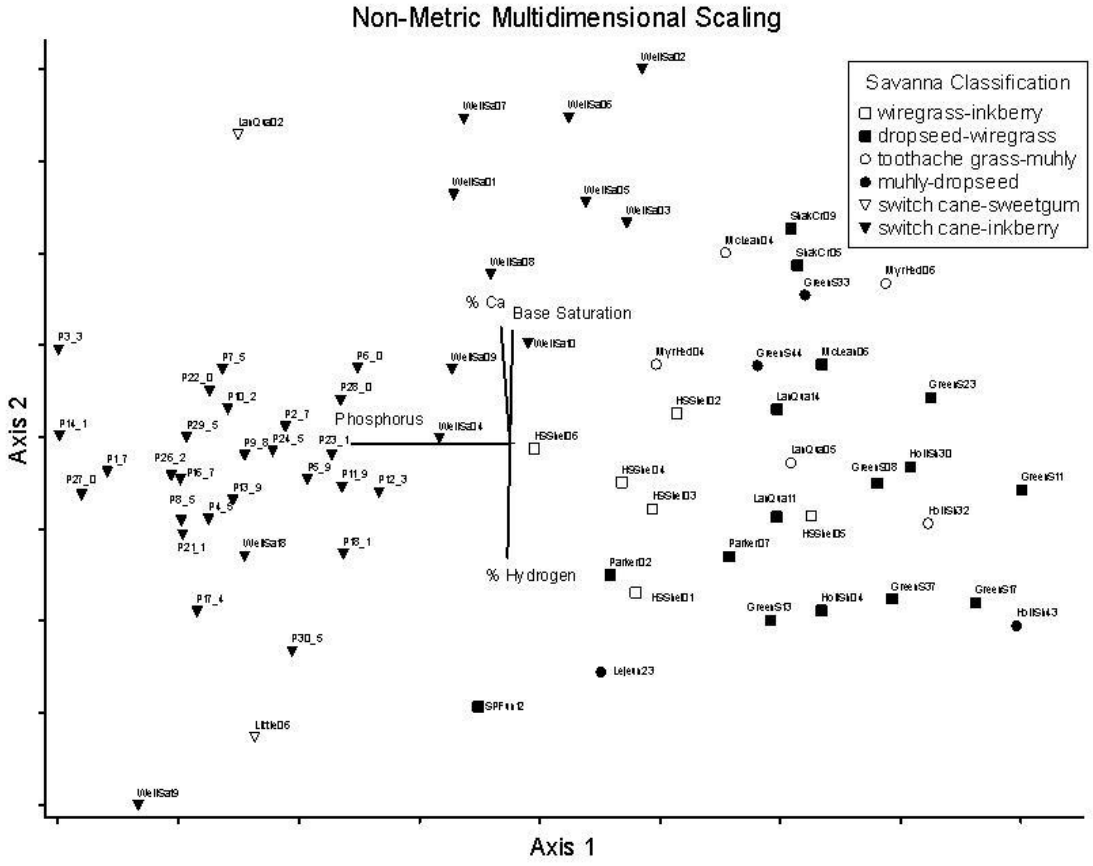


Figure 5. Non-metric multidimensional scaling ordination of the 71 wet savanna quadrats. Ordination rotated -109 degrees. Symbols follow Peet community classification using naming system employed in this thesis (Table 1). R^2 cutoff for vectors is 0.22. Important environmental vectors are % Hydrogen, % base saturation, % Calcium, and Phosphorus (ppm).

NMDS ordination performed with the woody species removed yielded similar results to NMDS ordination with the full suite of species (Figures 5 and 6). The 27 wet savanna quadrats and the Holly Shelter quadrats (wiregrass-inkberry savanna community type) separated from the Wells Savannah/ Taylor Tract quadrats. LanQua2 and Little6 were again closer to the Wells Savannah/ Taylor Tract quadrats in ordination space. Overlay of environmental vectors yielded similar results, with phosphorus being an important environmental vector (Figure 6).

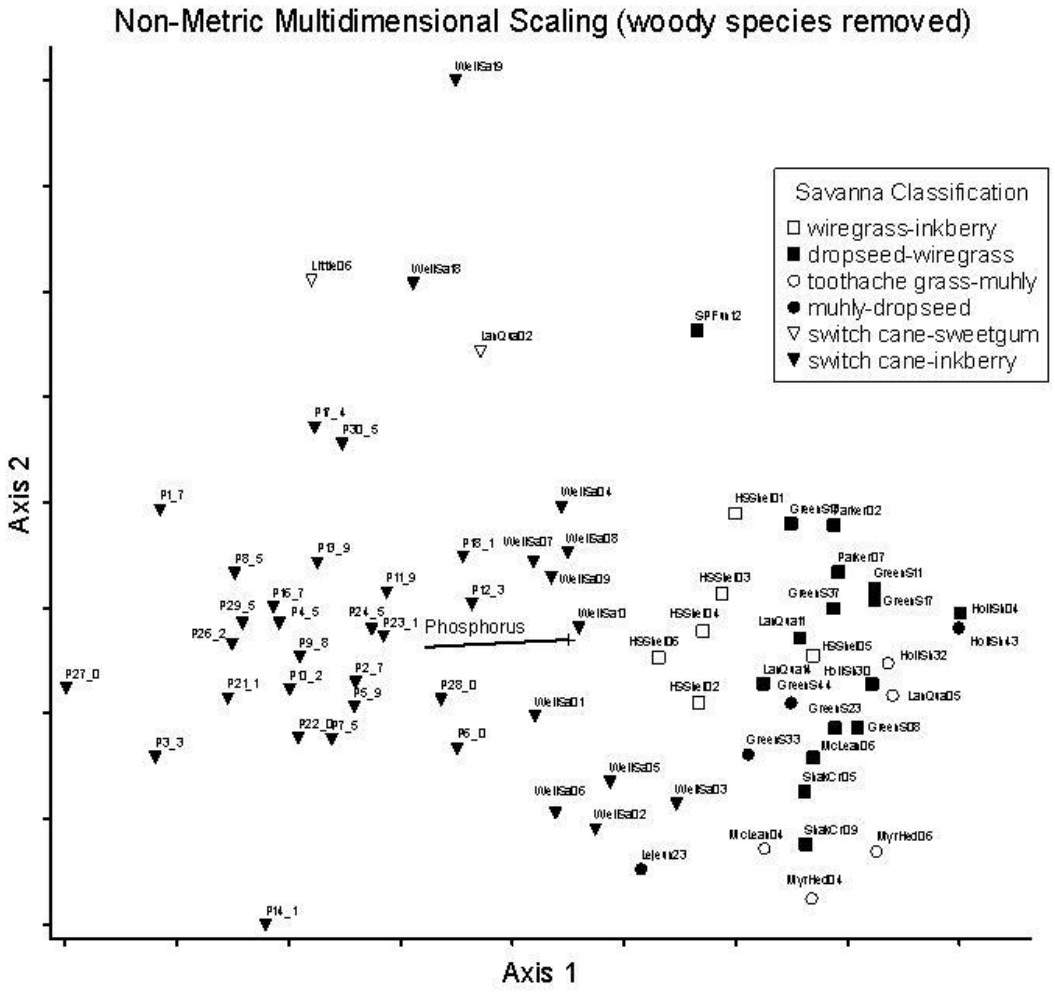


Figure 6: Non-metric multidimensional scaling ordination of the 71 wet savanna quadrats, with woody species removed. Ordination rotated -10 degrees. R^2 cutoff is 0.22. The only environmental vector represented is Phosphorus (ppm).

Linear discriminant analysis (LDA) separated the Wells Savannah/ Taylor Tract quadrats from the CVS and Holly Shelter wet savanna quadrats (Figure 7). Soil variables with high discriminant scores were pH, B (ppm), and percentage Mg (Table 4). None of the Wells Savannah/ Taylor Tract quadrats were misclassified as the other wet savannas, and only 3 of the 33 other savannas were misclassified with the Wells Savannah/ Taylor Tract quadrats (Table 5). Using 10-fold cross-validation, linear discriminant analysis correctly

classified quadrats as either "other wet savannas" or as belonging to Wells Savannah/ Taylor Tract with a prediction rate of 76%.

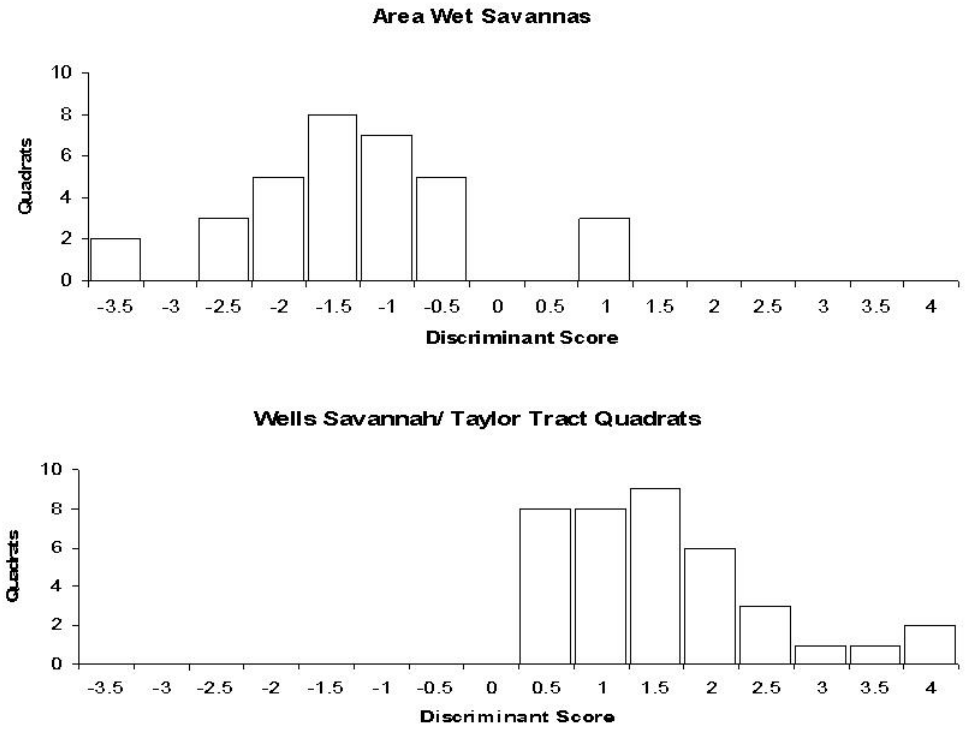


Figure 7. Linear discriminant scores for the Wells Savannah/ Taylor Tract quadrats (bottom) and 27 wet savanna quadrats extracted from the CVS plot and 6 quadrats inventoried at the Holly Shelter Game Land (top). The Wells Savannah/ Taylor Tract quadrats in general have higher discrimininant scores (lower graphic), compared to the other savannas. Overall prediction rate was 76%.

Linear discriminant analysis of the Wells Savannah/ Taylor Tract quadrats and the other savanna quadrats grouped according to the Peet classification also separated the groups; although the correct classification rate was not as high as in the previous LDA (Figures 7 and 8). Percentage Potassium and Boron (ppm) were loaded on axis 1 and pH on axis 2 (Table 4). Ten-fold cross validation yielded a prediction rate of 63%.

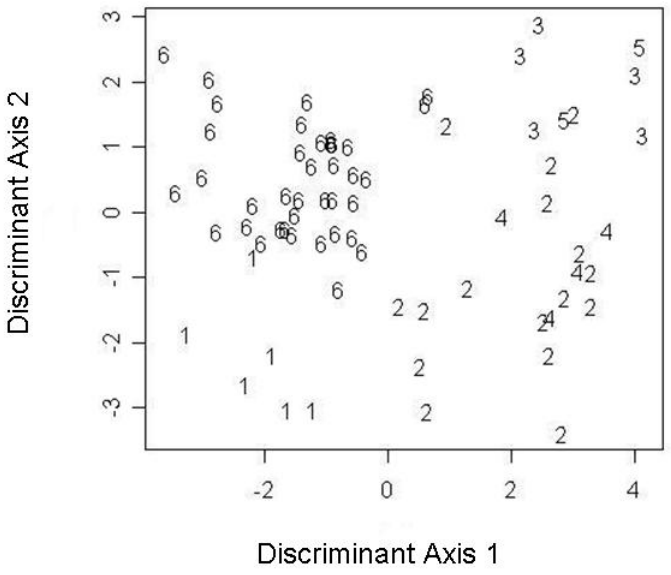


Figure 8: Linear discriminant scores of the first two principal components for the Wells Savannah/Taylor Tract quadrats and 27 wet savanna quadrats extracted from the CVS database, grouped according to the Peet classification (Table 1). Also included are 6 quadrats inventoried from Holly Shelter Game Land by Shelingoski *et al.* (2004). 1 represents the Holly Shelter quadrats surveyed by Shelingoski *et al.* (2006), 2 represents group 6.1.1, 3 represents 6.1.2, 4 represents 6.1.5, 5 represents 6.1.8, and 6 represents the Wells Savannah/ Taylor Tract quadrats. Important discriminant scores on axis 1 were potassium (%) and B (ppm). pH was the dominant score on axis 2.

Classification tree modeling (CART) separated the savanna quadrats according to *a priori* assigned group membership (Figure 9). The dropseed-wiregrass and toothache grass-muhly savanna quadrats separated from all other groups based on their higher silt content. The two quadrats, LanQua02 and Little06, were misclassified as toothache grass-muhly savannas (Table 7) due to their high silt percentage, averaging 72% (Table 8). Ca (ppm) separates the dropseed-wiregrass savanna quadrats from the toothache grass-muhly savanna quadrats, with the former averaging 109 ppm Ca and the latter averaging 364 ppm Ca. The wiregrass-inkberry savanna quadrats, the 6 Holly Shelter quadrats inventoried by

Shelingoski, are defined by their high sand content (Figure 8, Table 8). Ca (ppm) differentiates The Wells/Taylor Tract quadrats from the muhly-dropseed savanna quadrats, with the former generally having higher Ca levels (Table 8). The overall successful prediction rate was 86% (Table 7).

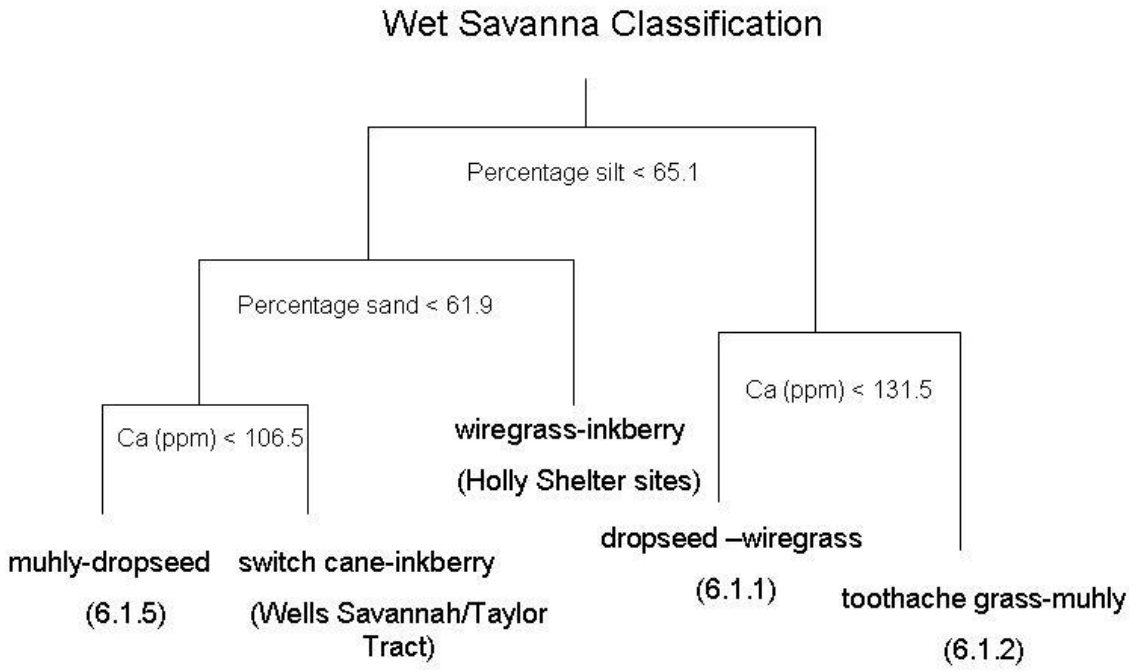


Figure 9. Classification tree modeling for the 71 wet savanna quadrats using environmental data, trimmed at 5 nodes. Variables used are Ca (ppm), percentage sand, and percentage silt. Overall prediction rate was 86%.

Discussion

Based on vegetation (Tables 2 and 3) and soil characteristics (Table 8), Wells Savannah and the Taylor Tract support vegetation different from previously-classified savanna communities (Taggart 1994, Peet 2006). Both sites appear to be remnants of a unique savanna association that was only known previously from the Big Savannah as described by B.W. Wells and was believed to have been extirpated from the North Carolina landscape (Wells 1967). This particular savanna type occurs on a geographically-limited

Inceptisol, the Liddell soil series, and both the community type and the soil series may be endemic to North Carolina. Previously described savannas mainly occur on Ultisols and Spodosols, and have formed the basis for other savanna classification systems (Taggart 1994, Peet 2006).

Cluster analysis clearly distinguished Wells Savannah and the Taylor Tract from other lower coastal plain wet savannas, with separation at the first division of the dendrogram (Figure 4). However, two quadrats classified as switch cane-sweetgum savannas, Little06 and LanQua02, clustered with the Wells and Taylor Tract quadrats. Little06 is the only quadrat included from Craven County and is the most geographically isolated of the wet savanna quadrats included in these analyses. LanQua02 is a quadrat from Pender County and is geographically close to the Wells Savannah/ Taylor Tract site. The two switch cane-sweetgum savanna quadrats and the Wells Savannah/ Taylor Tract quadrats share a number of woody species, such as *Arundinaria tecta, Acer rubrum,* and *Ilex glabra*; however, underlying soil variables are not similar across the two groups (Figure 7, Table 8). Organic matter and pH are both much lower for the two switch cane-sweetgum quadrats, and percentage silt higher, when compared to the Wells Savannah/ Taylor Tract quadrats.

Non-metric multidimensional scaling ordination displayed compositional separation of the Wells/ Taylor Tract quadrats from other quadrats, again with the exception of the switch cane-sweetgum savanna quadrats (Figure 5). Separation also occurred between the Wells Savannah and Taylor Tract quadrats. This is probably due to the different disturbance histories of the two sites, with portions of the Wells Savannah being regularly mowed and the Taylor Tract being fire suppressed until clear cut in the late 1990s. As might be expected, the two quadrats in the woodland between the two power line corridors of Wells Savannah

clustered with the Taylor Tract quadrats (Figure 4) and were closer to the Taylor Tract quadrats in the ordination (Figure 5).

Organic matter decreased weakly along axis 1 of the NMDS ordination, indicating a moisture gradient from the wetter Wells Savannah/ Taylor Tract quadrats to drier sites that have an increasing dominance of *Aristida stricta*. Wells remarked that the Big Savannah was saturated for up to 10 months of the year (1928b) and, during the summer of 2005, portions of the Taylor Tract remained saturated to the surface until August (personal observation). Phosphorus also decreased along axis 1 (Figure 4), though organic matter and phosphorus were not highly correlated among quadrats ($r < 0.16$). The decrease in phosphorus from the Wells Savannah and Taylor Tract quadrats toward the other savanna quadrats may be due to a number of factors. Burning has been shown to decrease phosphorus levels (Brady and Weil 1999); however this effect may be caused by subsequent erosion rather than the actual burning (Saa *et al.* 1994). Another factor may be that older soils, such as Oxisols and Ultisols, are known to be deficient in phosphorus. The main source of phosphorus in natural systems comes from weathering of minerals, and Oxisols and Ultisols tend to be highly weathered. This leads to a reduction in phosphorus availability in many Oxisols and Ultisols. Most of the wet savanna sites in North Carolina are on Ultisols, while Wells Savannah and the Taylor Tract are on a relatively young Inceptisol.

On axis 2 there was an increase in pH, percentage Ca, and base saturation. These three soil variables are generally correlated (Brady and Weil 1999). pH, percentage Ca, and base saturation were not useful for separating the Wells Savannah and Taylor Tract quadrats from the other savanna quadrats; the pH range and variance of the Wells Savannah and Taylor Tract quadrats were the same as those of all other savanna quadrats.

Other soil characteristics that distinguished Wells Savannah and the Taylor Tract from other savanna quadrats were higher percentage clay (also reflected in higher Fe (ppm)) and a slightly elevated Ca (ppm) (Table 8). The higher clay percentage of the Wells Savannah/ Taylor Tract quadrat soils relative to other area savanna soils may be due to the fact that Ultisols are generally more highly weathered with subsequent translocation of clay downward (Brady and Weil 1999). The fact that the Wells Savannah and Taylor Tract quadrats are on a relatively young Inceptisol may indicate that geologic time has been too short for the translocation of clays downward in the horizon.

The mean Ca (ppm) for the Wells Savannah/ Taylor Tract quadrats was higher than that of most other savanna groups, but not as high as the mean for the toothache grass-muhly savanna quadrats (6.1.2). However, mean Ca (ppm) for these quadrats was inflated by one outlier, MyrHed06, a quadrat from Myrtle Head Savanna that is on marl and had 994 ppm Ca. The presence of MyrHed06 increased the mean of the toothache grass-muhly quadrats from 207.3 ppm, below the calcium (ppm) mean for the Wells Savannah/ Taylor Tract quadrats, to 364.6 ppm.

Interestingly, the percentage silt at Wells Savannah and the Taylor Tract was not unusually high (Table 7). We expected to find that the silt percentage would distinguish the Wells/Taylor Tract quadrats, because the Liddell soil series is considered a "high silt" soil. However, a number of other sites had higher silt percentages, and all groups, with the exception of the Holly Shelter quadrats inventoried by Shelingoski, had higher silt percentages relative to the Wells Savannah/ Taylor Tract quadrats (Table 8).

Results from indicator species analysis and the higher percentage soil organic matter indicate that Wells Savannah and the Taylor Tract represent the extreme hydric end of the

savanna hydrological gradient. A number of the Wells/Taylor Tract indicator species, such as *Scleria minor* and *Andropogon glaucopsis,* are indicative of sites experiencing longer hydroperiods. Species such as *Scleria ciliata* and *Xyris caroliniana* generally occur at drier sites (Richard LeBlond, personal communication) and both are indicators of other wet savanna sites (Table 2).

It is well known that fire suppression can lead to increased woody abundance (Waldrop *et al.* 1992) and a decrease in species richness (Walker and Peet 1983). Fire suppression is especially detrimental to both the species richness and abundance values of species of Asteraceae, Fabaceae, and bunchgrass species of Poaceae (Walker and Silletti 2006). Wells Savannah and the Taylor Tract have both been fire suppressed, although the two power line corridors at Wells Savannah have been mowed at 3 year intervals for over 30 years (Shelingoski *et al*. 2002). Seventeen members of Asteraceae appear as indicator species of other savanna sites that have fire regimes more representative of historical fire frequency (Table 2); however, Asteraceae was also the third most-represented family at Wells Savannah (Shelingoski *et al*. 2002). At the Taylor Tract, there is a noticeable dearth of members of Asteraceae, possibly due to fire suppression. Members of Fabaceae are relatively absent from most wet savanna sites and the bunch grasses are not unusually abundant in the other wet savanna sites, compared to the Wells Savannah/ Taylor Tract.

There is an increase of woody species abundance values (Tables 2 and 3) and a decrease in species richness at the Wells Savannah/ Taylor Tract, with the effects more pronounced at the Taylor Tract. Species richness is lower in the Wells Savannah and Taylor Tract quadrats (mean 43.7 species), when compared to other wet savanna sites (overall mean 57.9 species). Most of the Carolina Vegetation Survey wet savanna quadrats are under more

or less active management, although exact disturbance histories are not known for all sites. Also, because of fire suppression, woody species abundance values are higher for the Taylor Tract than other inventoried savannas.

Does fire suppression alone account for the vegetation differences between the Wells/Taylor Tract site and other wet savanna sites in North Carolina? Although we cannot rule this possibility out completely, additional analyses we performed with the removal of all woody species from the dataset (Figure 6) and the removal of the Taylor Tract quadrats (results not shown) yielded results similar to those presented above, with environmental variable overlays also consistent (Figures 5 and 6).

Wells Savannah and the Taylor Tract, remnants of the longleaf pine savanna community formerly only known from the Big Savannah, warrant recognition as a new community type because of their unique vegetation and underlying soils. The two sites represent a wet savanna community at the extreme end of the hydrological gradient. Although this community may be limited to the northern part of Pender County, NC, other areas in the Atlantic coastal plain include Inceptisols under long hydroperiods, and we recommend that researchers seek other representatives of this rare community type in the Atlantic Coastal Plain.

Table 1. Wet savanna community classification codes. Peet refers to savanna classification codes proposed by Dr. Robert Peet (Jose *et al.* 2006) and used in this paper. Names used in the present paper are synonymous with Peet classification codes. NatureServe Association codes are synonymous, except for 6.1.1, which is greater than CEGL004501 and CEGL004086.

Peet Classification Codes (Jose *et al.* 2006)	Description of community and dominant species	NatureServ Association (unique identifier)	Names used in the present paper
	Holly Shelter sites surveyed by Shelingoski	not classified	Wiregrass-inkberry savanna
6.1.1	Pinus palustris/Sporobolus pinetorum-Schizachrium-Eryngium integrifolium woodland	>CEGL004501 >CEGL004086	Dropseed-wiregrass savanna
6.1.2	Pinus palustris-Pinus serotina/Ctenium aromaticum-Muhlenbergia expansa-Rhynchospora latifolia woodland	CEGL003660	Toothache grass-Muhly savanna
6.1.5	Pinus palustris-Pinus serotina/Sporobolus pinetorum-Ctenium aromaticum-Eriocaulon decangulare woodland	CEGL004502	Muhly-dropseed savanna
6.1.8	Pinus palustris/Arundinaria gigantea ssp. tecta-Liquidambar styraciflua/Andropogon glomeratus-Sarracenia minor woodland	CEGL004495	Switch cane-sweetgum savanna
	Wells and Taylor Tract plots	not classified	Switch cane-inkberry savanna

Table 2: Indicator species analysis comparing Wells Savannah/ Taylor Tract quadrats to other wet savannas in southeastern North Carolina. Species included have p-values less than .05 and importance values (IV) greater than 25 (scale 0 to 100). Group values: 1 = other wet savanna quadrats, 2 = Wells Savannah/ Taylor Tract quadrats.

Scientific Name	Group	IV	p-value	Scientific Name	Group	IV	p-value
Aletris farinosa	1	50.4	0.001	*Sporobolus pinetorum*	1	48.5	0.001
Aristida stricta	1	72.7	0.001	*Symphyotrichum dumosum*	1	64.6	0.001
Bigelowia nudata ssp. nudata	1	81.8	0.001	*Triantha racemosa*	1	27.3	0.001
Calopogon pallidus	1	36.4	0.001	*Viola X primulifolia*	1	45.5	0.001
Carphephorus odoratissimus	1	31.2	0.001	*Xyris caroliniana*	1	66.6	0.001
Carphephorus paniculatus	1	35	0.001	*Acer rubrum*	2	76.1	0.001
Carphephorus tomentosus	1	46.2	0.001	*Andropogon glaucopsis*	2	63.3	0.001
Chaptalia tomentosa	1	30.8	0.001	*Andropogon glomeratus var. glomeratus*	2	51.9	0.001
Cirsium virginianum	1	25.9	0.002	*Andropogon glomeratus var. hirsutior*	2	42.1	0.001
Cleistes divaricata	1	26.5	0.043	*Arundinaria tecta*	2	62.9	0.001
Coreopsis linifolia	1	69.7	0.001	*Clethra alnifolia*	2	74.6	0.001
Ctenium aromaticum	1	52.3	0.001	*Cyrilla racemiflora*	2	55.7	0.001
Dichanthelium strigosum	1	30.3	0.001	*Dichanthelium scabriusculum*	2	52.6	0.001
Dionaea muscipula	1	42.7	0.001	*Eubotrys racemosa*	2	27	0.003
Erigeron vernus	1	63.2	0.001	*Gaylussacia frondosa*	2	45.3	0.028
Eupatorium leucolepis	1	38.8	0.02	*Gelsemium sempervirens*	2	42.9	0.001
Eurybia paludosa	1	68.2	0.001	*Ilex coriacea*	2	60.5	0.001
Fimbristylis puberula	1	30.3	0.001	*Lyonia lucida*	2	38.3	0.006
Gymnopogon brevifolius	1	30.3	0.001	*Magnolia virginiana*	2	55.6	0.001
Helianthus angustifolius	1	28.8	0.003	*Morella caroliniensis*	2	62.2	0.001
Helianthus heterophyllus	1	59.4	0.001	*Nyssa biflora*	2	56.2	0.001
Lachnocaulon anceps	1	54.5	0.001	*Persea palustris*	2	71	0.001
Lysimachia loomisii	1	30.7	0.002	*Photinia pyrifolia*	2	67.5	0.001
Marshallia graminifolia	1	26.6	0.007	*Rhynchospora cephalantha*	2	27.6	0.001
Muhlenbergia capillaris var. trichopodes	1	57.6	0.001	*Rhynchospora chalarocephala*	2	44.7	0.001
Nyssa sylvatica	1	31.7	0.004	*Rhynchospora gracilenta*	2	47.4	0.001
Pinus palustris	1	57.7	0.001	*Rhynchospora rariflora*	2	29.4	0.005

Table 2, continued.

Scientific Name	Group	IV	p-value	Scientific Name	Group	IV	p-value
Pityopsis graminifolia	1	48.5	0.001	*Rubus sp.*	2	36.6	0.001
Polygala lutea	1	50.8	0.004	*Scleria minor*	2	38.2	0.049
Rhexia alifanus	1	64.6	0.001	*Smilax glauca*	2	38.2	0.02
Rhynchospora baldwinii	1	33.7	0.001	*Smilax laurifolia*	2	75.7	0.001
Rhynchospora plumosa	1	52.3	0.001	*Symplocos tinctoria*	2	29.2	0.011
Sisyrinchium capillare	1	51.5	0.001	*Vaccinium formosum*	2	46.2	0.014
Solidago pulchra	1	29.7	0.007	*Vaccinium fuscatum*	2	58	0.001
Solidago stricta	1	25.4	0.006	*Zigadenus glaberrimus*	2	36.5	0.038

Table 3: Indicator species analysis using Peet classification of wet savannas. Species included have p-values < .05 and importance value greater than 20. Group values correspond to classification method of Robert Peet (Jose *et al.* 2006) (Table 1). 610 = Holly Shelter quadrats inventoried by Shelingoski *et al.* (2004), 619 represents Wells Savannah and Taylor Tract quadrats.

Scientific Name	Group	IV	p-value	Scientific Name	Group	IV	p-value
Andropogon virginicus	610	40.5	0.042	*Panicum anceps*	6.1.8	47.5	0.043
Helianthus atrorubens	610	50	0.002	*Rubus flagellaris*	6.1.8	50	0.037
Platanthera blephariglottis	610	50	0.005	*Scleria triglomerata*	6.1.8	44.5	0.027
Tofieldia racemosa	610	45.2	0.006	*Smilax bona-nox*	6.1.8	50	0.03
Viola primulifolia	610	45.7	0.007	*Smilax glauca*	6.1.8	44.5	0.028
Dichanthelium ovale	6.1.2	39.8	0.016	*Solidago petiolaris*	6.1.8	50	0.037
Eryngium aquaticum var. aquaticum	6.1.2	40	0.046	*Styrax americanus*	6.1.8	50	0.037
Polygala brevifolia	6.1.2	39.5	0.031	*Symphyotrichum concolor*	6.1.8	50	0.037
Sporobolus teretifolius	6.1.2	40	0.05	*Symphyotrichum pilosum var. pilosum*	6.1.8	50	0.037
Chaptalia tomentosa	6.1.5	35.7	0.04	*Toxicodendron radicans*	6.1.8	38.8	0.042
Cirsium virginianum	6.1.5	34.6	0.047	*Vaccinium fuscatum*	6.1.8	36.9	0.021
Eupatorium pilosum	6.1.5	34	0.045	*Viburnum nudum*	6.1.8	71.4	0.002
Polygala ramosa	6.1.5	36.5	0.042	*Vitis rotundifolia*	6.1.8	40.4	0.041
Sarracenia rubra ssp. rubra	6.1.5	75	0.001	*Andropogon glaucopsis*	619	45.7	0.027
Acer rubrum	6.1.8	37.7	0.002	*Andropogon glomeratus var. hirsutior*	619	42.1	0.046
Arundinaria tecta	6.1.8	37.7	0.011	*Clethra alnifolia*	619	58.8	0.001
Carex debilis var. debilis	6.1.8	50	0.037	*Dichanthelium scabriusculum*	619	52.6	0.014
Chasmanthium laxum	6.1.8	50	0.03	*Ilex coriacea*	619	45.1	0.01
Chionanthus virginicus	6.1.8	50	0.037	*Nyssa biflora*	619	49.7	0.015
Gelsemium sempervirens	6.1.8	45.7	0.036	*Persea palustris*	619	34.8	0.044
Gentiana catesbaei	6.1.8	50	0.037	*Photinia pyrifolia*	619	29.3	0.025
Hypericum hypericoides	6.1.8	78.9	0.002	*Rhynchospora chalarocephala*	619	44.7	0.045
Liquidambar styraciflua	6.1.8	59.2	0.008	*Rhynchospora gracilenta*	619	47.4	0.036
Lycopus virginicus	6.1.8	50	0.037	*Smilax laurifolia*	619	37.3	0.006

Table 4: Linear discriminant scores for Wells Savannah/ Taylor Tract quadrats vs. CVS and Holly Shelter savanna quadrats as (1) one group and (2) using Peet classification (Table 1).

	Other savannas	Other savanns using Peet classification				
	LD1	LD1	LD2	LD3	LD4	LD5
pH	2.4479	0.2326	2.5106	1.0855	-15.0844	1.6256
% Org	0.1412	-0.1619	-0.0573	0.1712	0.0739	-0.0905
S (ppm)	-0.0535	0.0863	-0.0362	0.0453	-0.0894	-0.0183
P (ppm)	0.1378	-0.0979	0.0982	0.0230	-0.1414	0.0038
Ca (ppm)	-0.0013	0.0002	0.0007	0.0021	0.0053	0.0076
Mg (ppm)	0.0149	0.0285	0.0453	-0.0055	-0.0136	-0.0428
K (ppm)	-0.0663	0.0254	-0.0264	-0.1245	-0.0225	0.0055
Na (ppm)	0.0341	-0.0636	-0.0053	-0.0113	-0.0262	0.0227
% Ca	-0.0523	-0.0948	-0.0887	-0.1125	0.7249	-0.1146
% Mg	-0.2327	-0.5521	-0.8128	-0.0582	0.6176	0.4062
% K	-0.1681	1.1737	0.7149	0.9158	1.8904	-0.6087
% Na	0.0588	0.2034	0.5155	-0.2142	0.4575	-0.0650
B (ppm)	0.4933	-1.7226	-0.0121	-0.0676	-3.9102	4.3107
Fe (ppm)	0.0049	-0.0022	0.0034	0.0047	0.0003	-0.0012
Zn (ppm)	-0.0030	0.0007	-0.0040	-0.0018	0.0038	-0.0022
Al (ppm)	0.0006	-0.0020	-0.0004	-0.0017	0.0015	-0.0003
% Clay	0.1928	-0.1345	0.0813	-0.0176	-0.0913	-0.2380
% Silt	0.0135	0.0405	0.0574	0.0272	-0.0073	-0.0054

Table 5. Linear discriminant scores and predicted groups. Class 1 refers to the CVS/ Holly Shelter quadrates. Class 2 refers to Wells/Taylor Tract quadrats. 10-fold cross validation prediction rate: 76%.

Quadrat	Prior	Predicted	LD1	Quadrat	Prior	Predicted	LD1
GreenS08	1	1	-2.081324	**P26_2**	2	2	1.45389
GreenS11	1	1	-0.954042	**P27_0**	2	2	0.635044
GreenS13	1	1	-1.90908	**P28_0**	2	2	1.414331
GreenS17	1	1	-2.805326	**P29_5**	2	2	1.440265
GreenS23	1	1	-2.539708	**P3_3**	2	2	1.360595
GreenS33	1	1	-2.20377	**P30_5**	2	2	0.456108
GreenS37	1	1	-1.69779	**P4_5**	2	2	0.678141
GreenS44	1	1	-1.529628	**P5_9**	2	2	2.139438
HollSh04	1	2	0.6295569	**P6_0**	2	2	0.197298
HollSh30	1	1	-1.328691	**P7_5**	2	2	3.971162
HollSh32	1	1	-1.232128	**P8_5**	2	2	1.896485
HollSh43	1	1	-1.42884	**P9_8**	2	2	2.578304
LanQua02	1	1	-2.620842	**Parker02**	1	1	-1.18883
LanQua05	1	1	-0.927786	**Parker07**	1	1	-3.93569
LanQua11	1	1	-1.232881	**ShakCr05**	1	1	-1.4422
LanQua14	1	1	-2.070689	**ShakCr09**	1	1	-1.76604
Lejeun23	1	1	-2.359135	**SPFun12**	1	1	-4.04617
Little06	1	1	-2.108622	**WellSa01**	2	2	1.536115
McLean04	1	1	-1.657687	**WellSa02**	2	2	3.231997
McLean06	1	1	-1.20247	**WellSa03**	2	2	2.307306
MyrHed04	1	1	-1.578407	**WellSa04**	2	2	1.16685
MyrHed06	1	1	-0.906668	**WellSa05**	2	2	0.650821
P1_7	2	2	0.4786212	**WellSa06**	2	2	1.018626
P10_2	2	2	1.139426	**WellSa07**	2	2	0.974073
P11_9	2	2	0.8523145	**WellSa08**	2	2	1.747496
P12_3	2	2	1.6473031	**WellSa09**	2	2	0.967948
P13_9	2	2	1.9595011	**WellSa10**	2	2	0.375348
P14_1	2	2	3.5609329	**HSShel01**	1	1	-0.59941
P16_7	2	2	0.0785632	**HSShel02**	1	1	-0.55123
P17_4	2	2	1.5730153	**HSShel03**	1	2	0.895005
P18_1	2	2	1.4057593	**HSShel04**	1	2	0.691474
P2_7	2	2	0.9562875	**HSShel05**	1	1	-1.65426
P21_1	2	2	1.4832182	**HSShel06**	1	1	-1.58125
P22_0	2	2	0.4298196	**WellSa18**	2	2	0.812005
P23_1	2	2	0.0306406	**WellSa19**	2	2	2.094374
P24_5	2	2	0.2251398				

Table 6: Linear discriminant scores for the first two principal components of the 71 wet savanna quadrats. *A priori* and predicted classification of wet savannas are also included. Prior and predicted group names follow those presented in Table 1. 610 refers to Holly Shelter quadrats inventoried by Shelingoski *et al.* (2004) and 619 refers to Wells Savannah/ Taylor Tract quadrats. Overall prediction rate was 63%.

Quadrat	Prior	Predicted	LD1	LD2	Quadrat	Prior	Predicted	LD1	LD2
GreenS08	611	611	3.2961	-0.9244	P26_2	619	619	-0.9160	1.1268
GreenS11	611	611	0.5968	-1.4953	P27_0	619	619	-0.3515	0.5226
GreenS13	611	611	2.5198	-1.6656	P28_0	619	619	-0.8711	0.7370
GreenS17	611	611	2.6155	-2.1902	P29_5	619	619	-1.6457	0.2662
GreenS23	611	611	3.2905	-1.4464	P3_3	619	619	-1.2204	0.7103
GreenS33	615	615	2.6454	-1.6005	P30_5	619	619	-0.5486	0.1466
GreenS37	611	611	0.5294	-2.3716	P4_5	619	619	-0.6359	1.0236
GreenS44	615	615	3.0792	-0.9079	P5_9	619	619	-2.8545	1.2422
HollSh04	611	619	0.9467	1.3288	P6_0	619	619	-0.5699	-0.3744
HollSh30	611	611	2.6562	0.7288	P7_5	619	619	-3.6127	2.4235
HollSh32	612	612	2.3757	1.2809	P8_5	619	619	-1.3918	1.3672
HollSh43	615	611	1.8596	-0.0717	P9_8	619	619	-3.4268	0.2958
LanQua02	618	618	4.0984	2.5350	Parker02	611	611	0.1805	-1.4342
LanQua05	612	612	2.1638	2.4099	Parker07	611	611	2.8156	-3.3846
LanQua11	611	611	2.6001	0.1641	ShakCr05	611	611	1.3034	-1.1513
LanQua14	611	615	3.1192	-0.6229	ShakCr09	611	611	0.6290	-3.0476
Lejeun23	615	615	3.5606	-0.2866	SPFun12	611	611	2.8545	-1.3059
Little06	618	618	2.8509	1.4122	WellSa01	619	619	-0.8927	1.0535
McLean04	612	612	4.0198	2.1201	WellSa02	619	619	-2.7566	1.6738
McLean06	611	612	3.0135	1.5006	WellSa03	619	619	-2.9879	0.5491
MyrHed04	612	612	4.1346	1.1914	WellSa04	619	619	-1.2976	1.6909
MyrHed06	612	612	2.4432	2.8743	WellSa05	619	619	0.6548	1.7766
P1_7	619	619	-0.5508	0.5822	WellSa06	619	619	-0.9977	0.1930
P10_2	619	619	-2.0524	-0.4794	WellSa07	619	619	-1.5022	-0.0369
P11_9	619	619	-1.5428	-0.3506	WellSa08	619	619	-1.0643	1.0800
P12_3	619	619	-1.4092	0.9371	WellSa09	619	619	-0.9151	1.0646
P13_9	619	619	-2.1871	0.1004	WellSa10	619	619	-0.8302	-0.3099
P14_1	619	619	-2.8883	2.0393	HSShel01	610	610	-1.8820	-2.1919
P16_7	619	619	0.6181	1.6591	HSShel02	610	610	-2.3189	-2.6501
P17_4	619	619	-2.2781	-0.2210	HSShel03	610	619	-2.1783	-0.6751
P18_1	619	619	-1.4254	0.1966	HSShel04	610	610	-3.2697	-1.8766
P2_7	619	619	-0.8881	0.1970	HSShel05	610	610	-1.6419	-3.0288
P21_1	619	619	-1.6677	-0.2531	HSShel06	610	610	-1.2177	-3.0340
P22_0	619	619	-1.0779	-0.4790	WellSa18	619	619	-1.7307	-0.2463
P23_1	619	619	-0.8001	-1.1877	WellSa19	619	619	-2.7756	-0.3013
P24_5	619	619	-0.3992	-0.5984					

Table 7. Prediction Table for classification tree modeling of the 71 wet savanna quadrats. Columns represent *a priori* community classification and rows represent predicted community membership. Names follow those presented in Table 1. 610 refers to Holly Shelter quadrats inventoried by Shelingoski et al. (2004) and 619 refers to Wells Savannah/ Taylor Tract quadrats. Overall prediction rate was 86%.

		a priori Community Classification					
		610	**6.1.1**	**6.1.2**	**6.1.5**	**6.1.8**	**619**
Predicted Community Membership	**610**	5	0	0	0	0	0
	6.1.1	1	12	0	1	0	0
	6.1.2	0	1	5	0	2	0
	6.1.5	0	0	0	3	0	2
	619	0	3	0	0	0	36

Table 8. Group means and standard errors for the 71 wet savanna quadrats. Group names (columns) follow Peet numeric classification system. 610 refers to Holly Shelter quadrats inventoried by Shelingoski et al. (2004) and 619 refers to Wells Savannah/ Taylor Tract quadrats

	610		6.1.1		6.1.2		6.1.5		6.1.8		619	
	mean	**s.e**	**mean**	**s.e**	**mean**	**s.e**	**mean**	**s.e**	**mean**	**s.e**	**mean**	**s.e**
CEC (meq/ 100 g)	**5.5**	1.2	**4.0**	0.5	**8.3**	2.6	**3.2**	0.1	**8.8**	2.7	**6.0**	0.5
pH	**4.2**	0.1	**4.0**	0.1	**4.0**	0.1	**3.9**	0.0	**3.8**	0.2	**4.1**	0.0
% Org	**8.1**	1.7	**6.8**	1.0	**3.2**	1.7	**5.0**	3.2	**1.2**	0.7	**8.8**	0.5
N (ENR)	**55.1**	2.9	**56.2**	1.5	**58.7**	1.7	**55.3**	3.6	**66.5**	3.5	**57.7**	0.9
S (ppm)	**17.8**	1.4	**31.7**	3.0	**27.6**	3.1	**42.3**	6.8	**27.0**	7.0	**22.1**	1.0
P (ppm)	**9.0**	1.2	**9.0**	0.7	**11.2**	1.2	**11.3**	2.7	**16.5**	6.5	**14.5**	1.0
Ca (ppm)	**181.0**	27.8	**109.3**	13.3	**364.6**	163.4	**84.5**	2.5	**213.0**	44.0	**232.0**	21.9
Mg (ppm)	**51.5**	13.7	**31.4**	5.3	**32.6**	3.7	**25.8**	0.7	**67.0**	31.0	**34.7**	1.4
K (ppm)	**29.3**	3.1	**23.8**	2.5	**26.0**	3.7	**22.3**	1.9	**57.5**	10.5	**22.2**	1.7
Na (ppm)	**26.7**	2.2	**22.0**	3.1	**21.2**	3.7	**19.5**	2.6	**37.5**	0.5	**24.4**	1.7
% Ca	**17.5**	1.2	**14.7**	1.0	**19.4**	2.4	**13.4**	0.5	**12.6**	1.4	**19.2**	0.7
% Mg	**7.7**	0.6	**6.6**	0.3	**4.3**	1.1	**6.8**	0.2	**6.0**	1.1	**5.5**	0.3
% K	**1.5**	0.2	**1.8**	0.2	**1.2**	0.4	**1.8**	0.2	**2.0**	0.9	**1.1**	0.1
% Na	**2.4**	0.3	**2.9**	0.5	**1.5**	0.4	**2.7**	0.3	**2.1**	0.6	**2.0**	0.1
% Other	**9.1**	0.2	**9.5**	0.2	**9.4**	0.3	**9.6**	0.1	**9.9**	0.3	**9.3**	0.1
% H	**61.8**	1.5	**64.6**	1.1	**64.2**	1.9	**65.8**	0.3	**67.5**	1.5	**62.9**	0.6
B (ppm)	**0.4**	0.0	**0.3**	0.0	**0.3**	0.1	**0.4**	0.0	**0.3**	0.2	**0.4**	0.0
Fe (ppm)	**243.2**	22.2	**195.8**	13.9	**199.6**	19.1	**198.0**	60.0	**107.5**	24.5	**269.7**	23.4
Mn (ppm)	**0.5**	0.0	**0.7**	0.1	**0.8**	0.2	**1.0**	0.0	**1.0**	0.0	**0.9**	0.1
Cu (ppm)	**0.4**	0.1	**0.3**	0.1	**0.3**	0.0	**0.2**	0.1	**0.3**	0.2	**0.2**	0.0
Zn (ppm)	**0.4**	0.1	**111.3**	77.2	**0.9**	0.2	**0.7**	0.1	**1.5**	0.2	**0.9**	0.1
Al (ppm)	**731.2**	112.4	**711.3**	99.8	**706.2**	89.5	**831.0**	126.1	**932.5**	570.5	**857.3**	33.4
Density	**0.7**	0.1	**0.9**	0.0	**0.8**	0.0	**0.9**	0.1	**0.7**	0.2	**0.7**	0.0
Base Sat	**29.1**	1.7	**26.0**	1.2	**26.4**	2.1	**24.7**	0.4	**22.6**	1.8	**27.8**	0.7
Ca/Mg_ratio	**3.9**	0.5	**3.8**	0.3	**10.5**	3.8	**3.3**	0.2	**3.7**	1.0	**6.8**	0.7
% Clay	**4.7**	0.6	**3.6**	0.4	**3.7**	0.6	**3.7**	0.3	**5.7**	2.1	**5.9**	0.5
% Silt	**18.5**	2.5	**53.4**	7.4	**78.4**	3.5	**61.2**	4.8	**71.7**	5.1	**51.5**	1.0
% Sand	**76.8**	2.2	**42.9**	7.5	**18.0**	3.7	**35.1**	4.8	**22.6**	3.0	**42.6**	0.8

References Cited

Barnhill WL. 1990. Soil survey of Pender County, North Carolina. US Department of Agriculture. Soil Conservation Service. Washington, D.C.

Brady NC, Weil RR. 1999. The Nature and Properties of Soils. Upper Saddle River, New Jersey: Prentice Hall. 881 p.

Collins B, Minchin PR, Dilustro J, Duncan L. 2006. Land use effects on groundlayer composition and regeneration of mixed pine hardwood forests in the Fall Line Sandhills, s.e. USA. Forest Ecology and Management 226: 181-188.

Dufrêne M, Legendre P. 1997. Species assemblages and indicator species: the need for a flexible asymmetric approach. Ecological Monographs 67: 345-366.

Frost CC. 1993. Four centuries of changing landscape patterns in the longleaf pine ecosystem. In: Hermann SM, editor. The Longleaf Pine Ecosystem: Ecology, Restoration and Management. : Proceedings of Tall Timbers Fire Ecology Conference No. 18. p 17-37.

Frost CC, Walker J, Peet RK. 1986. Fire-dependent savannas and prairies of the Southeast: Original extent, preservation and status. In: Kulhavy DL,Connor RN, editors. Wilderness and natural areas in the eastern United States: a management challenge. Nacogdoches, Texas: Center for Applied Studies, School of Forestry, Stephen F. Austin St. University. p 348-57.

Gee GW, Bauder, JW. 1986. Particle size analysis. In: Methods of soil analysis, Part 1. Physical and mineralogical methods. Madison, Wisconsin: American Society of Agronomy. p 383-411.

Ihaka R, Gentleman R. 1996. R: a language for data analysis and graphics. Journal of Computational and Graphical Statistics 5:299–314.

Lance GN, Williams WT. 1967. A general theory of classification of sorting strategies. I. Hierarchical systems. Computer Journal 9: 373-380.

LeBlond RJ. 2000. Natural Area Inventory of Pender County, North Carolina. North Carolina Natural Heritage Program, Raleigh, NC.

McCune B. Grace JB. 2002. Analysis of Ecological Communities. Gleneden Beach, Oregon: MjM Software Design. 237 p.

McCune B, Mefford MJ. 1999. PCORD. Multivariate analysis of ecological data, version 4. Gleneden Beach, Oregon: MjM Software Design. 300 p.

Mielke PW, Berry KJ. 2001. Permutation Procedures. New York: Springer-Verlag. 289 p.

Peet RK. 2006. Ecological Classification of Longleaf Pine Woodlands. In: Jose S, Jokela EJ, Miller DL, editors. The Longleaf Pine Ecosystem: Ecology, Silviculture, and Restoration. New York: Springer. p 51-93.

Peet RK, Wentworth TR, White PS. 1998. A flexible, multipurpose method for recording vegetation composition and structure. Castanea 63(3):262-274.

Saa AM, Trasar-Cepeda MC, Soto B, Gil-Sotres F, Diaz-Fierros F. 1994. Forms of phosphorus in sediments eroded from burnt soils. Journal of Environmental Quality. 23: 739-746.

Shelingoski S. 2004. Wells Savannah, an example of a unique fire-dependent ecosystem in the North Carolina coastal plain [thesis]. Raleigh (NC): North Carolina State University. 182 pp.

Shelingoski S, LeBlond RJ, Stucky JM, Wentworth TR. 2005. Flora and soils of Wells Savannah, an example of a unique savanna type. Castanea 2:101-14.

Taggart JB. 1990. Inventory, classification and preservation of coastal plain savannas in the Carolinas. Ph.D. dissertation, University of North Carolina, Chapel Hill, North Carolina.

Waldrop TA, White DL, Jones SM. 1992. Fire-regimes for pine-grassland communities in the southeastern United States. Forest Ecology and Management. 47: 197-210.

Walker JW, Peet RK. 1983. Composition and species diversity of pine – wiregrass savannas of the Green Swamp, North Carolina. Vegetatio 55: 163-179.

Walker JL, Silletti AM. 2006. Restoring the ground layer of longleaf pine ecosystems. In: Jose S, Jokela EJ, Miller DL, editors. The Longleaf Pine Ecosystem: Ecology, Silviculture, and Restoration. New York: Springer. p 297-325.

Weakley AS. 2005. *Flora of the Carolinas, Virginia, and Georgia*, working draft as of March, 2005. University of North Carolina Herbarium, North Carolina Botanical Garden: Chapel Hill, North Carolina.

Wells BW. 1967. The natural gardens of North Carolina. Chapel Hill, North Carolina: University of North Carolina Press. 235 p.

Wells BW, Shunk IV. 1928a. Plant communities of the coastal plain of NC and their successional relations. Ecology 9(2):230-242.

Wells BW, Shunk IV. 1928b. A southern upland grass-sedge bog: An

ecological study. NC Agricultural Experiment Station Technical Bulletin no. 32. 75 p.

Wells BW, Shunk IV. 1931. The vegetation and habitat factors of the courser sands of the North Carolina coastal plain: An ecological study. Ecological Monographs 1:464-520.

APPENDICES

Appendix 1
Taylor Tract Species

Appendix 1. Species codes and corresponding scientific names for all species recorded at the Taylor Tract, Pender County, North Carolina.

CVS Code	Scientific Name	CVS Code	Scientific Name
ACERRUB	*Acer rubrum* L.	DROSCAP	*Drosera capillaris* Poir.
AMELOBO	*Amelanchier obovalis* (Michx.) Ashe	DROSINT	*Drosera intermedia* Hayne
AMPHPUR	*Amphicarpum purshii* Kunth	ELEOMIC	*Eleocharis microcarpa* Torr.
ANDR1S1	*Andropogon sp.* L.	ELEOTUB	*Eleocharis tuberculosa* (Michx.) Roemer & J.A. Schultes
ANDR1S2	*Andropogon sp*. #2 L.	ERAGSPE	*Eragrostis spectabilis* (Pursh) Steud.
ANDRGLA	*Andropogon glaucopsis* Ell.	ERECHIEH	*Erechtites hieraciifolia var. hieraciifolia* (L.) Raf. ex DC.
ANDRGLO1	*Andropogon glomeratus var. glomeratus* (Walt.) B.S.P.	ERIODECD	*Eriocaulon decangulare var. decangulare* L.
ANDRGLOH	*Andropogon glomeratus var. hirsutior* (Hack.) C. Mohr	EUBORAC	*Eubotrys racemosa* (L.) Nuttall
ANDRMOH	*Andropogon mohrii* (Hack.) Hack. ex Vasey	EUPAANO	*Eupatorium anomalum* Nash
ANDRVIR	*Andropogon virginicus* L.	EUPACAP	*Eupatorium capillifolium* (Lam.) Small
ARISVIR	*Aristida virgata* Trin.	EUPALEU	*Eupatorium leucolepis* (DC.) Torr. & Gray
ARUNTCT	*Arundinaria tecta* (Walt.) Muhl.	EUPAPIL	*Eupatorium pilosum* Walt.
ASTE1S1	*Aster sp.* L.	EUPAROT	*Eupatorium rotundifolium* L.
ASTE-S1	*Asteraceae sp.*	EUTHCAR	*Euthamia caroliniana* (L.) Greene ex Porter & Britt.
BARTVIR	*Bartonia virginica* (L.) B.S.P.	GAYLDUM	*Gaylussacia dumosa* (Andr.) Torr. & Gray
CALABRE	*Calamovilfa brevipilis* (Torr.) Scribn.	GAYLFRO	*Gaylussacia frondosa* (L.) Torr. & Gray ex Torr.
CAMPRAD	*Campsis radicans* (L.) Seem. ex Bureau	GELSSEM	*Gelsemium sempervirens* (L.) Ait. f.
CAREGLC	*Carex glaucescens* Ell.	GORDLAS	*Gordonia lasianthus* (L.) Ellis
CAREINT	*Carex intumescens* Rudge	HYPECRU	*Hypericum crux-andreae* (L.) Crantz
CARESTTB	*Carex striata var. brevis* Bailey	HYPEDNS	*Hypericum densiflorum* Pursh
CARPTOM	*Carphephorus tomentosus* (Michx.) Torr. & Gray	HYPEDNT	*Hypericum denticulatum* Walt.
CHIOVIR	*Chionanthus virginicus* L.	HYPEGAL	*Hypericum galioides* Lam.
CLEIDIV	*Cleistes divaricata* (L.) Ames	ILEXCRC	*Ilex coriacea* (Pursh) Chapman
CLETALN	*Clethra alnifolia* L.	ILEXGLA	*Ilex glabra* (L.) Gray
CORNFLO	*Cornus florida* L.	ILEXLAE	*Ilex laevigata* (Pursh) Gray
CTENARO	*Ctenium aromaticum* (Walt.) Wood	ILEXMYR	*Ilex myrtifolia* Walt.
CYRIRAC	*Cyrilla racemiflora* L.	ILEXOPAO	*Ilex opaca var. opaca* Ait.
DICH1S1	*Dichanthelium sp.* (A.S. Hitchc. & Chase) Gould	IRISVERV	*Iris verna var. verna* L.
DICH1S2	*Dichanthelium sp. #2* (A.S. Hitchc. & Chase) Gould	JUNC1S1	*Juncus sp.* L.
DICHACU	*Dichanthelium acuminatum* (Sw.) Gould & C.A. Clark	JUNCACU	*Juncus acuminatus* Michx.
DICHDICN	*Dichanthelium dichotomum var. 1* (=nitidum) (L.) Gould	JUNCBIF	*Juncus biflorus* Ell.
DICHENS	*Dichanthelium ensifolium* (Baldw. ex Ell.) Gould	JUNCEFF	*Juncus effusus* L.
DICHENSC	*Dichanthelium ensifolium var. 1* (=curtifolium) (Baldw. ex Ell.) Gould	JUNCMAR	*Juncus marginatus* Rostk.
DICHLCT	*Dichanthelium leucothrix* (Nash) Freckmann	KALMCAR	*Kalmia carolina* Small
DICHMAT	*Dichanthelium mattamuskeetense* (Ashe) Mohlenbrock	LACHCAR	*Lachnanthes caroliana* (Lam.) Dandy
DICHSCA	*Dichanthelium scabriusculum* (Ell.) Gould & C.A. Clark	LILICAT	*Lilium catesbaei* Walt.
DICHTEN	*Dichanthelium sp. #7* (=tenue) (A.S. Hitchc. & Chase) Gould	LIQUSTY	*Liquidambar styraciflua* L.
DICOT1	Dicot sp. #1	LOBENUT	*Lobelia nuttallii* J.A. Schultes
DICOT2	Dicot sp. #2	LUDW1S1	*Ludwigia sp.* L.
DIONMUS	*Dionaea muscipula* Ellis	LUDWALT	*Ludwigia alternifolia* L.
DIOSVIL	*Dioscorea villosa* L.	LUDWHIR	*Ludwigia hirtella* Raf.
DIOSVIR	*Diospyros virginiana* L.	LUDWLNR	*Ludwigia linearis* Walt.

Appendix 1, continued.

CVS Code	Scientific Name	CVS Code	Scientific Name
LUDWVIR	*Ludwigia virgata* Michx.	RHYNCHP	*Rhynchospora chapmanii* M.A. Curtis
LYCOALP	*Lycopodiella alopecuroides* (L.) Cranfill	RHYNCIL	*Rhynchospora ciliaris* (Michx.) C. Mohr
LYCOAPR	*Lycopodiella appressa* (Chapman) Cranfill	RHYNDEB	*Rhynchospora debilis* Gale
LYCOCRL	*Lycopodiella caroliniana* (L.) Pichi Sermolli	RHYNELL	*Rhynchospora elliottii* A. Dietr.
LYONLIG	*Lyonia ligustrina* (L.) DC.	RHYNFIL	*Rhynchospora filifolia* Gray
LYONLUC	*Lyonia lucida* (Lam.) K. Koch	RHYNGLM	*Rhynchospora glomerata* (L.) Vahl
LYONMAR	*Lyonia mariana* (L.) D. Don	RHYNGRC	*Rhynchospora gracilenta* Gray
MAGNVIR	*Magnolia virginiana* L.	RHYNINE	*Rhynchospora inexpansa* (Michx.) Vahl
MITCREP	*Mitchella repens* L.	RHYNMCE	*Rhynchospora microcephala* (Britt.) Britt.
MORECAR	*Morella caroliniensis* (P. Mill.) Small	RHYNPLU	*Rhynchospora plumosa* Ell.
MORECER	*Morella cerifera* (L.) Small	RHYNRAR	*Rhynchospora rariflora* (Michx.) Ell.
NYSSBIF	*Nyssa biflora* Walt.	RUBU1S1	*Rubus sp.* L.
NYSSSYL	*Nyssa sylvatica* Marsh.	SABADIF	*Sabatia difformis* (L.) Druce
OSMUCINC	*Osmunda cinnamomea var. cinnamomea* L.	SACCGIG	*Saccharum giganteum* (Walt.) Pers.
OSMUREGS	*Osmunda regalis var. spectabilis* (Willd.) Gray	SARRFLA	*Sarracenia flava* L.
PERSPLS	*Persea palustris* (Raf.) Sarg.	SARRPUR	*Sarracenia purpurea* L.
PHOTPYR	*Photinia pyrifolia* (Lam.) Robertson & Phipps	SASSALB	*Sassafras albidum* (Nutt.) Nees
PINUPAL	*Pinus palustris* P. Mill.	SCHISCO	*Schizachyrium scoparium* (Michx.) Nash
PINUSER	*Pinus serotina* Michx.	SCIRCYP	*Scirpus cyperinus* (L.) Kunth
PINUTAE	*Pinus taeda* L.	SCLEMIN	*Scleria minor* W. Stone
POAC-S1	*Poaceae* sp.	SCLEPAUP	*Scleria pauciflora var. pauciflora* Muhl. ex Willd.
POAC-S2	*Poaceae sp. #2*	SCLETRI	*Scleria triglomerata* Michx.
POLYLUT	*Polygala lutea* L.	SMILGLA	*Smilax glauca* Walt.
POLYPLPM	*Polypodium polypodioides var. michauxianum* Weatherby	SMILLAU	*Smilax laurifolia* L.
POLYRMA	*Polygala ramosa* Ell.	SMILROT	*Smilax rotundifolia* L.
PROSPEC	*Proserpinaca pectinata* Lam.	SYMPTIN	*Symplocos tinctoria* (L.) L'Hér.
PRUNSER	*Prunus serotina* Ehrh.	TOXIRAD	*Toxicodendron radicans* (L.) Kuntze
PTERAQU	*Pteridium aquilinum* (L.) Kuhn	UTRISUB	*Utricularia subulata* L.
QUERLAU	*Quercus laurifolia* Michx.	VACC1S1	*Vaccinium sp.* L.
QUERNIG	*Quercus nigra* L.	VACCCRA	*Vaccinium crassifolium* Andr.
RHEXALI	*Rhexia alifanus* Walt.	VACCFOR	*Vaccinium formosum* Andr.
RHEXLUT	*Rhexia lutea* Walt.	VACCFUS	*Vaccinium fuscatum* Ait.
RHEXMARM	*Rhexia mariana var. mariana* L.	VACCTEN	*Vaccinium tenellum* Ait.
RHEXNAS	*Rhexia nashi*i Small	VIBUNUD	*Viburnum nudum* L.
RHEXPET	*Rhexia petiolata* Walt.	VIOLPRM	*Viola primulifolia* L.
RHODATL	*Rhododendron atlanticum* (Ashe) Rehd.	VITIROT	*Vitis rotundifolia* Michx.
RHODVIS	*Rhododendron viscosum* (L.) Torr.	WOODARE	*Woodwardia areolata* (L.) T. Moore
RHUSCOP	*Rhus copallinum* L.	WOODVIR	*Woodwardia virginica* (L.) Sm.
RHYN1S1	*Rhynchospora sp.* Vahl	XYRIAMB	*Xyris ambigua* Bey. ex Kunth
RHYN1S2	*Rhynchospora sp. #2* Vahl	XYRIBAL	*Xyris baldwiniana* J.A. Schultes
RHYNBAL	*Rhynchospora baldwinii* Gray	XYRICAR	*Xyris caroliniana* Walt.
RHYNCEP	*Rhynchospora cephalantha* Gray	ZIGADEN	*Zigadenus densus* (Desr.) Fern.
RHYNCHL	*Rhynchospora chalarocephala* Fern. & Gale	ZIGAGLB	*Zigadenus glaberrimus* Michx.

Appendix 2
Environmental Variables

Appendix 2: Taylor Tract Environmental Variables.

Plot	P1_0	P1_7	P10_2	P10_7	P11_4	P11_9	P12_3	P12_9
Class	2	1	1	2	2	1	1	2
CEC (meq/100 g)	14.51	5.71	3.38	2.95	3.70	5.44	5.64	5.19
pH	4.2	4.4	4.2	4.4	4.2	4.0	4.2	4.1
% Org	10.38	4.87	6.57	13.38	5.43	8.29	7.50	5.74
N	62.5	49.5	54.0	63.5	51.0	58.0	56.0	52.0
S	22	12	19	26	21	20	21	22
P	78	41	55	41	46	46	64	41
Ca (ppm)	749	327	127	119	141	195	267	205
Mg(ppm)	48	30	31	33	33	34	31	35
K(ppm)	34	7	11	19	15	17	10	19
Na(ppm)	28	14	21	22	21	21	17	18
%Ca	25.80	28.64	18.81	20.18	19.06	17.92	23.66	19.74
%Mg	2.76	4.38	7.65	9.33	7.43	5.21	4.58	5.62
%K	0.60	0.31	0.84	1.65	1.04	0.80	0.45	0.94
%Na	0.84	1.07	2.70	3.24	2.47	1.68	1.31	1.51
%Other	9.00	8.60	9.00	8.60	9.00	9.40	9.00	9.20
%H	61.00	57.00	61.00	57.00	61.00	65.00	61.00	63.00
B(ppm)	0.34	0.21	0.21	0.10	0.32	0.28	0.34	0.36
Fe(ppm)	142	180	196	64	222	266	285	373
Mn(ppm)	3	1	1	1	1	1	1	1
Cu(ppm)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Zn(ppm)	1.03	0.20	0.49	0.51	0.77	0.64	0.20	0.46
Al(ppm)	538	461	1026	1681	846	1081	910	833
Density	0.71	0.71	0.72	0.72	0.71	0.71	0.71	0.71
%BaseSat	30	34.4	30	34.4	30	25.6	30	27.8
Ca/Mg	15.60	10.90	4.10	3.61	4.27	5.74	8.61	5.86
Clay	2.56	3.30	5.13	15.00	4.61	4.82	3.08	6.89
Silt	56.32	55.32	60.78	49.34	49.96	47.40	59.79	56.09
Sand	41.13	41.38	34.09	35.67	45.43	47.78	37.13	37.02
Clay_deep	5.46	5.46	24.65	24.65	7.25	7.25	4.53	4.53
silt_deep	54.69	54.69	51.86	51.86	48.72	48.72	54.29	54.29
sand_deep	39.85	39.85	23.49	23.49	44.03	44.03	41.17	41.17
UTM_Zone	18	18	18	18	18	18	18	18
UTM.E	227000	227000	226923	226923	226979	226979	226965	226965
UTM.N	3838315	3838315	3838064	3838064	3837989	3837989	3837881	3837881

Appendix 2, continued

Plot	P13_5	P13_9	P14_1	P14_6	P15_7	P15_9	P16_3	P16_7
Class	2	1	1	2	2	2	2	1
CEC (meq/100 g)	14.08	6.71	5.25	5.32	3.90	8.31	8.67	10.38
pH	4.1	4.0	3.8	4.1	3.8	4.2	3.6	4.0
% Org	10.56	14.21	6.05	5.88	7.41	18.91	8.52	4.59
N	62.5	63.5	52.5	52.0	56.0	64.5	59.0	48.0
S	16	15	20	19	17	32	24	21
P	55	46	160	60	105	92	119	73
Ca (ppm)	670	248	159	204	101	404	285	453
Mg(ppm)	50	39	37	37	33	36	30	33
K(ppm)	15	15	11	18	20	32	18	14
Na(ppm)	25	26	20	24	17	21	19	19
%Ca	23.80	18.49	15.14	19.17	12.94	24.30	16.43	21.81
%Mg	2.96	4.85	5.87	5.80	7.05	3.61	2.88	2.65
%K	0.27	0.57	0.54	0.87	1.31	0.99	0.53	0.35
%Na	0.77	1.69	1.66	1.96	1.89	1.10	0.95	0.80
%Other	9.20	9.40	9.80	9.20	9.80	9.00	10.20	9.40
%H	63.00	65.00	67.00	63.00	67.00	61.00	69.00	65.00
B(ppm)	0.31	0.33	0.10	0.31	0.10	0.10	0.24	0.30
Fe(ppm)	180	262	120	176	142	74	84	88
Mn(ppm)	1	1	1	1	1	1	1	1
Cu(ppm)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Zn(ppm)	0.42	0.60	0.47	0.51	0.20	0.47	0.61	0.93
Al(ppm)	561	599	1053	620	842	1739	979	794
Density	0.70	0.70	0.70	0.69	0.71	0.71	0.71	0.71
%BaseSat	27.8	25.6	23.2	27.8	23.2	30	20.8	25.6
Ca/Mg	13.40	6.36	4.30	5.51	3.06	11.22	9.50	13.73
Clay	2.25	4.13	5.78	2.99	5.57	6.29	7.11	3.12
silt	56.23	49.61	63.68	55.50	52.06	50.55	55.72	59.71
sand	41.52	46.26	30.54	41.50	42.37	43.16	37.17	37.18
Clay_deep	5.23	5.23	6.09	6.09	7.07	7.07	6.64	6.64
silt_deep	53.87	53.87	60.86	60.86	48.15	48.15	55.87	55.87
sand_deep	40.90	40.90	33.05	33.05	44.77	44.77	37.49	37.49
UTM_Zone	18	18	18	18	18	18	18	18
UTM.E	227035	227035	227047	227047	227196	227196	227331	227331
UTM.N	3837860	3837860	3838389	3838389	3838271	3838271	3838176	3838176

Appendix 2, continued

Plot	P17_4	P17_7	P18_1	P18_6	P2_7	P2_8	P21_1	P21_9
Class	1	2	1	2	1	2	1	2
CEC (meq/100 g)	5.79	4.43	5.67	5.19	5.48	5.18	5.04	10.99
pH	3.8	3.9	3.8	4.0	4.0	3.9	4.0	3.7
% Org	12.71	7.89	7.52	8.34	8.17	7.76	10.23	16.31
N	63.0	57.0	56.5	58.5	58.0	57.0	62.5	64.0
S	19	22	25	20	19	19	21	20
P	73	60	82	69	60	46	73	101
Ca (ppm)	155	116	162	157	195	164	166	388
Mg(ppm)	48	38	42	45	35	36	40	36
K(ppm)	30	28	18	27	16	15	14	22
Na(ppm)	21	26	25	23	22	24	21	28
%Ca	13.39	13.09	14.29	15.12	17.79	15.84	16.46	17.65
%Mg	6.91	7.14	6.18	7.22	5.32	5.80	6.61	2.73
%K	1.33	1.62	0.81	1.33	0.75	0.74	0.71	0.51
%Na	1.58	2.55	1.92	1.93	1.74	2.02	1.81	1.11
%Other	9.80	9.60	9.80	9.40	9.40	9.60	9.40	10.00
%H	67.00	66.00	67.00	65.00	65.00	66.00	65.00	68.00
B(ppm)	0.35	0.24	0.34	0.28	0.30	0.31	0.21	0.10
Fe(ppm)	333	249	308	280	247	243	170	118
Mn(ppm)	1	1	1	1	1	2	1	1
Cu(ppm)	0.10	0.23	0.10	0.10	0.10	0.10	0.10	0.99
Zn(ppm)	0.74	2.89	0.20	0.50	0.76	2.23	0.75	0.70
Al(ppm)	1121	840	789	1068	601	798	735	968
Density	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
%BaseSat	23.2	24.4	23.2	25.6	25.6	24.4	25.6	22
Ca/Mg	3.23	3.05	3.86	3.49	5.57	4.56	4.15	10.78
Clay	5.19	6.97	4.84	4.50	4.23	1.65	5.29	4.06
silt	54.52	48.64	50.64	52.90	50.22	50.73	56.00	56.47
sand	40.28	44.39	44.52	42.60	45.55	47.62	38.72	39.47
Clay_deep	7.12	7.12	4.97	4.97	8.78	8.78	5.90	5.90
silt_deep	49.60	49.60	54.21	54.21	46.51	46.51	56.41	56.41
sand_deep	43.28	43.28	40.82	40.82	44.71	44.71	37.69	37.69
UTM_Zone	18	18	18	18	18	18	18	18
UTM.E	227228	227228	227408	227408	227134	227134	231452	231452
UTM.N	3838363	3838363	3838246	3838246	3838207	3838207	3830915	3830915

Appendix 2, continued.

Plot	P22_0	P22_5	P23_1	P23_7	P24_1	P24_5	P25_2	P25_6
Class	1	2	1	2	2	1	2	2
CEC (meq/100 g)	5.20	5.33	3.49	5.11	4.64	3.31	5.92	5.53
pH	4.1	3.8	4.0	4.0	3.9	4.2	3.6	3.9
% Org	7.23	11.91	9.62	9.13	9.97	10.96	10.38	11.05
N	55.5	63.0	61.5	60.5	62.5	62.5	62.5	63.0
S	18	21	17	20	20	29	25	21
P	55	78	60	69	46	64	41	82
Ca (ppm)	202	162	104	179	129	111	138	163
Mg(ppm)	38	35	30	35	38	31	35	43
K(ppm)	12	17	18	15	24	28	18	23
Na(ppm)	20	21	18	19	25	25	47	27
%Ca	19.44	15.20	14.88	17.52	13.90	16.75	11.65	14.73
%Mg	6.09	5.47	7.16	5.71	6.83	7.80	4.92	6.48
%K	0.59	0.82	1.32	0.75	1.33	2.17	0.78	1.07
%Na	1.67	1.71	2.24	1.62	2.34	3.28	3.45	2.12
%Other	9.20	9.80	9.40	9.40	9.60	9.00	10.20	9.60
%H	63.00	67.00	65.00	65.00	66.00	61.00	69.00	66.00
B(ppm)	0.10	0.20	0.10	0.10	0.23	0.34	0.30	0.10
Fe(ppm)	160	205	153	166	247	222	314	235
Mn(ppm)	1	1	1	1	1	1	1	1
Cu(ppm)	0.10	0.36	0.10	0.10	0.10	0.10	0.10	0.10
Zn(ppm)	0.68	0.20	0.49	0.77	0.55	0.61	0.20	0.57
Al(ppm)	901	1040	802	1082	847	838	868	1080
Density	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
%BaseSat	27.8	23.2	25.6	25.6	24.4	30	20.8	24.4
Ca/Mg	5.32	4.63	3.47	5.11	3.39	3.58	3.94	3.79
Clay	2.88	2.87	2.99	3.16	2.83	4.54	2.31	2.83
silt	54.83	53.29	50.40	51.72	51.84	49.58	50.46	51.59
sand	42.29	43.84	46.60	45.12	45.33	45.89	47.23	45.58
Clay_deep	6.43	6.43	6.32	6.32	5.89	5.89	7.02	7.02
silt_deep	54.88	54.88	56.35	56.35	50.81	50.81	46.13	46.13
sand_deep	38.69	38.69	37.33	37.33	43.30	43.30	46.85	46.85
UTM_Zone	18	18	18	18	18	18	18	18
UTM.E	226560	226560	226491	226491	226362	226362	226441	226735
UTM.N	3838518	3838518	3838459	3838459	3838431	3838431	3838366	3838448

Appendix 2, continued.

Plot	P26_2	P26_4	P27_0	P27_2	P28_0	P28_6	P29_3	P29_5
Class	1	2	1	2	1	2	2	1
CEC (meq/100 g)	6.35	5.71	7.18	9.10	10.40	11.44	2.79	3.79
pH	3.9	4.1	3.5	4.0	3.5	3.8	4.1	4.1
% Org	11.23	9.50	6.55	10.38	9.58	17.87	4.57	11.48
N	63.0	61.0	54.0	62.5	61.5	64.5	48.0	63.0
S	25	26	32	28	35	30	23	31
P	114	87	105	101	92	73	37	73
Ca (ppm)	229	186	203	385	277	430	95	114
Mg(ppm)	29	40	32	32	50	29	22	31
K(ppm)	21	31	12	13	11	21	12	25
Na(ppm)	25	56	22	24	48	48	20	37
%Ca	18.03	16.30	14.13	21.16	13.32	18.79	17.02	15.04
%Mg	3.81	5.84	3.71	2.93	4.01	2.11	6.57	6.82
%K	0.85	1.39	0.43	0.37	0.27	0.47	1.10	1.69
%Na	1.71	4.27	1.33	1.15	2.01	1.82	3.11	4.25
%Other	9.60	9.20	10.40	9.40	10.40	9.80	9.20	9.20
%H	66.00	63.00	70.00	65.00	70.00	67.00	63.00	63.00
B(ppm)	0.10	0.30	0.41	0.54	0.22	0.10	0.10	0.10
Fe(ppm)	118	148	54	85	109	199	44	117
Mn(ppm)	1	1	1	1	1	1	1	1
Cu(ppm)	0.10	0.10	0.10	0.10	0.23	0.10	0.10	0.10
Zn(ppm)	0.67	0.81	0.49	0.69	0.54	0.82	0.20	0.73
Al(ppm)	1011	830	1030	818	771	1398	1588	1467
Density	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
%BaseSat	24.4	27.8	19.6	25.6	19.6	23.2	27.8	27.8
Ca/Mg	7.90	4.65	6.34	12.03	5.54	14.83	4.32	3.68
Clay	1.22	6.23	4.98	5.56	3.96	3.67	13.46	6.24
silt	56.54	54.22	60.14	51.60	56.00	48.97	50.39	55.69
sand	42.24	39.55	34.88	42.83	40.04	47.35	36.16	38.07
Clay_deep	4.07	4.07	5.28	5.28	7.73	7.73	19.82	19.82
silt_deep	58.77	58.77	59.75	59.75	48.94	48.94	49.43	49.43
sand_deep	37.16	37.16	34.97	34.97	43.33	43.33	30.75	30.75
UTM_Zone	18	18	18	18	18	18	18	18
UTM.E	226735	226735	226821	226821	226657	226657	226589	226589
UTM.N	3838448	3838448	3838385	3838385	3838322	3838322	3838248	3838248

Appendix 2, continued.

Plot	P3_0	P3_3	P30_0	P30_5	P4_5	P4_7	P5_5	P5_9
Class	2	1	2	1	1	2	2	1
CEC (meq/100 g)	6.54	6.23	6.33	4.84	7.11	7.29	7.85	15.00
pH	4.2	4.2	3.9	3.9	3.8	4.0	4.1	4.0
% Org	6.33	8.14	11.22	8.77	12.88	8.04	11.25	12.25
N	53.5	58.0	63.0	59.5	63.0	57.5	63.0	63.0
S	29	19	22	21	22	19	26	35
P	73	69	78	64	78	60	64	60
Ca (ppm)	288	293	188	136	187	266	328	638
Mg(ppm)	32	33	45	37	44	39	42	36
K(ppm)	20	10	35	31	42	21	31	28
Na(ppm)	47	24	32	26	55	36	26	64
%Ca	22.02	23.50	14.86	14.05	13.16	18.25	20.89	21.27
%Mg	4.08	4.41	5.93	6.37	5.16	4.46	4.46	2.00
%K	0.78	0.41	1.42	1.64	1.52	0.74	1.01	0.48
%Na	3.12	1.67	2.20	2.34	3.37	2.15	1.44	1.86
%Other	9.00	9.00	9.60	9.60	9.80	9.40	9.20	9.40
%H	61.00	61.00	66.00	66.00	67.00	65.00	63.00	65.00
B(ppm)	0.22	0.21	0.23	0.38	0.23	0.10	0.54	0.30
Fe(ppm)	207	157	176	361	158	149	334	295
Mn(ppm)	1	1	1	1	1	1	1	1
Cu(ppm)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Zn(ppm)	1.14	1.03	0.62	0.64	0.99	0.97	1.16	0.70
Al(ppm)	701	560	855	790	619	694	1013	1190
Density	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
%BaseSat	30	30	24.4	24.4	23.2	25.6	27.8	25.6
Ca/Mg	9.00	8.88	4.18	3.68	4.25	6.82	7.81	17.72
Clay	3.54	3.56	2.47	3.43	3.02	5.49	3.88	5.42
silt	55.81	51.61	52.35	48.51	54.67	51.29	49.63	45.79
sand	40.65	44.83	45.18	48.06	42.31	43.21	46.49	48.79
Clay_deep	6.05	6.05	3.62	3.62	1.01	1.01	6.23	6.23
silt_deep	53.88	53.88	53.94	53.94	57.57	57.57	50.29	50.29
sand_deep	40.06	40.06	42.44	42.44	41.42	41.42	43.48	43.48
UTM_Zone	18	18	18	18	18	18	18	18
UTM.E	227273	227273	226507	226507	226935	226935	227073	227073
UTM.N	3838094	3838094	3838182	3838182	3838261	3838261	3838146	3838146

Appendix 2, continued.

Plot	P6_0	P6_9	P7_2	P7_5	P8_5	P8_6	P9_2	P9_8
Class	1	2	2	1	1	2	2	1
CEC (meq/100 g)	4.12	3.68	4.35	6.41	7.03	4.51	6.50	4.99
pH	4.1	4.1	4.4	4.3	3.9	3.9	4.0	3.8
% Org	4.76	6.65	9.31	13.58	8.71	9.53	6.89	10.78
N	49.0	54.0	61.0	63.5	59.5	61.5	54.5	62.5
S	22	21	14	16	23	24	20	23
P	46	46	101	147	101	73	55	73
Ca (ppm)	146	113	220	308	262	134	249	148
Mg(ppm)	34	34	32	38	29	30	33	31
K(ppm)	13	24	13	32	15	21	15	15
Na(ppm)	23	26	22	29	29	29	24	28
%Ca	17.70	15.36	25.30	24.02	18.62	14.86	19.17	14.82
%Mg	6.87	7.70	6.13	4.94	3.44	5.55	4.23	5.17
%K	0.81	1.67	0.77	1.28	0.55	1.19	0.59	0.77
%Na	2.42	3.07	2.20	1.97	1.79	2.80	1.61	2.44
%Other	9.20	9.20	8.60	8.80	9.60	9.60	9.40	9.80
%H	63.00	63.00	57.00	59.00	66.00	66.00	65.00	67.00
B(ppm)	0.29	0.23	0.10	0.10	0.10	0.36	1.17	0.85
Fe(ppm)	235	222	136	155	137	188	276	286
Mn(ppm)	1	1	1	1	1	1	1	1
Cu(ppm)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Zn(ppm)	0.63	0.64	0.75	0.91	0.53	0.60	0.92	0.75
Al(ppm)	745	647	849	823	948	1099	821	993
Density	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
%BaseSat	27.8	27.8	34.4	32.2	24.4	24.4	25.6	23.2
Ca/Mg	4.29	3.32	6.88	8.11	9.03	4.47	7.55	4.77
Clay	4.16	4.77	4.31	6.25	3.82	3.52	6.33	6.06
silt	56.29	56.83	55.13	50.76	52.77	50.34	55.10	49.09
sand	39.54	38.39	40.56	42.99	43.41	46.13	38.57	44.84
Clay_deep	5.08	5.08	6.31	6.31	7.59	7.59	6.40	6.40
silt_deep	57.50	57.50	59.93	59.93	51.67	51.67	52.63	52.63
sand_deep	37.41	37.41	33.77	33.77	40.74	40.74	40.97	40.97
UTM_Zone	18	18	18	18	18	18	18	18
UTM.E	227200	227200	226865	226865	227001	227001	227131	227131
UTM.N	3838033	3838033	3838209	3838209	3838100	3838100	3837975	3837975

Appendix 3
Vegetation Data

Appendix 3. Taylor Tract vegetation data, by quadrat

Plot	Species	Cover
P1_0	ACERRUB	5
P1_0	AMELOBO	3
P1_0	ANDRGLO1	5
P1_0	ARUNTCT	2
P1_0	CAMPRAD	4
P1_0	CLETALN	6
P1_0	CYRIRAC	4
P1_0	DICHENS	3
P1_0	DIOSVIL	3
P1_0	GAYLFRO	4
P1_0	GELSSEM	6
P1_0	HYPEDNS	3
P1_0	ILEXCRC	8
P1_0	ILEXGLA	4
P1_0	LIQUSTY	3
P1_0	LYONLIG	3
P1_0	MAGNVIR	6
P1_0	MITCREP	3
P1_0	MORECER	5
P1_0	PERSPLS	6
P1_0	PHOTPYR	5
P1_0	PINUSER	4
P1_0	PTERAQU	4
P1_0	QUERNIG	4
P1_0	RHEXMARM	2
P1_0	RHEXNAS	2
P1_0	RHODVIS	2
P1_0	RUBU1S1	2
P1_0	SMILGLA	4
P1_0	SMILLAU	5
P1_0	TOXIRAD	4
P1_0	VACCFOR	5
P1_0	VACCFUS	3
P1_7	ACERRUB	6
P1_7	ANDRGLO1	6
P1_7	CARESTTB	3
P1_7	CLETALN	5
P1_7	CYRIRAC	6
P1_7	DICHENS	3
P1_7	EUBORAC	4
P1_7	GELSSEM	5
P1_7	ILEXCRC	7
P1_7	ILEXGLA	5
P1_7	JUNC1S1	4
P1_7	MAGNVIR	7
P1_7	MORECAR	7
P1_7	MORECER	4
P1_7	NYSSBIF	4
P1_7	PERSPLS	6
P1_7	PHOTPYR	5
P1_7	PINUSER	4
P1_7	RHYNRAR	4
P1_7	RUBU1S1	2
P1_7	SMILGLA	2
P1_7	SMILLAU	4
P1_7	VACC1S1	3
P1_7	VACCFUS	2
P1_7	XYRIAMB	4
P10_2	ACERRUB	6
P10_2	ANDRGLA	3
P10_2	ANDRGLO1	5
P10_2	ANDRGLOH	2
P10_2	ARUNTCT	6
P10_2	CAREGLC	2
P10_2	CARESTTB	2
P10_2	CLETALN	4
P10_2	CYRIRAC	3
P10_2	DICHENSC	2
P10_2	DICHSCA	3
P10_2	DROSCAP	2
P10_2	ERIODECD	2
P10_2	EUBORAC	2
P10_2	GAYLFRO	4
P10_2	HYPECRU	2
P10_2	HYPEDNS	3
P10_2	ILEXCRC	4
P10_2	ILEXGLA	7
P10_2	ILEXOPAO	3
P10_2	LYONLIG	2
P10_2	LYONLUC	7
P10_2	MAGNVIR	5
P10_2	MORECAR	4
P10_2	NYSSBIF	4
P10_2	OSMUCINC	4
P10_2	OSMUREGS	5
P10_2	PERSPLS	4
P10_2	PHOTPYR	4
P10_2	PINUSER	2
P10_2	RHEXLUT	2
P10_2	RHYNGRC	6
P10_2	RHYNRAR	2
P10_2	SACCGIG	3
P10_2	SARRFLA	2
P10_2	SARRPUR	2
P10_2	SCLEMIN	6

P10_2	SMILLAU	7	P11_4	CYRIRAC	8
P10_2	VACCFOR	2	P11_4	DICHENS	4
P10_2	VACCFUS	3	P11_4	DICHMAT	2
P10_2	VACCTEN	2	P11_4	DICOT1	2
P10_2	XYRIAMB	2	P11_4	DROSCAP	2
P10_2	XYRIAMB	2	P11_4	GAYLDUM	5
P10_2	ZIGAGLB	2	P11_4	GAYLFRO	6
P10_7	ACERRUB	6	P11_4	HYPECRU	2
P10_7	ANDRGLA	2	P11_4	HYPEDNS	2
P10_7	ANDRGLO1	4	P11_4	HYPEGAL	2
P10_7	ANDRGLOH	2	P11_4	ILEXCRC	4
P10_7	CAREGLC	3	P11_4	ILEXGLA	6
P10_7	CLETALN	4	P11_4	LOBENUT	2
P10_7	CYRIRAC	8	P11_4	LYCOALP	2
P10_7	DICHENSC	4	P11_4	LYONLIG	4
P10_7	EUPAANO	2	P11_4	LYONLUC	2
P10_7	HYPECRU	2	P11_4	MAGNVIR	4
P10_7	HYPEDNS	2	P11_4	MORECAR	3
P10_7	ILEXCRC	5	P11_4	PERSPLS	4
P10_7	ILEXGLA	4	P11_4	PHOTPYR	5
P10_7	LIQUSTY	4	P11_4	PINUSER	5
P10_7	LUDWHIR	3	P11_4	POLYLUT	2
P10_7	LUDWLNR	4	P11_4	RHEXALI	2
P10_7	LYCOALP	2	P11_4	RHEXLUT	2
P10_7	LYONLUC	7	P11_4	RHEXPET	2
P10_7	MORECAR	4	P11_4	RHODVIS	2
P10_7	NYSSBIF	5	P11_4	RHYN1S1	2
P10_7	OSMUREGS	2	P11_4	RHYNCEP	3
P10_7	PERSPLS	4	P11_4	RHYNCHL	2
P10_7	PROSPEC	4	P11_4	RHYNCHP	2
P10_7	QUERNIG	2	P11_4	RHYNCIL	2
P10_7	RHYNCEP	3	P11_4	RHYNELL	2
P10_7	RHYNGRC	4	P11_4	RHYNFIL	4
P10_7	SMILGLA	2	P11_4	RHYNGRC	3
P10_7	SMILLAU	6	P11_4	RHYNRAR	2
P10_7	SYMPTIN	3	P11_4	RUBU1S1	2
P10_7	VACCFUS	4	P11_4	SCLEMIN	4
P10_7	VACCTEN	2	P11_4	SCLEPAUP	2
P10_7	VIBUNUD	2	P11_4	SMILGLA	2
P10_7	WOODARE	4	P11_4	SMILLAU	4
P10_7	WOODVIR	2	P11_4	SYMPTIN	5
P10_7	XYRIAMB	2	P11_4	VACCCRA	6
P11_4	ACERRUB	4	P11_4	VACCFOR	4
P11_4	AMPHPUR	2	P11_4	VACCFUS	2
P11_4	ANDRGLA	3	P11_4	VACCTEN	2
P11_4	ANDRGLO1	5	P11_4	XYRICAR	4
P11_4	ANDRGLOH	3	P11_4	ZIGAGLB	3
P11_4	ARUNTCT	4	P11_9	ACERRUB	4
P11_4	CAREINT	2	P11_9	AMPHPUR	2
P11_4	CLETALN	4	P11_9	ANDRGLA	4

P11_9	ANDRGLO1	6	P12_3	ACERRUB	5
P11_9	ANDRGLOH	4	P12_3	AMELOBO	2
P11_9	ARUNTCT	4	P12_3	AMPHPUR	2
P11_9	ASTE1S1	2	P12_3	ANDRGLA	6
P11_9	CLEIDIV	2	P12_3	ANDRGLO1	5
P11_9	CLETALN	4	P12_3	ANDRGLOH	4
P11_9	CYRIRAC	5	P12_3	ANDRVIR	4
P11_9	DICHENS	4	P12_3	ARUNTCT	3
P11_9	DICHMAT	4	P12_3	ASTE1S1	2
P11_9	DICOT2	2	P12_3	CALABRE	3
P11_9	DROSCAP	2	P12_3	CARPTOM	2
P11_9	ELEOTUB	2	P12_3	CLETALN	4
P11_9	GAYLDUM	3	P12_3	CTENARO	3
P11_9	GAYLFRO	4	P12_3	CYRIRAC	6
P11_9	HYPECRU	2	P12_3	DICHENS	2
P11_9	HYPEDNS	2	P12_3	DIONMUS	2
P11_9	ILEXCRC	5	P12_3	DROSCAP	2
P11_9	ILEXGLA	7	P12_3	GAYLDUM	5
P11_9	IRISVERV	2	P12_3	GAYLFRO	6
P11_9	LOBENUT	2	P12_3	GELSSEM	3
P11_9	LYONLIG	4	P12_3	ILEXCRC	2
P11_9	LYONLUC	2	P12_3	ILEXGLA	7
P11_9	MAGNVIR	3	P12_3	LYCOCRL	2
P11_9	MORECAR	4	P12_3	LYONLIG	3
P11_9	MORECER	4	P12_3	MAGNVIR	4
P11_9	NYSSBIF	2	P12_3	MORECAR	5
P11_9	PERSPLS	4	P12_3	NYSSBIF	2
P11_9	PHOTPYR	4	P12_3	OSMUCINC	2
P11_9	PINUSER	4	P12_3	PERSPLS	2
P11_9	POLYLUT	2	P12_3	PHOTPYR	4
P11_9	RHEXALI	2	P12_3	PINUSER	5
P11_9	RHEXPET	2	P12_3	POLYLUT	2
P11_9	RHYNCEP	2	P12_3	PTERAQU	2
P11_9	RHYNCHL	3	P12_3	QUERNIG	2
P11_9	RHYNCHP	3	P12_3	RHEXALI	3
P11_9	RHYNCIL	2	P12_3	RHEXLUT	2
P11_9	RHYNFIL	3	P12_3	RHYNCHL	4
P11_9	RHYNGRC	2	P12_3	RHYNCIL	3
P11_9	RHYNRAR	2	P12_3	RHYNPLU	2
P11_9	SABADIF	2	P12_3	RHYNRAR	2
P11_9	SCLEMIN	5	P12_3	SARRPUR	2
P11_9	SCLEPAUP	2	P12_3	SCLEMIN	2
P11_9	SMILGLA	2	P12_3	SMILGLA	2
P11_9	SMILLAU	4	P12_3	SMILLAU	4
P11_9	VACCCRA	6	P12_3	SYMPTIN	3
P11_9	VACCFOR	2	P12_3	VACCCRA	6
P11_9	VACCFUS	3	P12_3	VACCFOR	4
P11_9	VACCTEN	2	P12_3	VACCFUS	4
P11_9	XYRIAMB	4	P12_3	VACCTEN	2
P11_9	ZIGAGLB	4	P12_3	XYRIAMB	2

P12_3	XYRICAR	2
P12_3	ZIGAGLB	4
P12_9	ACERRUB	6
P12_9	AMELOBO	4
P12_9	AMPHPUR	2
P12_9	ANDR1S1	2
P12_9	ANDRGLA	4
P12_9	ANDRGLO1	5
P12_9	ANDRGLOH	5
P12_9	ANDRVIR	4
P12_9	ARUNTCT	3
P12_9	ASTE1S1	2
P12_9	CALABRE	2
P12_9	CARPTOM	2
P12_9	CLETALN	5
P12_9	CTENARO	2
P12_9	CYRIRAC	2
P12_9	DICHENS	2
P12_9	GAYLDUM	6
P12_9	GAYLFRO	7
P12_9	ILEXCRC	4
P12_9	ILEXGLA	7
P12_9	LYONLIG	5
P12_9	MAGNVIR	6
P12_9	MORECAR	6
P12_9	NYSSBIF	2
P12_9	PERSPLS	4
P12_9	PHOTPYR	4
P12_9	PINUPAL	4
P12_9	PINUSER	2
P12_9	QUERNIG	3
P12_9	RHEXALI	2
P12_9	RHYNCHL	2
P12_9	RHYNDEB	2
P12_9	RHYNRAR	2
P12_9	SARRPUR	2
P12_9	SMILGLA	2
P12_9	SMILLAU	4
P12_9	SYMPTIN	4
P12_9	TOXIRAD	2
P12_9	VACCCRA	6
P12_9	VACCFUS	5
P12_9	VACCTEN	2
P12_9	ZIGAGLB	3
P13_5	ACERRUB	6
P13_5	AMELOBO	4
P13_5	ANDRGLA	2
P13_5	ANDRGLO1	2
P13_5	ANDRVIR	6
P13_5	ARUNTCT	4
P13_5	CAMPRAD	3
P13_5	CAREGLC	2
P13_5	CLETALN	6
P13_5	CYRIRAC	5
P13_5	DIOSVIR	4
P13_5	EUBORAC	5
P13_5	EUPAROT	2
P13_5	GAYLFRO	6
P13_5	GELSSEM	2
P13_5	ILEXCRC	7
P13_5	ILEXGLA	7
P13_5	MAGNVIR	6
P13_5	MORECAR	5
P13_5	PERSPLS	6
P13_5	PHOTPYR	7
P13_5	PINUSER	5
P13_5	PRUNSER	3
P13_5	QUERNIG	4
P13_5	RHUSCOP	4
P13_5	RUBU1S1	4
P13_5	SCLEMIN	2
P13_5	SMILGLA	4
P13_5	SMILLAU	6
P13_5	SMILROT	4
P13_5	SYMPTIN	5
P13_5	TOXIRAD	3
P13_5	VACCCRA	2
P13_5	VACCFOR	4
P13_5	VACCFUS	6
P13_5	VACCTEN	3
P13_5	VIBUNUD	3
P13_5	VITIROT	3
P13_5	WOODVIR	2
P13_9	ACERRUB	6
P13_9	ANDRGLA	6
P13_9	ANDRGLO1	4
P13_9	ANDRGLOH	2
P13_9	ANDRVIR	5
P13_9	ARUNTCT	4
P13_9	CAREGLC	5
P13_9	CLETALN	7
P13_9	CYRIRAC	6
P13_9	DICHENS	2
P13_9	DICHSCA	2
P13_9	GAYLFRO	5
P13_9	GELSSEM	2
P13_9	ILEXCRC	5
P13_9	ILEXGLA	7
P13_9	LUDWHIR	2
P13_9	MAGNVIR	5

P13_9	MORECAR	5	P14_1	SMILGLA	5
P13_9	MORECER	4	P14_1	SMILROT	3
P13_9	PERSPLS	6	P14_1	SYMPTIN	4
P13_9	PHOTPYR	6	P14_1	TOXIRAD	2
P13_9	PINUSER	4	P14_1	VACCFOR	4
P13_9	PTERAQU	3	P14_1	VIBUNUD	2
P13_9	RHEXLUT	2	P14_1	VITIROT	3
P13_9	RHEXPET	2	P14_6	ACERRUB	7
P13_9	RHYNCHL	3	P14_6	AMELOBO	3
P13_9	RHYNGLM	2	P14_6	ANDR1S1	3
P13_9	RHYNGRC	3	P14_6	ANDRGLA	4
P13_9	SCLEMIN	2	P14_6	ARUNTCT	2
P13_9	SMILGLA	2	P14_6	CLETALN	5
P13_9	SMILLAU	6	P14_6	CYRIRAC	5
P13_9	SYMPTIN	4	P14_6	DICH1S1	2
P13_9	VACCFOR	3	P14_6	DIOSVIR	2
P13_9	VACCFUS	5	P14_6	EUBORAC	3
P13_9	VACCTEN	4	P14_6	GAYLDUM	3
P13_9	VIOLPRM	2	P14_6	GAYLFRO	4
P13_9	XYRIAMB	2	P14_6	GELSSEM	2
P14_1	ACERRUB	5	P14_6	ILEXCRC	5
P14_1	ANDR1S1	4	P14_6	ILEXGLA	4
P14_1	ANDRGLA	7	P14_6	LIQUSTY	3
P14_1	CLETALN	5	P14_6	LYONLIG	5
P14_1	CYRIRAC	4	P14_6	LYONLUC	7
P14_1	DICHENS	3	P14_6	MAGNVIR	6
P14_1	EUTHCAR	2	P14_6	MORECAR	6
P14_1	GELSSEM	4	P14_6	MORECER	3
P14_1	HYPECRU	2	P14_6	NYSSBIF	3
P14_1	ILEXCRC	7	P14_6	OSMUREGS	2
P14_1	LIQUSTY	4	P14_6	PERSPLS	6
P14_1	LYONLUC	7	P14_6	PHOTPYR	3
P14_1	MAGNVIR	6	P14_6	PINUSER	3
P14_1	MORECAR	6	P14_6	QUERNIG	4
P14_1	MORECER	4	P14_6	RUBU1S1	2
P14_1	NYSSBIF	4	P14_6	SMILGLA	2
P14_1	OSMUCINC	5	P14_6	SMILLAU	3
P14_1	OSMUREGS	4	P14_6	SYMPTIN	3
P14_1	PERSPLS	6	P14_6	VACCFOR	4
P14_1	PHOTPYR	3	P14_6	VACCFUS	4
P14_1	PINUSER	3	P15_7	ACERRUB	5
P14_1	POLYLUT	2	P15_7	ANDR1S1	4
P14_1	QUERNIG	4	P15_7	ANDRGLA	4
P14_1	RHEXPET	2	P15_7	ARUNTCT	6
P14_1	RHODVIS	4	P15_7	CLETALN	7
P14_1	RHUSCOP	3	P15_7	CYRIRAC	6
P14_1	RHYNPLU	2	P15_7	GELSSEM	4
P14_1	RUBU1S1	3	P15_7	ILEXCRC	6
P14_1	SCIRCYP	3	P15_7	ILEXGLA	4
P14_1	SCLEMIN	2	P15_7	LIQUSTY	6

P15_7	LYONLUC	8
P15_7	MAGNVIR	6
P15_7	MORECAR	2
P15_7	NYSSBIF	4
P15_7	OSMUCINC	3
P15_7	PERSPLS	6
P15_7	PHOTPYR	3
P15_7	PINUSER	2
P15_7	PINUTAE	2
P15_7	QUERNIG	2
P15_7	SASSALB	2
P15_7	SMILGLA	4
P15_7	SMILLAU	4
P15_7	SYMPTIN	5
P15_7	TOXIRAD	4
P15_7	VACCFOR	4
P15_7	VACCFUS	4
P15_7	VACCTEN	2
P15_9	ACERRUB	7
P15_9	AMELOBO	2
P15_9	ANDR1S1	3
P15_9	ANDRGLA	3
P15_9	ANDRGLO1	5
P15_9	ANDRVIR	4
P15_9	ARUNTCT	6
P15_9	CLETALN	6
P15_9	CYRIRAC	5
P15_9	DICHENS	4
P15_9	DICHMAT	2
P15_9	EUPACAP	2
P15_9	GELSSEM	4
P15_9	HYPEDNS	2
P15_9	ILEXCRC	7
P15_9	ILEXGLA	4
P15_9	LIQUSTY	7
P15_9	LYONLUC	7
P15_9	MAGNVIR	5
P15_9	MORECAR	2
P15_9	OSMUCINC	2
P15_9	PERSPLS	6
P15_9	PHOTPYR	2
P15_9	PINUSER	3
P15_9	QUERLAU	2
P15_9	QUERNIG	2
P15_9	SMILGLA	4
P15_9	SMILLAU	6
P15_9	VACCFOR	5
P15_9	VACCTEN	2
P15_9	VIBUNUD	3
P15_9	WOODARE	3
P15_9	WOODVIR	4
P16_3	ACERRUB	6
P16_3	ANDRGLA	6
P16_3	ANDRGLO1	3
P16_3	ANDRGLOH	3
P16_3	ARUNTCT	2
P16_3	CARESTTB	6
P16_3	CLETALN	4
P16_3	CYRIRAC	6
P16_3	DICHSCA	3
P16_3	GAYLFRO	2
P16_3	GELSSEM	4
P16_3	HYPECRU	2
P16_3	ILEXGLA	4
P16_3	LYONLUC	4
P16_3	MAGNVIR	4
P16_3	MORECAR	4
P16_3	MORECER	2
P16_3	NYSSBIF	7
P16_3	PERSPLS	7
P16_3	PHOTPYR	2
P16_3	PINUSER	4
P16_3	PINUTAE	2
P16_3	QUERLAU	2
P16_3	QUERNIG	3
P16_3	RHYNCHL	4
P16_3	RUBU1S1	2
P16_3	SACCGIG	3
P16_3	SMILGLA	2
P16_3	SMILLAU	6
P16_3	SMILROT	2
P16_3	SYMPTIN	3
P16_3	VACCFOR	2
P16_3	VACCFUS	3
P16_3	VACCTEN	2
P16_3	VIBUNUD	3
P16_3	XYRIAMB	2
P16_7	ACERRUB	6
P16_7	ANDR1S1	3
P16_7	ANDRGLA	5
P16_7	ANDRGLO1	3
P16_7	ANDRGLOH	2
P16_7	ANDRVIR	2
P16_7	ARUNTCT	2
P16_7	ASTE1S1	2
P16_7	CARESTTB	8
P16_7	CLEIDIV	2
P16_7	CLETALN	5
P16_7	CYRIRAC	5
P16_7	DICH1S2	2

P16_7	DICHENS	2	P17_4	LYONLUC	4
P16_7	DICHSCA	4	P17_4	MAGNVIR	4
P16_7	GAYLFRO	3	P17_4	MORECAR	3
P16_7	GELSSEM	4	P17_4	MORECER	5
P16_7	ILEXCRC	4	P17_4	NYSSBIF	5
P16_7	ILEXGLA	5	P17_4	PERSPLS	5
P16_7	LUDWVIR	2	P17_4	PHOTPYR	4
P16_7	LYONLUC	6	P17_4	PINUTAE	2
P16_7	MAGNVIR	5	P17_4	POLYLUT	3
P16_7	MORECAR	5	P17_4	QUERLAU	4
P16_7	MORECER	3	P17_4	QUERNIG	2
P16_7	NYSSBIF	3	P17_4	RHEXPET	2
P16_7	OSMUCINC	2	P17_4	RHODATL	3
P16_7	PERSPLS	6	P17_4	RHUSCOP	5
P16_7	PHOTPYR	2	P17_4	RHYNMCE	2
P16_7	PINUTAE	2	P17_4	SCLETRI	4
P16_7	QUERLAU	2	P17_4	SMILGLA	2
P16_7	QUERNIG	3	P17_4	SMILLAU	4
P16_7	RHEXPET	2	P17_4	SYMPTIN	6
P16_7	RHYNCEP	2	P17_4	VACCCRA	3
P16_7	RHYNCHL	3	P17_4	VACCFOR	4
P16_7	RHYNGRC	3	P17_4	VACCFUS	5
P16_7	RHYNRAR	3	P17_4	VACCTEN	2
P16_7	RUBU1S1	2	P17_4	VITIROT	2
P16_7	SMILGLA	2	P17_4	ZIGAGLB	2
P16_7	SMILLAU	3	P17_7	ACERRUB	5
P16_7	SYMPTIN	4	P17_7	AMELOBO	2
P16_7	VACCCRA	2	P17_7	ANDR1S1	4
P16_7	VACCFOR	3	P17_7	ANDRGLA	3
P16_7	VACCFUS	3	P17_7	ANDRGLO1	4
P16_7	VITIROT	2	P17_7	ANDRGLOH	4
P16_7	WOODARE	2	P17_7	ARUNTCT	5
P16_7	XYRIAMB	2	P17_7	CLEIDIV	2
P17_4	ACERRUB	5	P17_7	CLETALN	6
P17_4	AMELOBO	4	P17_7	CYRIRAC	6
P17_4	ANDR1S1	5	P17_7	DICOT1	2
P17_4	ANDRGLA	6	P17_7	DROSCAP	2
P17_4	ANDRGLOH	4	P17_7	EUBORAC	5
P17_4	ARUNTCT	2	P17_7	GAYLDUM	2
P17_4	CLETALN	7	P17_7	GAYLFRO	5
P17_4	DICHMAT	4	P17_7	ILEXCRC	7
P17_4	EUPAROT	2	P17_7	ILEXGLA	7
P17_4	GAYLDUM	3	P17_7	LIQUSTY	5
P17_4	GAYLFRO	6	P17_7	LYONLUC	7
P17_4	GELSSEM	2	P17_7	MAGNVIR	6
P17_4	ILEXCRC	5	P17_7	MORECAR	5
P17_4	ILEXGLA	6	P17_7	MORECER	2
P17_4	IRISVERV	2	P17_7	NYSSBIF	5
P17_4	LILICAT	2	P17_7	OSMUCINC	2
P17_4	LIQUSTY	6	P17_7	PERSPLS	6

P17_7	PHOTPYR	4	P18_1	PINUTAE	3
P17_7	PINUTAE	3	P18_1	QUERNIG	2
P17_7	QUERNIG	4	P18_1	RHEXALI	2
P17_7	RHEXLUT	2	P18_1	RHEXPET	2
P17_7	RHYNBAL	3	P18_1	RHYNCIL	4
P17_7	RHYNCHP	2	P18_1	RHYNPLU	2
P17_7	RHYNCIL	2	P18_1	SASSALB	2
P17_7	SCLEMIN	2	P18_1	SCHISCO	2
P17_7	SCLEPAUP	2	P18_1	SCLEMIN	4
P17_7	SMILGLA	3	P18_1	SCLETRI	2
P17_7	SMILLAU	5	P18_1	SMILLAU	2
P17_7	SYMPTIN	4	P18_1	SYMPTIN	4
P17_7	UTRISUB	2	P18_1	TOXIRAD	2
P17_7	VACCCRA	2	P18_1	VACCCRA	6
P17_7	VACCFOR	3	P18_1	VACCFOR	2
P17_7	VACCFUS	4	P18_1	VACCFUS	4
P17_7	XYRIAMB	2	P18_1	VACCTEN	2
P17_7	ZIGAGLB	2	P18_1	XYRIAMB	2
P18_1	ACERRUB	6	P18_6	ACERRUB	6
P18_1	AMELOBO	3	P18_6	AMELOBO	2
P18_1	ANDR1S1	3	P18_6	ANDR1S1	2
P18_1	ANDR1S2	2	P18_6	ANDRGLA	3
P18_1	ANDRGLA	4	P18_6	ANDRGLO1	3
P18_1	ANDRGLO1	4	P18_6	ARUNTCT	2
P18_1	ANDRGLOH	4	P18_6	CLETALN	8
P18_1	ARUNTCT	2	P18_6	DICHENS	2
P18_1	ASTE-S1	2	P18_6	DROSCAP	2
P18_1	CARPTOM	2	P18_6	GAYLFRO	7
P18_1	CLEIDIV	2	P18_6	GELSSEM	3
P18_1	CLETALN	3	P18_6	ILEXCRC	7
P18_1	DICHACU	2	P18_6	ILEXGLA	6
P18_1	DICHENS	2	P18_6	MAGNVIR	4
P18_1	DROSCAP	2	P18_6	MORECAR	3
P18_1	EUPACAP	2	P18_6	MORECER	5
P18_1	EUPALEU	2	P18_6	NYSSBIF	3
P18_1	EUPAROT	2	P18_6	OSMUCINC	2
P18_1	GAYLDUM	3	P18_6	PERSPLS	4
P18_1	GAYLFRO	7	P18_6	PHOTPYR	3
P18_1	GELSSEM	4	P18_6	PINUTAE	3
P18_1	ILEXGLA	7	P18_6	POLYLUT	2
P18_1	IRISVERV	4	P18_6	QUERNIG	2
P18_1	LIQUSTY	4	P18_6	RHEXPET	2
P18_1	LYONLIG	3	P18_6	RHYNCIL	2
P18_1	LYONLUC	4	P18_6	SCLEMIN	2
P18_1	MAGNVIR	4	P18_6	SMILGLA	2
P18_1	MORECAR	5	P18_6	SMILLAU	2
P18_1	MORECER	4	P18_6	SYMPTIN	4
P18_1	NYSSBIF	3	P18_6	VACCCRA	3
P18_1	PERSPLS	5	P18_6	VACCFOR	5
P18_1	PHOTPYR	4	P18_6	VACCFUS	4

P18_6	VACCTEN	2	P2_8	ANDRGLOH	3
P18_6	VITIROT	2	P2_8	ARUNTCT	4
P18_6	XYRIAMB	2	P2_8	CLETALN	7
P2_7	ACERRUB	4	P2_8	CYRIRAC	3
P2_7	ANDR1S1	4	P2_8	DICHENS	3
P2_7	ANDRGLA	6	P2_8	DROSCAP	2
P2_7	ANDRGLO1	3	P2_8	GAYLFRO	6
P2_7	ANDRGLOH	3	P2_8	GELSSEM	5
P2_7	ARUNTCT	4	P2_8	HYPECRU	2
P2_7	CARESTTB	2	P2_8	ILEXCRC	5
P2_7	CLETALN	6	P2_8	ILEXGLA	8
P2_7	CYRIRAC	3	P2_8	ILEXOPAO	3
P2_7	DICHENS	3	P2_8	LIQUSTY	3
P2_7	DROSCAP	2	P2_8	LUDW1S1	2
P2_7	DROSINT	2	P2_8	LYCOAPR	2
P2_7	EUTHCAR	2	P2_8	MORECAR	4
P2_7	GAYLFRO	4	P2_8	MORECER	4
P2_7	GELSSEM	4	P2_8	PERSPLS	5
P2_7	HYPECRU	3	P2_8	PHOTPYR	5
P2_7	ILEXCRC	4	P2_8	PINUSER	6
P2_7	ILEXGLA	7	P2_8	POLYLUT	2
P2_7	ILEXOPAO	3	P2_8	QUERNIG	3
P2_7	JUNC1S1	2	P2_8	RHEXPET	2
P2_7	JUNCEFF	2	P2_8	RHODVIS	2
P2_7	JUNCMAR	2	P2_8	RHYN1S1	2
P2_7	LYCOALP	3	P2_8	RHYNFIL	2
P2_7	LYONLIG	3	P2_8	SABADIF	2
P2_7	MORECER	4	P2_8	SMILGLA	2
P2_7	OSMUCINC	2	P2_8	SMILLAU	5
P2_7	PERSPLS	5	P2_8	SYMPTIN	3
P2_7	PHOTPYR	3	P2_8	VACCCRA	2
P2_7	PINUSER	5	P2_8	VACCFOR	3
P2_7	POLYLUT	2	P2_8	VACCFUS	4
P2_7	POLYRMA	2	P2_8	WOODARE	2
P2_7	RHEXLUT	2	P2_8	XYRIAMB	2
P2_7	RHEXNAS	2	P21_1	ACERRUB	6
P2_7	RHEXPET	2	P21_1	ANDRGLA	7
P2_7	RHYN1S1	3	P21_1	ANDRVIR	3
P2_7	RHYNFIL	4	P21_1	ARUNTCT	2
P2_7	RUBU1S1	2	P21_1	ASTE1S1	2
P2_7	SMILLAU	4	P21_1	CAREGLC	2
P2_7	SYMPTIN	3	P21_1	CLETALN	7
P2_7	VACCCRA	3	P21_1	CYRIRAC	2
P2_7	VACCFOR	4	P21_1	DICHENS	2
P2_7	VACCFUS	4	P21_1	DROSCAP	2
P2_7	XYRIAMB	4	P21_1	ELEOMIC	5
P2_8	ACERRUB	3	P21_1	ERECHIEH	2
P2_8	AMELOBO	3	P21_1	EUBORAC	5
P2_8	ANDR1S1	3	P21_1	GAYLFRO	3
P2_8	ANDRGLA	4	P21_1	GELSSEM	3

P21_1	HYPECRU	2	P21_9	PERSPLS	6
P21_1	ILEXCRC	4	P21_9	PHOTPYR	4
P21_1	ILEXGLA	3	P21_9	PINUSER	6
P21_1	LIQUSTY	2	P21_9	RHEXNAS	2
P21_1	LUDWLNR	2	P21_9	RHODVIS	3
P21_1	LYCOALP	2	P21_9	RHYNCHL	2
P21_1	LYONLIG	4	P21_9	SMILGLA	3
P21_1	LYONLUC	7	P21_9	SMILLAU	6
P21_1	MAGNVIR	6	P21_9	SYMPTIN	3
P21_1	MORECAR	4	P21_9	TOXIRAD	5
P21_1	MORECER	4	P21_9	VACCFUS	4
P21_1	OSMUCINC	2	P21_9	VACCTEN	3
P21_1	OSMUREGS	2	P21_9	WOODVIR	4
P21_1	PERSPLS	6	P21_9	XYRICAR	2
P21_1	PHOTPYR	4	P22_0	ACERRUB	2
P21_1	PINUSER	6	P22_0	ANDR1S1	4
P21_1	POAC-S1	2	P22_0	ANDRGLA	5
P21_1	QUERNIG	2	P22_0	ANDRGLOH	3
P21_1	RHEXNAS	2	P22_0	ANDRVIR	4
P21_1	RHYNCHL	5	P22_0	ARUNTCT	5
P21_1	RHYNGRC	4	P22_0	BARTVIR	2
P21_1	RHYNINE	2	P22_0	CLETALN	4
P21_1	RHYNRAR	2	P22_0	CORNFLO	2
P21_1	RUBU1S1	3	P22_0	CYRIRAC	2
P21_1	SMILGLA	2	P22_0	DICHLCT	4
P21_1	SMILLAU	6	P22_0	DICHSCA	4
P21_1	SMILROT	2	P22_0	DICHTEN	4
P21_1	TOXIRAD	4	P22_0	DROSCAP	2
P21_1	UTRISUB	2	P22_0	ELEOMIC	6
P21_1	VACCFUS	4	P22_0	EUBORAC	2
P21_1	VACCTEN	2	P22_0	EUPACAP	2
P21_1	WOODARE	2	P22_0	EUTHCAR	4
P21_1	XYRIAMB	2	P22_0	GAYLFRO	4
P21_1	XYRICAR	2	P22_0	GELSSEM	4
P21_9	ACERRUB	6	P22_0	GORDLAS	2
P21_9	ANDRGLA	4	P22_0	HYPECRU	3
P21_9	ARUNTCT	2	P22_0	ILEXCRC	6
P21_9	ASTE1S1	2	P22_0	ILEXGLA	4
P21_9	CAREGLC	2	P22_0	JUNCACU	2
P21_9	CAREINT	2	P22_0	LYCOALP	2
P21_9	CLETALN	7	P22_0	LYONLUC	3
P21_9	GELSSEM	4	P22_0	MAGNVIR	4
P21_9	ILEXCRC	6	P22_0	MORECAR	4
P21_9	ILEXGLA	4	P22_0	MORECER	2
P21_9	KALMCAR	3	P22_0	NYSSBIF	4
P21_9	LIQUSTY	4	P22_0	PERSPLS	5
P21_9	LYONLUC	9	P22_0	PHOTPYR	2
P21_9	MAGNVIR	5	P22_0	PINUSER	5
P21_9	MORECAR	3	P22_0	POAC-S1	2
P21_9	OSMUCINC	3	P22_0	POLYLUT	2

P22_0	RHEXLUT	2
P22_0	RHEXPET	2
P22_0	RHODVIS	2
P22_0	RHYNCEP	2
P22_0	RHYNCHL	7
P22_0	RHYNCIL	2
P22_0	RHYNGRC	4
P22_0	RHYNRAR	4
P22_0	SACCGIG	3
P22_0	SCLEMIN	3
P22_0	SCLEPAUP	2
P22_0	SMILLAU	5
P22_0	UTRISUB	2
P22_0	VACCFOR	2
P22_0	VACCFUS	3
P22_0	XYRIAMB	5
P22_0	XYRIBAL	2
P22_5	ACERRUB	5
P22_5	AMELOBO	4
P22_5	ANDRGLA	4
P22_5	ANDRGLO1	3
P22_5	ANDRGLOH	3
P22_5	ANDRVIR	3
P22_5	ARUNTCT	3
P22_5	BARTVIR	2
P22_5	CLETALN	6
P22_5	CYRIRAC	2
P22_5	DICHLCT	2
P22_5	DICHMAT	2
P22_5	DICHSCA	2
P22_5	DIOSVIR	2
P22_5	EUBORAC	5
P22_5	GAYLFRO	7
P22_5	ILEXCRC	8
P22_5	ILEXGLA	6
P22_5	LYONLIG	2
P22_5	MAGNVIR	4
P22_5	MORECAR	5
P22_5	NYSSBIF	2
P22_5	PERSPLS	5
P22_5	PHOTPYR	5
P22_5	PINUSER	4
P22_5	PTERAQU	2
P22_5	RHEXPET	2
P22_5	RHODVIS	6
P22_5	RHUSCOP	2
P22_5	RHYNCHL	2
P22_5	RHYNCIL	2
P22_5	RHYNINE	2
P22_5	RUBU1S1	2
P22_5	SCLEMIN	3
P22_5	SMILGLA	2
P22_5	SMILLAU	5
P22_5	SYMPTIN	2
P22_5	VACCFOR	3
P22_5	VACCFUS	4
P22_5	VACCTEN	3
P22_5	VIBUNUD	2
P22_5	XYRIAMB	2
P23_1	ACERRUB	2
P23_1	ANDRGLA	4
P23_1	ANDRGLO1	4
P23_1	ANDRGLOH	5
P23_1	ANDRVIR	6
P23_1	ARUNTCT	4
P23_1	BARTVIR	2
P23_1	CLEIDIV	2
P23_1	CLETALN	5
P23_1	DICHENS	2
P23_1	DICHSCA	2
P23_1	DROSCAP	2
P23_1	ERIODECD	3
P23_1	EUBORAC	2
P23_1	GAYLDUM	4
P23_1	GAYLFRO	6
P23_1	HYPECRU	2
P23_1	ILEXCRC	3
P23_1	ILEXGLA	6
P23_1	LACHCAR	5
P23_1	LYCOALP	2
P23_1	LYCOAPR	2
P23_1	LYONLIG	2
P23_1	MAGNVIR	4
P23_1	MORECAR	5
P23_1	MORECER	2
P23_1	NYSSBIF	4
P23_1	PERSPLS	4
P23_1	PHOTPYR	4
P23_1	PINUSER	4
P23_1	POLYLUT	2
P23_1	RHEXLUT	2
P23_1	RHEXPET	2
P23_1	RHYNCEP	4
P23_1	RHYNCHL	4
P23_1	RHYNCIL	2
P23_1	RHYNGRC	4
P23_1	RHYNPLU	2
P23_1	RHYNRAR	2
P23_1	SCLEMIN	2
P23_1	SMILGLA	2

P23_1	SMILLAU	6	P23_7	XYRIAMB	4
P23_1	UTRISUB	2	P23_7	ZIGAGLB	2
P23_1	VACCFOR	3	P24_1	ACERRUB	2
P23_1	VACCFUS	4	P24_1	AMELOBO	4
P23_1	VACCTEN	2	P24_1	ANDRGLA	2
P23_1	XYRIAMB	4	P24_1	ANDRGLOH	2
P23_1	ZIGAGLB	4	P24_1	ANDRVIR	2
P23_7	ACERRUB	4	P24_1	ARUNTCT	6
P23_7	AMELOBO	2	P24_1	CLETALN	5
P23_7	ANDR1S1	4	P24_1	DICH1S1	2
P23_7	ANDRGLA	4	P24_1	DIOSVIR	2
P23_7	ANDRGLO1	2	P24_1	GAYLDUM	4
P23_7	ANDRVIR	5	P24_1	GAYLFRO	7
P23_7	ARUNTCT	5	P24_1	ILEXCRC	6
P23_7	BARTVIR	2	P24_1	ILEXGLA	6
P23_7	CAREGLC	3	P24_1	LYONLIG	3
P23_7	CLETALN	6	P24_1	LYONLUC	5
P23_7	DICHENS	2	P24_1	LYONMAR	3
P23_7	DICHSCA	2	P24_1	MAGNVIR	4
P23_7	DROSCAP	2	P24_1	MORECAR	4
P23_7	ERIODECD	2	P24_1	MORECER	3
P23_7	EUBORAC	2	P24_1	NYSSBIF	5
P23_7	GAYLDUM	4	P24_1	PERSPLS	4
P23_7	GAYLFRO	5	P24_1	PHOTPYR	4
P23_7	HYPECRU	2	P24_1	PINUSER	3
P23_7	ILEXCRC	4	P24_1	PTERAQU	5
P23_7	ILEXGLA	4	P24_1	RHODVIS	5
P23_7	LOBENUT	2	P24_1	RHUSCOP	5
P23_7	LYCOALP	2	P24_1	SCLEMIN	2
P23_7	LYCOAPR	2	P24_1	SMILGLA	3
P23_7	MAGNVIR	6	P24_1	SMILLAU	3
P23_7	MORECAR	6	P24_1	SYMPTIN	2
P23_7	NYSSBIF	2	P24_1	VACCFOR	3
P23_7	OSMUCINC	2	P24_1	VACCFUS	4
P23_7	PERSPLS	6	P24_1	VACCTEN	6
P23_7	PHOTPYR	4	P24_1	ZIGAGLB	3
P23_7	PINUSER	5	P24_5	ACERRUB	4
P23_7	POLYLUT	2	P24_5	ANDRGLA	3
P23_7	RHEXLUT	2	P24_5	ANDRGLO1	3
P23_7	RHEXPET	2	P24_5	ANDRGLOH	4
P23_7	RHODVIS	3	P24_5	ANDRVIR	4
P23_7	RHYNCEP	3	P24_5	ARUNTCT	5
P23_7	RHYNCHL	4	P24_5	CLETALN	5
P23_7	RHYNGRC	4	P24_5	CYRIRAC	4
P23_7	SCLEMIN	4	P24_5	DICHENS	2
P23_7	SMILGLA	2	P24_5	DICHSCA	2
P23_7	SMILLAU	6	P24_5	DROSCAP	2
P23_7	UTRISUB	3	P24_5	ERIODECD	3
P23_7	VACCFUS	5	P24_5	EUPAPIL	2
P23_7	VACCTEN	2	P24_5	GAYLDUM	4

P24_5	GAYLFRO	7	P25_2	PHOTPYR	4
P24_5	GORDLAS	2	P25_2	PINUSER	2
P24_5	HYPEDNS	5	P25_2	PTERAQU	4
P24_5	ILEXCRC	3	P25_2	QUERNIG	7
P24_5	ILEXGLA	7	P25_2	RHODVIS	3
P24_5	ILEXLAE	4	P25_2	RHUSCOP	2
P24_5	KALMCAR	5	P25_2	RUBU1S1	3
P24_5	LYONLIG	2	P25_2	SMILGLA	4
P24_5	MAGNVIR	4	P25_2	SMILLAU	4
P24_5	MORECAR	5	P25_2	SYMPTIN	5
P24_5	NYSSBIF	4	P25_2	VACCFOR	4
P24_5	OSMUCINC	2	P25_2	VACCFUS	5
P24_5	PERSPLS	5	P25_2	VACCTEN	2
P24_5	PHOTPYR	5	P25_2	VIBUNUD	3
P24_5	PINUSER	4	P25_6	ACERRUB	3
P24_5	POAC-S2	2	P25_6	ANDR1S1	2
P24_5	RHEXALI	2	P25_6	ANDR1S2	2
P24_5	RHYNFIL	2	P25_6	ANDRGLA	5
P24_5	RHYNGLM	3	P25_6	ANDRGLOH	4
P24_5	RHYNGRC	2	P25_6	ANDRVIR	3
P24_5	SABADIF	2	P25_6	ARUNTCT	6
P24_5	SARRFLA	2	P25_6	CLETALN	6
P24_5	SARRPUR	2	P25_6	CYRIRAC	4
P24_5	SCLEMIN	3	P25_6	DICHENS	2
P24_5	SMILLAU	5	P25_6	DICHMAT	3
P24_5	SYMPTIN	3	P25_6	EUPAPIL	2
P24_5	UTRISUB	2	P25_6	GAYLDUM	4
P24_5	VACCFUS	6	P25_6	GAYLFRO	7
P24_5	VACCTEN	4	P25_6	HYPECRU	2
P24_5	XYRIAMB	4	P25_6	ILEXCRC	5
P24_5	ZIGAGLB	4	P25_6	ILEXGLA	6
P25_2	ACERRUB	3	P25_6	IRISVERV	2
P25_2	AMELOBO	4	P25_6	LYONLIG	4
P25_2	ANDRGLA	2	P25_6	LYONLUC	4
P25_2	ANDRVIR	2	P25_6	MAGNVIR	4
P25_2	ARUNTCT	5	P25_6	MORECAR	4
P25_2	CAREGLC	2	P25_6	MORECER	3
P25_2	CLETALN	6	P25_6	NYSSBIF	4
P25_2	DIOSVIR	2	P25_6	OSMUCINC	2
P25_2	GAYLDUM	4	P25_6	PERSPLS	4
P25_2	GAYLFRO	7	P25_6	PHOTPYR	5
P25_2	ILEXCRC	7	P25_6	PINUSER	5
P25_2	ILEXGLA	7	P25_6	POLYLUT	2
P25_2	LYONLUC	8	P25_6	PTERAQU	4
P25_2	MAGNVIR	5	P25_6	RHEXPET	2
P25_2	MORECAR	4	P25_6	RHODVIS	6
P25_2	MORECER	2	P25_6	RHYNCIL	3
P25_2	NYSSBIF	5	P25_6	SASSALB	2
P25_2	OSMUCINC	2	P25_6	SMILGLA	3
P25_2	PERSPLS	5	P25_6	SMILLAU	3

P25_6	SYMPTIN	3
P25_6	VACCFUS	3
P25_6	VACCTEN	4
P25_6	XYRIAMB	2
P25_6	ZIGAGLB	4
P26_2	ACERRUB	6
P26_2	ANDRGLA	6
P26_2	ANDRGLOH	2
P26_2	ANDRVIR	5
P26_2	ARUNTCT	2
P26_2	ASTE1S1	2
P26_2	CAREGLC	3
P26_2	CARESTTB	4
P26_2	CLETALN	3
P26_2	CYRIRAC	6
P26_2	DICHSCA	2
P26_2	DROSCAP	2
P26_2	EUBORAC	5
P26_2	EUPALEU	2
P26_2	GAYLFRO	4
P26_2	GELSSEM	4
P26_2	ILEXCRC	5
P26_2	ILEXGLA	5
P26_2	LYONLUC	5
P26_2	MAGNVIR	4
P26_2	MORECAR	4
P26_2	OSMUCINC	3
P26_2	PERSPLS	5
P26_2	PHOTPYR	4
P26_2	PINUSER	5
P26_2	RHYN1S1	4
P26_2	RHYNCHL	3
P26_2	RHYNGLM	2
P26_2	RHYNGRC	4
P26_2	RHYNRAR	2
P26_2	RUBU1S1	2
P26_2	SMILGLA	2
P26_2	SMILLAU	5
P26_2	UTRISUB	2
P26_2	VACCFOR	4
P26_2	VACCFUS	4
P26_2	XYRIAMB	4
P26_2	ZIGAGLB	2
P26_4	ACERRUB	6
P26_4	ANDRGLA	6
P26_4	ANDRGLOH	2
P26_4	ANDRVIR	4
P26_4	CAREGLC	2
P26_4	CYRIRAC	5
P26_4	DROSCAP	2
P26_4	EUBORAC	2
P26_4	GAYLFRO	3
P26_4	GELSSEM	5
P26_4	ILEXCRC	7
P26_4	ILEXGLA	5
P26_4	ILEXMYR	3
P26_4	LOBENUT	2
P26_4	LYONLUC	7
P26_4	MAGNVIR	5
P26_4	MORECAR	4
P26_4	MORECER	4
P26_4	OSMUCINC	3
P26_4	PERSPLS	6
P26_4	PHOTPYR	6
P26_4	PINUSER	5
P26_4	RHODVIS	2
P26_4	RHYNCHL	3
P26_4	RHYNGLM	2
P26_4	RUBU1S1	2
P26_4	SABADIF	2
P26_4	SCIRCYP	2
P26_4	SMILGLA	2
P26_4	SMILLAU	6
P26_4	UTRISUB	2
P26_4	VACCFOR	4
P26_4	VACCFUS	4
P26_4	XYRIAMB	2
P27_0	ACERRUB	4
P27_0	ANDR1S1	3
P27_0	ANDRGLA	4
P27_0	CARESTTB	9
P27_0	CYRIRAC	7
P27_0	ILEXCRC	6
P27_0	ILEXGLA	5
P27_0	LIQUSTY	2
P27_0	MAGNVIR	6
P27_0	MORECAR	4
P27_0	PERSPLS	5
P27_0	PHOTPYR	4
P27_0	PINUSER	4
P27_0	RHYNCHL	3
P27_0	RHYNGRC	4
P27_0	SMILLAU	4
P27_0	UTRISUB	2
P27_0	VACCFOR	4
P27_0	XYRIAMB	4
P27_2	ACERRUB	5
P27_2	ANDR1S1	3
P27_2	ANDRGLA	5
P27_2	ANDRGLO1	2

P27_2	CARESTTB	6	P28_0	RHYNCEP	2
P27_2	CLETALN	6	P28_0	SABADIF	2
P27_2	CYRIRAC	6	P28_0	SARRFLA	4
P27_2	GAYLFRO	4	P28_0	SARRPUR	2
P27_2	GELSSEM	3	P28_0	SCLEMIN	2
P27_2	ILEXCRC	7	P28_0	SMILLAU	5
P27_2	ILEXGLA	6	P28_0	UTRISUB	2
P27_2	MAGNVIR	5	P28_0	VACCFOR	4
P27_2	MORECAR	6	P28_0	VACCFUS	5
P27_2	MORECER	6	P28_0	XYRIAMB	3
P27_2	PERSPLS	4	P28_0	XYRIAMB	4
P27_2	PHOTPYR	3	P28_0	ZIGADEN	2
P27_2	PINUSER	4	P28_0	ZIGAGLB	7
P27_2	RHYNBAL	2	P28_6	ACERRUB	5
P27_2	RHYNCHL	6	P28_6	AMELOBO	3
P27_2	RHYNGLM	2	P28_6	ANDR1S1	4
P27_2	RHYNGRC	2	P28_6	ANDRGLA	3
P27_2	SMILLAU	6	P28_6	ARUNTCT	4
P27_2	VACCFOR	5	P28_6	CLETALN	4
P27_2	VACCFUS	3	P28_6	CYRIRAC	4
P27_2	XYRIAMB	4	P28_6	DICHDICN	3
P27_2	ZIGAGLB	2	P28_6	DROSCAP	2
P28_0	ACERRUB	3	P28_6	EUBORAC	3
P28_0	ANDR1S1	4	P28_6	GAYLDUM	3
P28_0	ANDR1S2	3	P28_6	GAYLFRO	8
P28_0	ANDRGLO1	3	P28_6	ILEXCRC	6
P28_0	ANDRGLOH	2	P28_6	ILEXGLA	5
P28_0	ANDRMOH	2	P28_6	ILEXOPAO	2
P28_0	ARUNTCT	2	P28_6	LYONLUC	3
P28_0	CLETALN	5	P28_6	MAGNVIR	5
P28_0	DICHENS	2	P28_6	MORECAR	6
P28_0	DROSCAP	2	P28_6	NYSSBIF	4
P28_0	ERIODECD	2	P28_6	PERSPLS	5
P28_0	GAYLDUM	2	P28_6	PHOTPYR	4
P28_0	GAYLFRO	6	P28_6	PINUSER	2
P28_0	ILEXCRC	4	P28_6	PTERAQU	2
P28_0	ILEXGLA	5	P28_6	RHODATL	2
P28_0	LYCOALP	5	P28_6	RHODVIS	2
P28_0	LYONLIG	2	P28_6	RHYN1S2	2
P28_0	MAGNVIR	6	P28_6	RHYNBAL	3
P28_0	MORECAR	5	P28_6	RHYNGRC	2
P28_0	NYSSBIF	4	P28_6	SMILLAU	5
P28_0	OSMUCINC	2	P28_6	UTRISUB	4
P28_0	PERSPLS	3	P28_6	VACCFOR	3
P28_0	PHOTPYR	3	P28_6	VACCFUS	5
P28_0	PINUSER	2	P28_6	XYRIAMB	2
P28_0	PTERAQU	2	P28_6	ZIGADEN	2
P28_0	RHEXALI	2	P28_6	ZIGAGLB	4
P28_0	RHEXLUT	2	P29_3	ACERRUB	5
P28_0	RHYN1S1	2	P29_3	AMELOBO	2

P29_3	ANDRGLO1	2
P29_3	ARUNTCT	3
P29_3	CARESTTB	2
P29_3	CHIOVIR	2
P29_3	CLETALN	5
P29_3	CYRIRAC	6
P29_3	DICHSCA	2
P29_3	GAYLFRO	3
P29_3	ILEXCRC	7
P29_3	ILEXGLA	3
P29_3	LYONLUC	8
P29_3	MAGNVIR	5
P29_3	MORECAR	3
P29_3	MORECER	3
P29_3	NYSSBIF	6
P29_3	PERSPLS	5
P29_3	PHOTPYR	4
P29_3	PINUSER	6
P29_3	RHYNCHL	2
P29_3	SMILLAU	6
P29_3	VACCFOR	5
P29_3	VACCFUS	4
P29_3	WOODVIR	5
P29_3	XYRIAMB	2
P29_5	ACERRUB	4
P29_5	AMELOBO	2
P29_5	ANDR1S1	3
P29_5	ANDR1S2	4
P29_5	ANDRGLA	4
P29_5	ANDRGLO1	4
P29_5	ARUNTCT	5
P29_5	CARESTTB	3
P29_5	CLETALN	4
P29_5	CYRIRAC	5
P29_5	DICHSCA	2
P29_5	DROSINT	4
P29_5	EUBORAC	2
P29_5	GAYLFRO	4
P29_5	HYPECRU	2
P29_5	ILEXCRC	6
P29_5	ILEXGLA	5
P29_5	ILEXOPAO	3
P29_5	LYONLUC	7
P29_5	MAGNVIR	4
P29_5	MORECAR	4
P29_5	MORECER	4
P29_5	NYSSBIF	6
P29_5	OSMUCINC	2
P29_5	PERSPLS	5
P29_5	PHOTPYR	3
P29_5	PINUSER	2
P29_5	RHYNCHL	3
P29_5	RHYNGLM	4
P29_5	RHYNGRC	3
P29_5	SARRFLA	2
P29_5	SCLEMIN	2
P29_5	SMILLAU	6
P29_5	SYMPTIN	2
P29_5	VACCFUS	4
P29_5	WOODVIR	5
P29_5	XYRIAMB	2
P3_0	ACERRUB	6
P3_0	ANDRGLA	6
P3_0	ANDRGLO1	4
P3_0	ARUNTCT	2
P3_0	CARESTTB	4
P3_0	CYRIRAC	4
P3_0	DICHSCA	4
P3_0	DROSCAP	2
P3_0	ERAGSPE	2
P3_0	ERIODECD	2
P3_0	EUPALEU	2
P3_0	EUTHCAR	2
P3_0	GELSSEM	5
P3_0	HYPECRU	2
P3_0	HYPEDNT	2
P3_0	ILEXCRC	4
P3_0	ILEXGLA	6
P3_0	LOBENUT	2
P3_0	LUDWHIR	2
P3_0	MAGNVIR	4
P3_0	MORECAR	4
P3_0	MORECER	6
P3_0	NYSSBIF	6
P3_0	PERSPLS	6
P3_0	PHOTPYR	4
P3_0	PINUSER	5
P3_0	QUERNIG	3
P3_0	RHEXLUT	2
P3_0	RHEXMARM	2
P3_0	RHUSCOP	2
P3_0	RHYNGLM	2
P3_0	RHYNGRC	4
P3_0	RHYNRAR	5
P3_0	RUBU1S1	3
P3_0	SCIRCYP	2
P3_0	SMILLAU	7
P3_0	SMILROT	2
P3_0	VACCFOR	3
P3_0	VACCFUS	3

P3_0	XYRIAMB	2
P3_3	ACERRUB	2
P3_3	ANDR1S1	5
P3_3	ANDRGLA	7
P3_3	ANDRGLO1	5
P3_3	ANDRMOH	3
P3_3	CARESTTB	6
P3_3	DICHSCA	4
P3_3	DROSCAP	2
P3_3	DROSINT	2
P3_3	ERAGSPE	4
P3_3	GELSSEM	5
P3_3	HYPECRU	2
P3_3	HYPEDNS	2
P3_3	ILEXGLA	5
P3_3	JUNCBIF	2
P3_3	LUDWALT	2
P3_3	LUDWHIR	2
P3_3	LUDWVIR	2
P3_3	MAGNVIR	4
P3_3	MORECAR	6
P3_3	NYSSBIF	5
P3_3	PERSPLS	5
P3_3	PHOTPYR	7
P3_3	QUERLAU	2
P3_3	RHYN1S1	2
P3_3	RHYN1S2	2
P3_3	RHYNCHL	3
P3_3	RHYNGLM	4
P3_3	RHYNGRC	3
P3_3	RHYNRAR	2
P3_3	RUBU1S1	2
P3_3	SCIRCYP	3
P3_3	SMILLAU	6
P3_3	SMILROT	2
P3_3	VACCFOR	5
P3_3	VACCFUS	4
P3_3	VITIROT	2
P3_3	XYRIAMB	2
P30_0	ACERRUB	5
P30_0	AMELOBO	2
P30_0	ANDR1S1	3
P30_0	ANDR1S2	2
P30_0	ANDRGLA	3
P30_0	ANDRGLO1	4
P30_0	ARUNTCT	6
P30_0	CLETALN	7
P30_0	CYRIRAC	8
P30_0	EUBORAC	3
P30_0	GAYLDUM	2
P30_0	GAYLFRO	6
P30_0	ILEXCRC	6
P30_0	ILEXGLA	3
P30_0	LYONLIG	2
P30_0	MAGNVIR	4
P30_0	MORECAR	4
P30_0	NYSSBIF	6
P30_0	PERSPLS	4
P30_0	PHOTPYR	4
P30_0	PINUSER	5
P30_0	PTERAQU	2
P30_0	RHODATL	2
P30_0	SMILGLA	2
P30_0	SMILLAU	6
P30_0	SYMPTIN	2
P30_0	UTRISUB	2
P30_0	VACCFOR	3
P30_0	VACCFUS	4
P30_0	XYRIAMB	2
P30_0	ZIGADEN	2
P30_0	ZIGAGLB	2
P30_5	ACERRUB	2
P30_5	ANDR1S1	5
P30_5	ANDRGLA	2
P30_5	ANDRGLO1	4
P30_5	ANDRGLOH	4
P30_5	ARUNTCT	6
P30_5	CLETALN	4
P30_5	GAYLDUM	4
P30_5	GAYLFRO	7
P30_5	ILEXGLA	6
P30_5	IRISVERV	2
P30_5	LYONLIG	2
P30_5	LYONMAR	3
P30_5	MORECAR	2
P30_5	OSMUCINC	2
P30_5	PERSPLS	3
P30_5	PHOTPYR	6
P30_5	PTERAQU	3
P30_5	RHEXALI	2
P30_5	RHODATL	6
P30_5	RHYNGRC	2
P30_5	SMILGLA	2
P30_5	SMILLAU	2
P30_5	VACCFOR	2
P30_5	VACCFUS	3
P30_5	VACCTEN	4
P4_5	ACERRUB	7
P4_5	AMELOBO	4
P4_5	ANDR1S1	2

P4_5	ANDRGLA	5	P4_7	GAYLFRO	3
P4_5	ANDRGLOH	3	P4_7	GELSSEM	6
P4_5	ANDRVIR	4	P4_7	HYPECRU	2
P4_5	ARUNTCT	4	P4_7	HYPEDNS	2
P4_5	CAREGLC	4	P4_7	ILEXCRC	6
P4_5	CLETALN	6	P4_7	ILEXGLA	5
P4_5	CYRIRAC	4	P4_7	LIQUSTY	4
P4_5	DICHENS	3	P4_7	LYONLIG	4
P4_5	DICHSCA	3	P4_7	LYONLUC	8
P4_5	DICOT1	2	P4_7	MAGNVIR	5
P4_5	DROSCAP	2	P4_7	MORECAR	4
P4_5	EUBORAC	3	P4_7	MORECER	5
P4_5	GAYLFRO	4	P4_7	NYSSBIF	6
P4_5	GELSSEM	4	P4_7	PERSPLS	6
P4_5	ILEXCRC	5	P4_7	PHOTPYR	4
P4_5	ILEXGLA	5	P4_7	PINUSER	6
P4_5	LIQUSTY	5	P4_7	POLYPLPM	2
P4_5	LUDWVIR	2	P4_7	RHEXNAS	3
P4_5	LYONLUC	5	P4_7	RHODVIS	2
P4_5	MAGNVIR	6	P4_7	RHUSCOP	4
P4_5	MORECAR	5	P4_7	RHYNGRC	3
P4_5	MORECER	5	P4_7	RUBU1S1	3
P4_5	NYSSBIF	5	P4_7	SABADIF	2
P4_5	PERSPLS	5	P4_7	SCIRCYP	2
P4_5	PHOTPYR	4	P4_7	SMILGLA	2
P4_5	PINUPAL	5	P4_7	SMILLAU	6
P4_5	PINUSER	5	P4_7	VACCFOR	4
P4_5	QUERLAU	2	P4_7	VACCFUS	4
P4_5	RHEXNAS	2	P4_7	VACCTEN	4
P4_5	RHODVIS	2	P4_7	VIBUNUD	2
P4_5	RHYNCEP	2	P4_7	VIOLPRM	2
P4_5	RHYNCHL	2	P5_5	ACERRUB	6
P4_5	RHYNGRC	4	P5_5	ANDR1S1	6
P4_5	RHYNRAR	4	P5_5	ANDRGLA	5
P4_5	SABADIF	2	P5_5	ANDRGLO1	5
P4_5	SMILGLA	4	P5_5	ANDRMOH	2
P4_5	SMILLAU	6	P5_5	ARUNTCT	5
P4_5	VACCFOR	4	P5_5	CALABRE	4
P4_5	VACCFUS	4	P5_5	CLEIDIV	2
P4_5	VACCTEN	3	P5_5	CLETALN	7
P4_5	WOODVIR	2	P5_5	CTENARO	3
P4_5	XYRIAMB	2	P5_5	DICHENS	3
P4_7	ACERRUB	5	P5_5	DICHSCA	2
P4_7	AMELOBO	3	P5_5	DROSCAP	2
P4_7	ANDRGLA	4	P5_5	GAYLFRO	7
P4_7	ANDRVIR	2	P5_5	HYPEDNS	4
P4_7	ARUNTCT	2	P5_5	ILEXCRC	6
P4_7	CAREGLC	3	P5_5	ILEXGLA	6
P4_7	CLETALN	7	P5_5	ILEXOPAO	4
P4_7	CYRIRAC	5	P5_5	LYONLIG	4

P5_5	LYONLUC	7	P5_9	RHEXNAS	3
P5_5	MAGNVIR	6	P5_9	RHODVIS	2
P5_5	MORECAR	6	P5_9	RHYN1S1	2
P5_5	MORECER	5	P5_9	RHYNBAL	2
P5_5	NYSSBIF	6	P5_9	RHYNCEP	2
P5_5	PERSPLS	5	P5_9	RHYNCHP	2
P5_5	PHOTPYR	5	P5_9	SABADIF	2
P5_5	PINUSER	5	P5_9	SCHISCO	4
P5_5	RHEXALI	2	P5_9	SCLEMIN	4
P5_5	RHEXPET	2	P5_9	SMILGLA	2
P5_5	RHYN1S1	2	P5_9	SMILLAU	6
P5_5	SABADIF	2	P5_9	VACCCRA	4
P5_5	SARRPUR	2	P5_9	VACCFOR	4
P5_5	SCHISCO	4	P5_9	VACCFUS	5
P5_5	SCLEMIN	4	P5_9	VACCTEN	2
P5_5	SMILGLA	4	P5_9	WOODARE	2
P5_5	SMILLAU	7	P5_9	XYRIAMB	2
P5_5	VACCCRA	4	P5_9	XYRIAMB	4
P5_5	VACCFOR	4	P5_9	ZIGAGLB	4
P5_5	VACCFUS	4	P6_0	ACERRUB	6
P5_5	XYRIAMB	2	P6_0	ANDR1S1	6
P5_5	XYRIAMB	3	P6_0	ANDRGLO1	6
P5_5	ZIGAGLB	4	P6_0	ANDRMOH	5
P5_9	ACERRUB	4	P6_0	ARISVIR	6
P5_9	AMELOBO	3	P6_0	ARUNTCT	4
P5_9	ANDR1S1	4	P6_0	CARESTTB	2
P5_9	ANDRGLA	6	P6_0	CARPTOM	2
P5_9	ANDRMOH	3	P6_0	CLETALN	4
P5_9	ARUNTCT	5	P6_0	CTENARO	5
P5_9	CARESTTB	4	P6_0	CYRIRAC	4
P5_9	CLETALN	5	P6_0	DICHENS	2
P5_9	DICHENS	3	P6_0	DROSCAP	2
P5_9	DICHSCA	2	P6_0	DROSINT	2
P5_9	ELEOTUB	2	P6_0	ERAGSPE	2
P5_9	GAYLDUM	3	P6_0	ERIODECD	2
P5_9	GAYLFRO	6	P6_0	EUTHCAR	3
P5_9	HYPECRU	2	P6_0	GAYLDUM	2
P5_9	ILEXCRC	7	P6_0	ILEXCRC	3
P5_9	ILEXGLA	7	P6_0	ILEXGLA	6
P5_9	LYCOALP	2	P6_0	LOBENUT	2
P5_9	LYONLIG	3	P6_0	LYCOALP	2
P5_9	LYONLUC	7	P6_0	LYONLIG	2
P5_9	MAGNVIR	4	P6_0	LYONLUC	3
P5_9	MORECAR	4	P6_0	MAGNVIR	4
P5_9	MORECER	4	P6_0	MORECAR	4
P5_9	NYSSSYL	2	P6_0	NYSSBIF	3
P5_9	PERSPLS	6	P6_0	OSMUREGS	2
P5_9	PHOTPYR	4	P6_0	PERSPLS	4
P5_9	PINUSER	6	P6_0	PHOTPYR	3
P5_9	RHEXLUT	2	P6_0	PINUSER	4

P6_0	RHEXALI	3	P7_2	ACERRUB	6
P6_0	RHEXLUT	4	P7_2	ANDRGLA	4
P6_0	RHYN1S1	2	P7_2	ANDRVIR	4
P6_0	RHYNGRC	2	P7_2	ARUNTCT	2
P6_0	RHYNRAR	3	P7_2	ASTE1S1	2
P6_0	SACCGIG	2	P7_2	CAREGLC	5
P6_0	SARRFLA	4	P7_2	CLETALN	3
P6_0	SMILLAU	5	P7_2	CYRIRAC	6
P6_0	VACCCRA	2	P7_2	DICHENS	4
P6_0	VACCFOR	4	P7_2	DICHENSC	2
P6_0	VACCFUS	2	P7_2	EUPAPIL	2
P6_0	XYRIAMB	5	P7_2	EUTHCAR	2
P6_0	ZIGADEN	2	P7_2	GAYLFRO	3
P6_0	ZIGAGLB	3	P7_2	HYPEDNS	2
P6_9	ACERRUB	6	P7_2	ILEXCRC	6
P6_9	AMELOBO	5	P7_2	ILEXGLA	4
P6_9	ANDR1S1	4	P7_2	ILEXLAE	4
P6_9	ANDRGLA	4	P7_2	LUDWHIR	4
P6_9	ANDRGLO1	4	P7_2	LYONLUC	8
P6_9	ARUNTCT	2	P7_2	MORECAR	4
P6_9	CARESTTB	4	P7_2	MORECER	4
P6_9	CARPTOM	2	P7_2	OSMUCINC	2
P6_9	CLETALN	7	P7_2	PERSPLS	5
P6_9	CTENARO	2	P7_2	PHOTPYR	2
P6_9	CYRIRAC	7	P7_2	PINUSER	2
P6_9	DICHENS	2	P7_2	PROSPEC	3
P6_9	ERIODECD	2	P7_2	RHYN1S1	2
P6_9	EUBORAC	3	P7_2	RHYNCHL	4
P6_9	GAYLFRO	7	P7_2	RHYNGRC	2
P6_9	ILEXCRC	6	P7_2	RUBU1S1	2
P6_9	ILEXGLA	7	P7_2	SMILLAU	6
P6_9	LYONLIG	4	P7_2	TOXIRAD	2
P6_9	LYONLUC	6	P7_2	UTRISUB	3
P6_9	MAGNVIR	7	P7_2	VACCFOR	2
P6_9	MORECAR	6	P7_2	VACCFUS	4
P6_9	MORECER	5	P7_2	VACCTEN	2
P6_9	NYSSBIF	7	P7_2	WOODARE	2
P6_9	PERSPLS	7	P7_2	WOODVIR	4
P6_9	PHOTPYR	5	P7_2	XYRIAMB	3
P6_9	PINUSER	4	P7_5	ACERRUB	6
P6_9	RHEXLUT	2	P7_5	ANDRGLA	6
P6_9	SABADIF	2	P7_5	ANDRVIR	5
P6_9	SARRFLA	3	P7_5	ARUNTCT	2
P6_9	SARRPUR	2	P7_5	ASTE1S1	2
P6_9	SMILGLA	2	P7_5	BARTVIR	2
P6_9	SMILLAU	7	P7_5	CAREGLC	3
P6_9	VACCFOR	6	P7_5	CLETALN	4
P6_9	XYRIAMB	2	P7_5	CYRIRAC	6
P6_9	ZIGADEN	4	P7_5	DICHENS	3
P6_9	ZIGAGLB	2	P7_5	DICHSCA	3

P7_5	DROSCAP	2	P8_5	GELSSEM	2
P7_5	ERIODECD	4	P8_5	HYPECRU	2
P7_5	EUTHCAR	2	P8_5	ILEXCRC	5
P7_5	GELSSEM	2	P8_5	ILEXGLA	7
P7_5	HYPECRU	2	P8_5	KALMCAR	3
P7_5	HYPEDNS	2	P8_5	LYONLUC	8
P7_5	ILEXCRC	6	P8_5	MORECAR	5
P7_5	ILEXGLA	5	P8_5	MORECER	4
P7_5	LUDWHIR	4	P8_5	NYSSBIF	2
P7_5	LYCOALP	2	P8_5	PERSPLS	5
P7_5	LYONLUC	6	P8_5	PHOTPYR	5
P7_5	MAGNVIR	5	P8_5	PINUSER	6
P7_5	NYSSBIF	2	P8_5	RHEXPET	2
P7_5	PERSPLS	4	P8_5	RHODVIS	4
P7_5	PHOTPYR	2	P8_5	RHYNCHL	4
P7_5	PINUSER	4	P8_5	RHYNCIL	2
P7_5	POLYLUT	2	P8_5	RHYNGRC	3
P7_5	RHEXLUT	2	P8_5	SACCGIG	2
P7_5	RHODVIS	2	P8_5	SCLEMIN	2
P7_5	RHYN1S1	2	P8_5	SMILLAU	6
P7_5	RHYNCEP	2	P8_5	UTRISUB	3
P7_5	RHYNCHL	3	P8_5	VACCFOR	3
P7_5	RHYNCHP	2	P8_5	VACCFUS	5
P7_5	RHYNGRC	3	P8_5	VACCTEN	3
P7_5	RUBU1S1	2	P8_5	WOODVIR	4
P7_5	SABADIF	2	P8_5	XYRIAMB	2
P7_5	SCIRCYP	3	P8_6	ACERRUB	4
P7_5	SCLEMIN	2	P8_6	AMELOBO	2
P7_5	SMILGLA	2	P8_6	AMPHPUR	2
P7_5	SMILLAU	6	P8_6	ANDR1S1	2
P7_5	TOXIRAD	2	P8_6	ANDRGLA	4
P7_5	UTRISUB	2	P8_6	ANDRGLO1	3
P7_5	VACCFOR	2	P8_6	ANDRGLOH	2
P7_5	VACCFUS	2	P8_6	ANDRVIR	3
P7_5	VACCTEN	2	P8_6	ARUNTCT	5
P7_5	WOODARE	2	P8_6	BARTVIR	2
P7_5	WOODVIR	4	P8_6	CLETALN	7
P7_5	XYRIAMB	3	P8_6	CYRIRAC	7
P8_5	ACERRUB	6	P8_6	DICHENS	2
P8_5	AMPHPUR	2	P8_6	DICHMAT	2
P8_5	ANDRGLA	4	P8_6	DICHSCA	2
P8_5	ANDRGLO1	3	P8_6	DROSCAP	2
P8_5	ARUNTCT	3	P8_6	EUBORAC	4
P8_5	BARTVIR	2	P8_6	GAYLDUM	2
P8_5	CLETALN	7	P8_6	GAYLFRO	6
P8_5	CYRIRAC	6	P8_6	ILEXCRC	6
P8_5	DICHENS	2	P8_6	ILEXGLA	7
P8_5	ELEOMIC	2	P8_6	KALMCAR	4
P8_5	EUBORAC	5	P8_6	LYONLIG	4
P8_5	GAYLFRO	5	P8_6	LYONLUC	7

P8_6	MAGNVIR	4
P8_6	MORECAR	4
P8_6	PERSPLS	4
P8_6	PHOTPYR	5
P8_6	PINUSER	5
P8_6	PTERAQU	2
P8_6	RHEXPET	2
P8_6	RHODVIS	4
P8_6	RHUSCOP	2
P8_6	RHYNCHL	2
P8_6	RHYNCIL	3
P8_6	RHYNGRC	2
P8_6	SCLEMIN	2
P8_6	SMILLAU	4
P8_6	UTRISUB	2
P8_6	VACCFUS	4
P8_6	VACCTEN	4
P8_6	WOODVIR	2
P8_6	XYRIAMB	2
P8_6	ZIGAGLB	2
P9_2	ACERRUB	5
P9_2	ANDRGLA	5
P9_2	ANDRGLO1	5
P9_2	ANDRGLOH	2
P9_2	ARUNTCT	2
P9_2	CAREGLC	2
P9_2	CARESTTB	7
P9_2	CYRIRAC	7
P9_2	DROSCAP	2
P9_2	GAYLFRO	4
P9_2	ILEXCRC	4
P9_2	ILEXGLA	6
P9_2	LOBENUT	2
P9_2	MAGNVIR	5
P9_2	MORECAR	4
P9_2	MORECER	4
P9_2	NYSSBIF	4
P9_2	PERSPLS	4
P9_2	PHOTPYR	4
P9_2	PINUSER	4
P9_2	RHEXLUT	2
P9_2	RHYN1S1	2
P9_2	RHYNBAL	2
P9_2	RHYNCHL	2
P9_2	RHYNGRC	3
P9_2	RHYNRAR	4
P9_2	SABADIF	2
P9_2	SCLEMIN	2
P9_2	SMILLAU	5
P9_2	SYMPTIN	4
P9_2	VACCFOR	2
P9_2	VACCFUS	4
P9_2	VACCTEN	2
P9_8	ACERRUB	4
P9_8	ANDRGLA	5
P9_8	ANDRGLO1	3
P9_8	ANDRGLOH	4
P9_8	ARUNTCT	3
P9_8	CARESTTB	8
P9_8	CLETALN	4
P9_8	CYRIRAC	6
P9_8	DICHLCT	2
P9_8	ERAGSPE	2
P9_8	ERIODECD	2
P9_8	GAYLFRO	3
P9_8	ILEXCRC	5
P9_8	ILEXGLA	6
P9_8	ILEXMYR	3
P9_8	MAGNVIR	5
P9_8	MORECAR	6
P9_8	MORECER	4
P9_8	NYSSBIF	2
P9_8	OSMUCINC	2
P9_8	PERSPLS	4
P9_8	PHOTPYR	4
P9_8	PINUSER	4
P9_8	RHEXALI	2
P9_8	RHEXLUT	2
P9_8	RHYN1S1	4
P9_8	RHYNCEP	2
P9_8	RHYNCHL	2
P9_8	RHYNGRC	3
P9_8	RHYNRAR	3
P9_8	SABADIF	2
P9_8	SARRFLA	2
P9_8	SARRPUR	2
P9_8	SCLEMIN	2
P9_8	SMILLAU	4
P9_8	SYMPTIN	2
P9_8	VACCFUS	4
P9_8	VACCTEN	2
P9_8	XYRIAMB	2
P9_8	XYRIAMB	2
P9_8	ZIGAGLB	4