Long-term species change in a Uruguayan grassland

Altesor, A.^{1*}, Di Landro, E.², May, H.² & Ezcurra, E.³

^{1*}Unidad Ecología Funcional, Facultad de Ciencias, Universidad de la República; Iguá s/n, Montevideo, Uruguay; ²Dirección General de Recursos Naturales Renovables, Ministerio de Ganadería, Agricultura y Pesca, Montevideo, Uruguay; ³ San Diego Natural History Museum, P.O. Box 1390, San Diego, CA 92112 USA; E-mail eezcurra@sdnhm.org; *Corresponding author; Fax + 598 2 5258617; E-mail aaltesor@genetica.edu.uy

Abstract. This paper reports on species changes which occurred in plots in a Uruguayan grassland after 55 yr of continuous grazing. The study was based on the pioneering work of B. Rosengurtt who sampled 10 plots in 1935; in 1990 we resampled five of them. Comparative studies were based on rank-frequency, diversity, evenness and multivariate analyses. Diversity was measured as species richness S, Shannon's index H and its exponential form $N = e^{H}$, evenness E = N/S and Gini's coefficient of hierarchy G. Species-richness of the plots increased significantly. Species which entered the sites are mostly weedy species, while those that have decreased are mostly palatable forage species. Evenness, however, remained constant. Floristic change was chiefly associated with time, and secondarily with plot soil-type. During the 55 yr that elapsed between both observation periods, a dramatic floristic change has occurred in this grassland site.

Keywords: Community structure; Deterioration; Diversity; Evenness; Gini coefficient; Species-abundance; Weed.

Nomenclature: Lombardo (1984).

Introduction

The natural grasslands of the temperate South American plains in Uruguay, Brazil and Argentina have been considerably transformed by human intervention, particularly grazing and change of land-use into intensive agriculture. Unfortunately, very few efforts were made before this large transformation occurred to make an inventory of the original composition of the South American grasslands and follow its changes through time. Furthermore, few efforts have been made to establish permanent plots that may allow the evaluation of the rate of transformation of these ecosystems. In many cases, the extant native vegetation has been eliminated during recent decades to establish modern, high-input agricultural systems, frequently based on chemical tillage which completely change the original plant community - possibly beyond recovery.

In Uruguay, the area occupied by natural grasslands amounts to more than $140\ 000\ \text{km}^2$, of which about 90 % are used for extensive grazing by cattle and sheep. The introduction of domestic herbivores following settlement by Europeans significantly changed the original structure of these grasslands (Gallinal et al. 1938). While the ungrazed vegetation grows 40-50 cm tall and is dominated by tussock grasses, under the current grazing regime it is short turf less than 5 cm tall (Sala et al. 1986; Millot et al. 1987; Panario 1994).

Herbivore-induced shifts in species composition and ecosystem function have been well documented in grasslands from Argentina. In the flooded Argentinian Pampas, exotic species that grow primarily during winter and spring are significantly promoted by domestic grazing (Facelli et al. 1988; Facelli 1988; Chaneton & Facelli 1991). These grazed grasslands have suffered a major change in ecosystem function with a significant decline (ca. 40 %) in above-ground net primary production primarily during the warm season (Rusch & Oesterheld 1997). Additionally, changes in the architecture of the vegetation in response to anthropogenic disturbance (especially grazing pressure) have been reported in montane grasslands of Argentina with a progressive miniaturisation of photosynthetic structures and concentration of biomass close to the ground (Díaz et al. 1992).

In this paper we present evidence on how and to what extent the biological diversity and species composition of a native grassland in Northern Uruguay has changed during 55 yr, between 1935 and 1990, under traditional continuous grazing. We based our study on the pioneering work of Bernardo Rosengurtt, who had the foresight to accurately describe the native grasslands of northern Uruguay in the early 20th century, by sampling and carefully mapping plots that can still be located in the field.

Methods

Study site

The study site was a native grassland on Cerro Largo, NW Uruguay, in the Estancia Palleros, a livestock breeding ranch (32° 05' S, 54° 30' W). Geomorphologically, the site forms part of the sedimentary plains of NE Uruguay, near the Brazilian border, at an altitude of ca. 150 m a.s.l. The soil is a dark prairie soil type, developed on sediments derived from igneous and metamorphic materials, with a high content of organic matter (> 3%) in the A-horizon and a moderate drainage capacity. In the higher parts, the soil profile is more developed, with a deeper A-horizon and an argillic Bhorizon. In the lower parts, poor drainage promotes the development of soils with less differentiation, with a higher pH, a more shallow A-horizon and a lower amount of clay in the B-horizon (Durán 1985).

Mean annual precipitation between 1961 and 1990 was 1098 mm. The rain is distributed evenly throughout the year (cf. Ezcurra & Rodrigues 1986). Mean annual temperature for the same period was 16.5 °C, ranging from a winter monthly mean of 10.7 °C in July to a summer mean temperature of 22.7 °C in January (Anon. 1996).

The dominant vegetation type is native grassland where the low herbaceous species are largely maintained by the grazing pressure of cattle. The normal height of the grassland canopy is around 5 cm, the dominant species are stoloniferous and caespitose grasses, and perennial herbs. In the non-grazed parts, some small woody shrubs and tussock grasses may appear (Rosengurtt 1943). In the region where our research site is located only 1.5 % of the area is used as cropland. Following the classification of grasslands of Milchunas et al. (1988), our study site corresponds to a subhumid grassland with a long history of grazing.

Data collection

The Palleros sites were first sampled in the summer of 1935 by B. Rosengurtt and collaborators (Gallinal et al. 1938). 10 plots were located in different parts of Estancia Palleros with the purpose of evaluating the species composition of the local native grasslands. Each plot was marked in the field as a $12 \text{ m} \times 12 \text{ m}$ square. Botanical composition and species frequency were determined in each plot by locating 25 random quadrats $0.5 \text{ m} \times 0.5 \text{ m}$ in size. In each quadrat, the presence of all species was recorded. The frequency of occurrence in the 25 quadrats was used as a measure of the relative abundance of the species in each plot. The first results were published shortly afterwards (Gallinal et al. 1938; Rosengurtt 1943). Since then, five of the plots have been lost, as they have been planted with Eucalyptus or have become flooded through water management. In 1990

we re-sampled the remaining plots, using exactly the same procedure that had been used by Rosengurtt et al. in 1935. The plots were relocated using the original maps, the 25 frequency quadrats were placed at random inside each plot. During the 55 yr that have elapsed between both samples, the fields were managed under traditional continuous grazing, with Hereford cows and sheep at a density of about one animal unit (i.e. one cow-equivalent) per 2 ha.

Data analysis

A species-by-plot matrix was prepared that included the species frequencies in the five plots in 1935, and in the same five plots in 1990. The matrix contained a total of 121 species (a magnetic copy of the complete data set can be obtained from the first author). For each plot, we counted the total species richness (S), calculated Shannon's diversity index (H) and its exponential diversity number ($N = e^H$), as well as the evenness (E = N/S; Hill 1973c) and Gini's coefficient of hierarchy (G; Weiner & Solbrig 1984). Because S, H, N, E and G are synthetic community descriptors that were measured in the same plot at two different times, they constitute a case of repeated measures with no replicates at the plot level. Differences in these values between the two years were evaluated by means of a procedure suggested by Mead (1988; see also Gurevitch & Chester 1986 and von Ende 1993) for the case of repeated measurements. We first calculated, for each plot, the differences between the values observed in 1935 and in 1990. Thus, for each community variable (i.e. S, H, N, E, and G) we obtained a vector of five difference-values. Under the null hypothesis of no change in the descriptor, we would expect the differences between the two years to be random deviates with expected mean equal to zero. We tested by means of a *t*-test the mean of each difference vector, under the null hypothesis that the mean difference between the two years should not be significantly different from zero.

We also ranked the species abundances in each plot and plotted the resulting rank-frequency curves on both an arithmetic and a logarithmic scale. Differences between these curves were evaluated by means of a loglinear model on the rank-ordered frequency matrix, taking the rank of the species, the year and the plot as predictors of the species frequencies.

To evaluate the importance of purely floristic changes, a Principal Component Analysis (non-standardized, with Gower's double centring procedure; see Gower 1966; Noy-Meir 1973; Noy-Meir et al. 1975; Ezcurra 1987) was performed on the whole data matrix with presence-absence data. To evaluate the importance of changes in species abundances in the plots, we also carried out a Correspondence Analysis on the same matrix with the complete frequency data. We used ORDEN version 2.0 for these analyses. To avoid distortion of the CA by rare species (i.e. the 'rare-species effect', see Gauch 1982), we eliminated from this second analysis all species that were present in only one plot and all species that were present in more than one plot but that showed low frequencies in the plots in which they were present (technically, the exact criterion we used was to eliminate all species that had expected values below unity in the frequency table, calculating the expected value in the standard way for contingency tables, i.e. row total \times column total / table total; see Everitt 1977). The resulting matrix contained 72 species. In both the Component Analysis and the Correspondence Analysis we evaluated the significance of the axes by comparing the percentage variance explained by each axis against the predicted values of the brokenstick distribution (Jackson 1993). In the case of correspondence analysis, we also calculated the χ^2 -value of each axis (calculated as the product of the axis' eigenvalue times the sum of all frequencies in the matrix; see Legendre & Legendre 1983) as a measure of significance. By means of an Analysis of Variance we evaluated the relationship between the axes and time as a predictive factor. Finally, the trajectories between 1935 and 1990 of the five plots in the reduced multivariate space were drawn on the ordination graphs to highlight differences and similarities in the vegetational changes between the plots.

Soil samples were taken from each plot during the 1990 sampling, and were air-dried and analysed in the laboratory (no soil samples were taken in 1935). After the laboratory analyses were completed, the soil features were summarised into a data table for statistical analysis, in which we included: (a) the thickness of the A-horizon, (b) the content of sand, loam and clay in the A-horizon, (c) the content of clay in the B-horizon, (d) the ratio of clay in the A-horizon to clay in the Bhorizon, (e) pH, (f) monovalent and bivalent cations (Ca, Mg, Na and K) and (g) the K/Na ratio as an indicator of soil fertility. We assigned the same values to both the 1935 and 1990 plots, as these soil variables are relatively constant in time. We excluded from the analysis other soil variables such as organic matter, nitrogen and phosphorus contents in the A-horizon, as their values may have changed substantially with time and with the management of the pasture. We calculated the correlation coefficients between the soils attributes and axes 1 and 2 of both the Component Analysis and the Correspondence Analysis. Because each axis was analysed against 12 non-independent soil variables, we used a Bonferroni criterion to correct the threshold values for the acceptance of a significant association, thus making the test of hypothesis more stringent (to calculate the corrected probabilities we used the Dunn-Šidák method as described in Ury 1976, and in Sokal & Rohlf 1995).

Results

Changes in species diversity

The log-linear model indicated that the rank-frequency plots differed significantly (p < 0.0001) between years. A significant (p < 0.0001) quadratic effect of the rank was also detected, a fact that highlights the notable convex shape of the rank-frequency curves on a logarithmic scale (Fig. 1). Finally, significant (although quantitatively less important when compared to the betweenyears effect) differences were also found between plots. These results were confirmed by the values of diversity and evenness (Table 1). Both Shannon's diversity index H and the diversity number N increased significantly with time (t = 50.2; p < 0.0001, d.f. = 4; and t = 25.6;p < 0.0001, d.f. = 4, respectively). However, when diversity was decomposed into species richness (S) and evenness (E), it was found that species richness increased significantly (t = 42.0; p < 0.0001, d.f. = 4) in all plots between 1935 and 1990, but that evenness did not change in a significant way (t = 2.6; p = 0.06, d.f. = 4). A statistical analysis of Gini's coefficient (G) also failed to detect any significant change (t = 1.7; p = 0.16, d.f. = 4) in the degree of hierarchical dominance of the rank-frequency curves between 1935 and 1990. This would be expected since both indices measure the evenness of the hierarchical distribution of species, a very high correlation was also found between E and G (r = 0.99; d.f. = 8; p < 0.0001).

In short, the species richness of the five plots in-



Fig. 1. Rank-frequency plots showing distribution curves for the five plots of Estancia Palleros in 1935 and 1990. Frequencies are shown on a logarithmic scale. All curves start from rank 1, and have been separated for clarity. (——) plot a; (……) plot b; (- - - -) plot c; (- - -) plot d; (——) plot e (same symbol as plot a).

Table 1. Shannon's diversity index (H) and its exponential diversity number (N), species richness (S), evenness (E), and Gini's coefficient of hierarchy (G) for the five plots of Estancia Palleros in 1935 (lower case) and 1990 (upper case).

Plot and year		Н	Ν	S	Ε	G
a	1935	3.26	26.14	39	0.67	0.536
b	"	3.44	31.23	43	0.73	0.582
с	"	2.96	19.35	31	0.62	0.504
d	"	3.23	25.40	37	0.69	0.555
e	"	3.33	27.83	43	0.65	0.511
А	1990	3.67	39.23	56	0.70	0.560
В	"	3.89	49.01	65	0.75	0.603
С	"	3.44	31.06	48	0.65	0.514
D	"	3.60	36.48	56	0.65	0.512
Е	"	3.74	42.17	60	0.70	0.557

creased ca. 50 % between 1935 and 1990, from a mean value of 38.6 species per plot (S.E. = 2.3) to a mean value of 57.0 species per plot (S.E. = 2.8). In contrast, the evenness of the species abundance distribution remained constant at a mean value of 0.68 (S.E. = 0.02). From the point of view of their biological diversity, the main change that has occurred during the last 55 yr, has been a large increase in the number of species in the native grassland, but no significant change has occurred in the patterns of species dominance or in the distribution of relative abundances within the grassland community.

Changes in species composition

The first two axes of the principal component analysis explained 32 % and 18 % of the variation in the data, and were either above or very near the values derived from the predictions of the broken-stick distribution under the null hypothesis of random variation (29 % and 19%, respectively, for axes 1 and 2). All other axes were well below the predictions of the random model, and were hence considered 'non-significant' axes. Furthermore, the first component was significantly related to time as a discrete factor ($F_{(1.8)} = 55.76; p < 0.0001$), while the second component was significantly correlated with the percentage of clay in the B-horizon (r = 0.86, uncorrected p = 0.0014; Bonferroni-corrected p = 0.016) and more weakly related to other variables such as depth of the A-horizon, pH, Na and K/Na (although the uncorrected *r*-values were significant for all these variables, the Bonferroni-corrected significances were slightly above the 0.05 threshold). That is, the Principal Component Analysis of the presence-absence data produced a first axis that highlights the floristic variation in time and a second axis that emphasises floristic differences in space (Fig. 2). The second axis clearly detected a soil gradient going from plot b (an acidic site located in an elevated part of the plain with a deeper A-horizon, a relatively high fertility as indicated by its high K/Na ratio, and a strongly argillic B-horizon that derives from its higher internal drainage) to plot a (a lightly alkaline site located in a topographic depression with a shallower A-horizon, relatively high sodium content and poor internal drainage; see Table 2). Thus, the secondary significant source of variation is basically associated with the level of profile development and internal drainage of the dark prairie soils. The dramatic change in species richness described in the previous section was clearly reflected in the component analysis, where the within-site floristic differences in time explained a larger proportion of the floristic variation than the differences between sites in space.

The first two axes of the correspondence analysis of the frequency data explained 29.1 % and 21.7 % of the variation in the quantitative data set, and were considered significant by the criteria of both the broken-stick and the χ^2 tests. In total agreement with the component analysis of the presence-absence data, the correspondence analysis detected primarily variation in time, and secondarily it also detected a spatial gradient from plot a in one extreme to plot b in the other (in the correspondence analysis, however, the Bonferroni-corrected correlations between multivariate axes and soil variables were, in all cases, higher than 0.05 and hence only very weakly significant). In short, for our data set the statistical relationship between the multivariate axes and time and soil variables was, in all cases, higher for the presence-absence component analysis than for the correspondence analysis with frequency data, indicating that



Fig. 2. Principal Components Analysis of the presence-absence data for the five plots belonging to 1935 (lower case) and 1990 (upper case) samples. The arrows indicate temporal trajectories for each plot.

in this grassland site the analysis of floristic variation in simple terms of presence-absence data is more robustly associated to long-term change than the analysis of relative frequencies of the dominant species.

Finally, using the species classification derived from the multivariate axes, we classified and listed the species that disappeared, decreased, increased or appeared in the sampling plots during the 55-yr period (App. 1).

Discussion

Based on the description by Rosengurtt (1979) of ecological, morphological and productivity traits of prairie plants in Uruguay, the species in our study area can be classified into three simple categories:

- I Palatable species: graminoids and herbs, presenting soft leaves throughout their life span and usually highly palatable. These plants tend to decrease in their frequency of occurrence as grazing increases.
- II Species of intermediate palatability: Graminoids and herbs with fibrous leaves when old and with medium to low palatability. These plants tend initially to increase in their frequency of occurrence as grazing pressure increases (although they may eventually decrease in heavily overgrazed plots).
- III Weedy species: Herbaceous plants and shrubs, usually unpalatable, inaccessible or toxic for herbivores. These are opportunistic species that generally colonise disturbed or heavily overgrazed sites.

For the discussion of the results, Rosengurtt's classification was superimposed onto the results of the multivariate analyses (App. 1). In the 1935 sample, 79 % of the recorded species were grasses. By 1990, the Poaceae had decreased to 48 % of the total species richness. One species (Piptochaetium panicoides) which was common in 1935 had completely disappeared by 1990. Twenty other species that were relatively rare in 1935 were extinct by 1990 (the second group in App. 1), 90 % of them belonging to the Poaceae. Most of the grasses that disappeared were native perennials with a caespitose growth form and high forage quality (categories I and II). Furthermore, the whole set of species that decreased (the third group in App. 1) belongs to forage categories I and II, and is formed by graminoids and legumes with a caespitose growth form.

In the group of species that remained common between 1935 and 1990 (group 4 in App. 1) five grasses: *Paspalum notatum, Setaria geniculata, Axonopus affinis, Bothriochloa laguroides* and *Coelorhachis selloana* are still dominant, together with a weedy composite (*Chevreulia sarmentosa*) that appeared in the 1990 census.

Most (64 %) of the 28 species that were absent or rare in 1935 and are now common (group 5) are weeds or low-palatability forbs belonging to category III. Only five (18%) of these immigrant species belong to the Poaceae. One of them is an introduced and cultivated forage species (Lolium multiflorum) and another is Cynodon dactylon, an aggressive invader characteristic of overgrazed grasslands (Lorenzi 1991; Ríos & Giménez 1992). A similar trend was observed in the 15 species that were absent in 1935 and are now present (but not abundant): 80 % of these belong to the type-III category, and only two of them (13 %) are grasses. Among these weedy newcomers a variety of different morphologies is found, ranging from rosette plants with below-ground storage organs and planophyllous leaves such as Chaptalia piloselloides, to shrubby species such as Baccharis trimera.

Some species remained throughout the period as good indicators of soil quality, and their presence was largely independent of the changes in species composition through time, as indicated by the second ordination axis. *Andropogon ternatus, Aristida murina, Aristida venustula, Desmanthus depressus,* and *Schizachyrium spicatum* (all of them belonging to types I and II), were common in 1935 and only remained in 1990 in plot b, a meadow with a well-developed soil, a deep A-horizon and comparatively high fertility. Another group of species only increased or appeared in this plot (see groups seven and eight of App. 1).

One group of species (*Ambrosia tenuifolia, Eleocharis* sp., *Eragrostis bahiensis, Hydrocotyle* sp., *Rhynchospora luzuliformis* and *Spilanthes decumbens*; most of them of type III) only appeared or increased in plot a, on slightly alkaline soil with a less-developed profile, a more shallow A-horizon (25 cm) and the highest proportion of interchangeable sodium. In contrast with the characteristic species of plot b, most of the plants that had a distinctive distribution in plot a were unpalatable weeds.

Table 2. Main soil attributes in each of the five plots, measured during the 1990 sampling. All values were measured in homogenized samples from the A-horizon, except for 'clay in B' which refers to % clay in the B-horizon.

Plot	Thickness	Sand	Loam	Clay	Clay in B		Ca	Mg	Na	K		
	(cm)	(%)				pH	(meq/100 g)				K/Na	
	25	44 5	22.6	22.2	20.5		10.0	25	0.0	0.2	0.22	
A	25	44.5	32.6	23.3	30.5	1.3	18.9	3.5	0.9	0.3	0.33	
В	53	30.3	34.0	35.6	46.8	5.9	22.8	2.4	0.25	0.45	1.8	
С	39	46.9	32.5	20.5	40.7	5.7	6.7	1.3	0.4	0.2	0.5	
D	28	59.3	21.1	19.6	40.3	5.6	4.6	1.45	0.2	0.3	1.5	
E	25	55.2	23.3	21.4	38.8	5.7	5.0	1.65	0.3	0.35	1.17	

Most of the species recorded, including a large proportion of the species that have colonized the area since 1935, are native to Uruguay. 86 % of the now widespread weedy invaders which were totally absent in 1935 are native to the region. These species include herbaceous composites, sedges, umbellifers and plantains of high dispersal capacity. Although there is no information on their original habitat, we assume that these plants have evolved as opportunists growing in disturbed areas, and have become colonizers of grazed pastures with the growing development of animal husbandry in Uruguay.

It should be noted that both the data for 1935 and for 1990 were obtained in a single season and we do not know whether these years were typical or atypical years. Thus, we have no means of differentiating within our data set short-term variation from long-term trends. From a biological viewpoint, however, the trend seems consistent, as most of the species that have changed in the plots are perennials and it does not seem likely that their extinction or appearance could be attributed to short-term trends. However, more detailed monitoring is necessary to confirm the preliminary trend described in this paper. Long-term monitoring sites are needed in the Uruguayan grasslands, and we are in the process of establishing such a longer-term project to follow floristic change in the Palleros plots.

Conclusions

Between 1935 and 1990 there has been a marked deterioration in the pasture quality of the Palleros grassland site: some palatable grasses have decreased or disappeared and a large number of low-quality invaders has immigrated into the plots. The species-richness of the plots has increased significantly, while the evenness of the species-abundance distribution has remained constant. The newcomers are mostly unpalatable weeds, while the species that have decreased are mostly palatable forage species.

The most significant change observed was in floristic composition, as the guild of dominant species remained relatively constant. A similar trend has been reported by other authors (e.g. Milchunas et al. 1988). Within the group of dominant species, the most abundant were prostrate species such as *Paspalum notatum* and *Axonopus affinis*. These are rhizomatose and stoloniferous plants that can spread horizontally at ground level, and thus avoid the effects of intense grazing.

Some palatable grasses have disappeared or decreased and many low-quality forbs have immigrated or increased their frequency in the plots. These plants belong mostly to category III, usually have a small leaf area and

storage structures close to the ground. Their growth form may be rosettophyllous (e.g. Plantago myosurus), shrubby (e.g. Gamochaeta spicata) or prostrate, in many cases with horizontal spread through stolons and rhizomes (e.g. Richardia humistrata, Cyperus sp., Chevreulia sarmentosa). As pointed out by Díaz et al. (1992), these morphological traits could be responses to the pressure of herbivores. Many of these plants can avoid herbivory through physical or chemical defences such as spiny, sclerophyllous or fibrous tissues (e.g. Eryngium horridum), or unpalatable secondary compounds (Baccharis coridifolia). In strong contrast with the high number of exotic invaders that have colonised the grasslands of the flooded Pampas (Sala et al. 1986; Facelli et al. 1988; Facelli 1988; Chaneton & Facelli 1991; Rusch & Oesterheld 1997), most of the invading species found in Palleros are native to the region.

Although there were no exclosures established as control plots in 1935 when this experiment was initiated, the comparative results strongly suggest that a large part of the floristic change observed is caused by cattle grazing. The establishment of permanent plots with exclosures is needed to evaluate whether the deterioration of these plots is reversible through a more adequate management of the grazing regime. However, other mechanisms contributing to the strong floristic change observed in Palleros cannot be discarded. Among these, we can mention an increased taxonomic knowledge which may have introduced formerly unidentified species into the 1990 sample, the possible existence of long-term climatic trends, or the effect of landscape alterations linked to animal husbandry, agriculture, new forms of land-use and transportation. In particular, a regional increase in transportation and in agriculture may have contributed substantially to the dispersal of weedy species into the pasture plots, further accentuating the floristic changes induced by grazing.

Finally, it is important to remark that the temperate grasslands of Uruguay, Brazil and Argentina are one of the ecosystems in the region that have received little attention in terms of the establishment of protected areas. Our data show that significant biological change has been occurring in these ecosystems even in areas that have been subject to a traditional, non-agricultural management. The protection of what remains of these grassland communities is of the highest importance.

Acknowledgements. We are grateful to the Gallinal family, owners of the Estancia Palleros, and to manager Enrique Sanner, for making this study possible. We thank the late César Álvarez for his contribution in the field work. The help in many ways of several colleagues, Julio Campo, Stella Grun, Fabiana Pezzani, Daniel Panario and Claudia Rodríguez is gratefully acknowledged.

References

- Anon. 1996. *Normales Climatológicas*. Dirección Nacional de Meteorología, Ministerio de Defensa, Montevideo.
- Chaneton, E.J. & Facelli, J.M. 1991. Disturbance effects on plant community diversity: spatial scales and dominance hierarchies. *Vegetatio* 93: 143-155.
- Díaz, S., Acosta, A. & Cabido, M. 1992. Morphological analysis of herbaceous communities under different grazing regimes. J. Veg. Sci. 3: 689-696.
- Durán, A. 1985. *Los suelos del Uruguay*. Ed. Hemisferio Sur, Montevideo.
- Everitt, B.S. 1977. *The analysis of contingency tables*. Chapman and Hall, London.
- Ezcurra, E. 1987. A comparison of reciprocal averaging and non centred principal component analysis. *Vegetatio* 71: 41-48.
- Ezcurra, E. & Rodrigues, V. 1986. Rainfall patterns in the Gran Desierto, Sonora, Mexico. J. Arid Environ. 10: 13-28.
- Facelli, J.M. 1988. Response to grazing after nine years of cattle exclusion in a Flooding Pampa grassland, Argentina. *Vegetatio* 78: 21-25.
- Facelli, J.M., León, R.J.C. & Deregibus, V.A. 1988. Community structure in grazed and ungrazed grassland sites in the Flooding Pampa, Argentina. Am. Midl. Nat. 121: 125-133.
- Gallinal, J., Bergalli, L., Campal, E., Aragone, L. & Rosengurtt, B. 1938. Estudios sobre praderas naturales del Uruguay. Primera Contribución. Imprenta Germano Uruguaya, Montevideo.
- Gauch, H.G. Jr. 1982. *Multivariate analysis in community* ecology. Cambridge University Press, Cambridge.
- Gower, J.C. 1966. Some distance properties of latent roots and vector methods used in multivariate analysis. *Biometrika* 53: 323-338.
- Gurevitch, J. & Chester, S.T. 1986. Analysis of repeated measurements. *Ecology* 67:251-255.
- Hill, M.O. 1973c. Diversity and evenness: a unifying notation and its consequences. *Ecology* 54: 427-432.
- Jackson, D.A. 1993. Principal component analysis: how many components are nontrivial and interpretable? *Ecology* 74: 2204-2214.
- Legendre, L. & Legendre, P. 1983. *Numerical ecology*. Elsevier, Amsterdam.
- Lombardo, A. 1984. *Flora montevidensis*. Tomos I, II, III. Intendencia Municipal de Montevideo, Montevideo.
- Lorenzi, H. 1991. *Plantas daninhas do Brasil*. Ed. Plantarum. São Paulo.
- Mead, R. 1988. The design of experiments. Cambridge University Press, New York, NY.
- Milchunas, D.G., Sala, O.E. & Lauenroth, W.K. 1988. A generalized model of the effects of grazing by large herbivores on grassland community structure. *Am. Nat.* 132: 87-106.
- Millot, J.C., Risso, D. & Methol, R. 1987. Relevamiento de pasturas naturales y mejoramientos extensivos en areas ganaderas del Uruguay. Informe Técnico, Ministerio de Ganadería, Agricultura y Pesca, Montevideo.
- Noy-Meir, I. 1973. Data transformations in ecological ordination: I. Some advantages of non-centering. J. Ecol. 61:

329-341.

- Noy-Meir, I., Walker, D. & Williams, W.T. 1975. Data transformations in ecological ordination: II. On the meaning of data standardization. J. Ecol. 63: 779-800.
- Panario, D. 1994. Evolución y tendencia de la vegetación nativa uruguaya I. La pradera. In: Contribución de los estudios edafológicos al conocimiento de la vegetación en la República Oriental del Uruguay. Boletín Técnico N 13, Ministerio de Ganadería, Agricultura y Pesca, Montevideo.
- Ríos, A. & Gimenez, A. 1992. Ecofisiología de malezas. *Rev.* INIA Invest. Agron. 1: 157-166.
- Rosengurtt, B. 1943. Estudios sobre Praderas Naturales del Uruguay. 3era. Contribución. Casa Barreiro y Ramos, S.A. Montevideo.
- Rosengurtt, B. 1979. *Tablas de comportamiento de las especies de plantas de campos naturales en el Uruguay*. Dirección General de Extensión Universitaria, División Publicaciones y Ediciones. Facultad de Agronomía, Montevideo.
- Rusch, G.M. & Oesterheld, M. 1997. Relationship between productivity, and species and functional group diversity in grazed and non-grazed Pampas grassland. *Oikos* 78: 519-526.
- Sala, O.E., Oesterheld M., León, R.J.C. & Soriano, A. 1986. Grazing effects upon plant community structure in subhumid grasslands of Argentina. *Vegetatio* 67: 27-32.
- Sokal, R.R. & Rohlf, F.J. 1995. *Biometry*. 3rd ed. W.H. Freeman and Company, New York, NY.
- Ury, H.K. 1976. A comparison of four procedures for multiple comparisons among means (pairwise contrasts) for arbitrary sample sizes. *Technometrics* 18: 89-97.
- von Ende, C.N. 1993. Repeated-measures analysis: Growth and other time-dependent measures. In: Scheiner, S.M. & Gurevitch, J. (eds.) *Design and analysis of ecological experiments*, pp. 113-137. Chapman & Hall. New York, NY.
- Weiner, J. & Solbrig, O.T. 1984. The meaning and measurement of size hierarchies in plant populations. *Oecologia* (*Berl.*) 61: 334-336.

Received 4 June 1997; Revision received 8 December 1997; Accepted 9 January 1998.

App. 1. List of species that changed significantly between 1935 and 1990, as inferred from their values on the multivariate axes. The species have been classified according to their tendency to invade or disappear from the plots. The 'family' column indicates the taxonomic family, 'life-cycle' indicates whether the plant is annual or perennial, 'type' shows the forage quality of the species (I: palatable, II: intermediate and III: unpalatable weed), and 'origin' indicates whether the species is native or alien.

Societa fue vere comune 10.32 ad barrese (state 19.1990) naries Parcharing motivations Parces pressual in an and in an an and in an an and in an a	Species	Family	Life-cycle	Туре	Origin	Species	Family	Life-cycle	Туре	Origin
Proceeding wave from a latter of the period of the peri	Species that were common	in 1935 and beca	me extinct b	v 1990		Plantago myosurus	Plantaginaceae	annual	ш	native
Operation Description Description <thdescription< th=""> <thdescription< th=""> <</thdescription<></thdescription<>	Piptochaetium panicoides	Poaceae	perennial	I	native	Relbunium richardianum	Rubiaceae	perennial	п	native
Special barrey neuronalApprox aapprox aBalanca <td></td> <td></td> <td>P</td> <td></td> <td></td> <td>Richardia humistrata</td> <td>Rubiaceae</td> <td>perennial</td> <td>Ш</td> <td>native</td>			P			Richardia humistrata	Rubiaceae	perennial	Ш	native
Arronso Ponce Parame I I Parame Ponce	Species that were present	in 1935 and becar	me extinct by	1990		Richardia stellaris	Rubiaceae	perennial	III	native
Advanges bernikNaceperentialIInaiveAdvance perplayAdvancepercentialIIIalientConstructionsNaceperentialIIantiveConstructionsNaceperentialIIIantiveDeckolor swere/shreinNaceperentialIIantiveConstructionsNaceperentialIIIantiveDeckolor swere/shreinNaceperentialIIantiveConstructionsNaceperentialIIIantiveDeckolor swere/shreinNaceperentialIIantiveConstructionsNaceperentialIIIantiveDeckolor swere/shreinNaceperentialIIIantiveConstructionsNaceperentialIIIantivePackadamine/shreinNaceperentialIIIantiveConstructionsNaceperentialIIIantivePackadamine/shreinNaceperentialIIIantiveConstructionsAtteraceperentialIIIantivePackadamine/shreinNaceperentialIIIantiveConstructionsAtteraceperentialIIIantiveStansmine/shreinNaceperentialIIIantiveConstructionsAtteraceperentialIIIantiveStansmine/shreinNaceperentialIIIantiveAtteraceperentialIIIantiveStansmine/shreinNaceperentialIIIantiveAtteraceperentialIII	Agrostis tandilensis	Poaceae	annual	I	native	Scoparia montevidensis	Scrophulariaceae	perennial	III	native
Artical public	Andropogon lateralis	Poaceae	perennial	П	native	Apium leptophyllum	Apiaceae	annual	П	alien
Advance Langener propertiesAdvance Personal <br< td=""><td>Aristida pallens</td><td>Poaceae</td><td>perennial</td><td>II</td><td>native</td><td>Eryngium horridum</td><td>Apiaceae</td><td>perennial</td><td>III</td><td>native</td></br<>	Aristida pallens	Poaceae	perennial	II	native	Eryngium horridum	Apiaceae	perennial	III	native
Anderstöre Person Per	Calamagrostis viridiflavescens	Poaceae	perennial	п	native	Glandularia selloi Varbana litoralis	Verbenaceae	perennial	III III	native
Decisory holdsmain Lances of personal personal of personal of per	Eriochloa montevidensis	Poaceae	nerennial	I	native	verbena morans	verbenaceae	perennai	m	nauve
Lapianophine indusion Lapianophine indusion Panciano ParentaParcane Parenta </td <td>Eustachys bahiensis</td> <td>Poaceae</td> <td>perennial</td> <td>ī</td> <td>native</td> <td>Species that were abs</td> <td>ent in 1935 and a</td> <td>re now pres</td> <td>ent</td> <td></td>	Eustachys bahiensis	Poaceae	perennial	ī	native	Species that were abs	ent in 1935 and a	re now pres	ent	
Panelam RegristPacearepertunialIInativeBaccharts trinkeraAtteracerepertunialIIInativePargadam quadrightamPacearepertunialIInativeCherrentla scanninalAtteracerepertunialIIInativePargadam quadrightamPacearepertunialIInativeCherrentla scanninalAtteracerepertunialIIInativePargadam guadrightamPacearepertuniIInativeCherrentla scanninalAtteracerepertunialIIInativePargadam guadrightamPacearepertunialIInativeCherrentla scanninalAtteracerepertunialIIInativeStops pringinPacearepertunialIInativeCherrentla scanninalPacearepertunialIIInativeStops pringinPacearepertunialIIInativeCherrentla scanninalPacearepertunialIIInativeStops pringinPacearepertunialIIInativePacearePerunialIIInativeStops pringinPacearepertunialIIInativePacearePerunialIIInativeStops pringinPacearepertunialIInativePacearePerunialIIInativeStops pringinPaceareperunialIInativePacearePacearePerunialIIInativeStops pringinPaceareperunialIInativePacearePe	Leptocoryphium lanatum	Poaceae	perennial	I	native	Aster squamatus	Asteraceae	perennial	III	native
Panicons Panicone percential II native Chappallang platholisheder Atteracce percential III native Parter handmath Passene percential III antive Charvara centinal Atteracce percential III antive Parter handmath Passene percential II antive Charvara percential III antive Stop pathogan Passene percential II antive Charvara percential III antive Stop pathogan Passene percential III antive Charvara percential III antive Stop pathogan Passene percential III antive Charvara percential III antive Stop pathogan Passene percential III antive Carvara percential III antive Stop pathogan Passene percential II antive Carvara percential III antive Stop pathogan Passene Percential	Panicum bergii	Poaceae	perennial	п	native	Baccharis trimera	Asteraceae	perennial	III	native
Important Proceed pertunial I native Cherrentia continuiton Attenance pertunial II native Prophen planting Proceed errential I native Comparison Attenance errential II native Prophen planting Proceed pertunial I native Controllecore Pertunial II native Stop Mightig Proceed pertunial I native Controllecore Percunial II native Stop Mightig Proceed percunial II native Controllecore Percunial II native Stop Mightig Proceed native Controllecore Percunial II native Stop Mightig Proceed native Attenance Percunial II native Stop Mightig Proceed percunial II native Attenance Percunial II native Stop Mightig Procecae Percunial II <td>Panicum sp.</td> <td>Poaceae</td> <td>perennial</td> <td>I</td> <td>native</td> <td>Chaptalia piloselloides</td> <td>Asteraceae</td> <td>perennial</td> <td>III</td> <td>native</td>	Panicum sp.	Poaceae	perennial	I	native	Chaptalia piloselloides	Asteraceae	perennial	III	native
Palaters is produced with the second secon	Paspalum quadrifarium	Poaceae	perennial	II T	native	Chevreulia acuminata	Asteraceae	perennial	III	native
Photogrammenu prime Processor perminal I adam Permine Convolution Permine It adam Spep runner ver, minipacelina Posceare permini It adam Germinim abilitants Convolutions perminis It adam Spep runner ver, minipacelina Posceare perminis It adam Schicklerinim abilitants Posceare perminis It adam Spep runner ver, minipacelina Run aver versiti It adam Schicklerinim abilitants Posceare perminis It adam Arrespect provide Posceare perminis It adam It adam Arrespect provide Posceare perminis It adam adam It adam Arrespect provide Posceare perminis It adam adam It adam Arrespect provide Posceare perminis It adam adam It adam Arrespect provide Posceare perminis	Phalaris platensis Pintochastium bicolor	Poaceae	annual	I	native	Conyza bonariensis Soliva pterogramma	Asteraceae	annual	Ш Ш	native
Substrations var, ensample (lata) Ponceare Personal I mative matrix Evolution sprices Convolutions operational I mative matrix Stops hilpip Ponceare Personal Ponceare Personal I mative matrix Diplimita organizabilisiti Marria Ponceare Personal I mative matrix Stops hilpip Ponceare Personal III mative Marria Diplimita organizabilisiti Marria Ponceare Personal III mative Marria Stops hilpip Ponceare Personal III mative Marria Marria III mative Marria Ponceare Personal III mative Marria Marria III mative Marria Ponceare Personal III mative Marria Marria IIII mative Marria Marria Ponceare Personal III mative Marria Marria Ponceare Personal IIII mative Marria Marria Ponceare Personal IIII mative Personal Marria Marria Marria Marria Marria Ponceare Personal Ponceare Personal Ponceare Personal IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Polynogon monspeliensis	Poaceae	annual	ш	alien	Vernonia sp	Asteraceae	nerennial	ш	alien
Ships hype Ponce permini 1 naive Germinin difficura onglemini Germinine difficura onglemini Germinine difficura onglemini Ponceae permini 1 naive Ships hype Ponceae permini 1 naive Shifacadryminine difficura ongleminis Ponceae permini 1 naive Shifacadryminine difficura Ponceae permini 1 naive Angellin minine Ponceae permini 1 naive Arrange hypeline Ponceae permini 1 naive Angellin minine Ponceae permini 1 naive Arrange hypeline Ponceae permini 1 naive Antoproprime Ponceae permini 1 naive Poncean permini 1 naive Antoproprime Ponceae permini 1 naive Poncean permini 1 naive Antoproprime Ponceae permini 1 naive Poncean permini 1 naive	Stipa nutans var. auinaueciliata	Poaceae	perennial	I	native	Evolvulus sericeus	Convolvulaceae	perennial	ш	native
Sign of the sectorPonceaeperminilInaiveDigitaria acquiginisisPonceaeperminiInaiveStorytechnisResourceperminiIInaiveMalacesperminiIInaiveStorytechnisResourcePonceaenaimeMalacesperminiIInaiveStorytechnisNoncear <t< td=""><td>Stipa philippii</td><td>Poaceae</td><td>perennial</td><td>I</td><td>native</td><td>Geranium albicans</td><td>Geraniaceae</td><td>perennial</td><td>III</td><td>native</td></t<>	Stipa philippii	Poaceae	perennial	I	native	Geranium albicans	Geraniaceae	perennial	III	native
Their brain br	Stipa sp.	Poaceae	perennial	Ι	native	Digitaria aequiglumis	Poaceae	annual	Ι	native
Sixyrichnumsp. Discusceve perminalIndiave anale <i>Heinis anticiplia</i> <i>Logalis nininaLybraceae</i> <i>Custa sp.</i> <i>Logalis nininaLybraceae</i> <i>Logalis niniiLybraceae</i> <i>Logalis niniiLybraceae</i> <i>LogalisLybraceae</i> <i>Logalis</i> </td <td>Tridens brasiliensis</td> <td>Poaceae</td> <td>perennial</td> <td>I</td> <td>native</td> <td>Schizachyrium tenerum</td> <td>Poaceae</td> <td>perennial</td> <td>II</td> <td>native</td>	Tridens brasiliensis	Poaceae	perennial	I	native	Schizachyrium tenerum	Poaceae	perennial	II	native
Margireque physical decisionRease-accepercunialIInativeCould sey, caractal commanicCould sevePercunialIInativeArea caryophysicalPaccaceannualIantiveCranadia commanicScraphilarinacera annualIIantiveArea caryophysicalPaccaceannualIantiveConcord commanicScraphilarinacera annualIIantiveArea caryophysicalPaccacepercinialIantiveAndropogo terrateaPaccacepercinialIantiveArea caryophysicalPaccacepercinialInativeAriatide murinaPaccacepercinialIantiveParicano balocoranPaccacepercinialInativeAriatide murinaPaccacepercinialIantiveParicano balocoranPaccacepercinialInativeAriatide murinaPaccacepercinialIantiveParicano balocoranPaccacepercinialInativePacitadian depressasFabacceepercinialIantiveAdamina bicolarPaccacepercinialInativeAriatide murinaPaccacepercinialIantiveAdamina bicolarPaccacepercinialInativeAriatide murinaPaccacepercinialIantiveAdamina bicolarPaccacepercinialInativeAriatide murinaPaccacepercinialIIantiveAdamina bicolarPaccace <t< td=""><td>Sisyrinchum sp.</td><td>Iridaceae</td><td>annual</td><td>III</td><td>native</td><td>Heimia salicifolia</td><td>Lythraceae</td><td>perennial</td><td>III</td><td>native</td></t<>	Sisyrinchum sp.	Iridaceae	annual	III	native	Heimia salicifolia	Lythraceae	perennial	III	native
Anagain miningPrimulaceou Scarapsymbly	Margyricarpus pinnatus	Rosaceae	perennial	III	native	Oxalis sp.	Oxalidaceae	perennial	III	native
Special discretization in the interval of the int	Success that have		J 1000			Anagallis minima	Primulaceae	annual	III	native
Mich minima Michael <br< td=""><td>Species that decres</td><td>Regeorge 193</td><td>5 and 1990</td><td>п</td><td>nativo</td><td>Gerardia communis</td><td>Scrophulariaceae</td><td>annual</td><td>111</td><td>native</td></br<>	Species that decres	Regeorge 193	5 and 1990	п	nativo	Gerardia communis	Scrophulariaceae	annual	111	native
Chancephase ConservationProcesse PerennialProcesse	Briza minor	Poaceae	annual	T	alien	Common species in 19	35 that now only i	emain in n	ot b	
Energonsin legens tergonsin legens personial miliola personial p	Chascolvtrum subaristatum	Poaceae	perennial	I	native	Andropogon ternatus	Poaceae	perennial	I	native
Eragrants Pensimum Millok Pensimum Millok Pensimum Millok Pensimum Millok Pensimum Millok Pensimum Millok Pensimum Pensimu Pensimum Millok Pensimum Pensimu Pensimum Pensimu Pensimum Pensim	Eragrostis lugens	Poaceae	perennial	п	native	Aristida murina	Poaceae	perennial	П	native
Panicam miliolizisPance or perennialPance or perenn	Eragrostis neesii	Poaceae	perennial	Π	native	Aristida venustula	Poaceae	perennial	Π	native
Panican glandinarumPaaceaceperemialInativePanicang beressatPichaceaceperemialIInativeSchizackryinn condensatumPaaceaceperemialIInativeSpecial dispersational second	Panicum milioides	Poaceae	perennial	I	native	Schizachyrium spicatum	Poaceae	perennial	II	native
Papalan plicatilamPoaceaeperenniaInativeSporobolus indicusPoaceaeperenniaIInativeSpecies that only appeared or increased in plot 5Sporobolus indicusPoaceaeperenniaIInativeCorys DakeiAtteraceaeperenniaIIAtternationFabaceaeperenniaInativeCorys DakeiAtteraceaeperenniaIInativeMinohosis sonoFabaceaeperenniaInativePipocheainus sipoide var. purpursacePoaceaeperenniaIInativeMinohosis sonoFabaceaeperenniaIInativePipocheainus sipoide var. purpursacePoaceaeperenniaIInativeCommon perisnotify Sam U 1990in viveCongrame marginalisFabaceaeperenniaIInativeRothorski capillarisCoyrenceaeperenniaIInativeCongrame signifisFabaceaeperenniaIInativeAnompas affinisPoaceaeperenniaIInativeCongrame signifisFabaceaeperenniaIInativeBohrinchola liguridesPoaceaeperenniaIInativeCongrame signifisFabaceaeperenniaIInativeCorrestoar infantiPoaceaeperenniaIInativeSplanthes decembentsAtteraceaeperenniaIInativeBohrinchola liguridesPoaceaeperenniaIInativeElochoraris sp.AtteraceaeperenniaIInative	Panicum sabulorum	Poaceae	perennial	I	native	Desmanthus depressus	Fabaceae	perennial	II	native
SchreidenstamProaccace perennialII IInativeSpecies that on y suppared or increased in polit or species that on y suppared or increased in polit or species that on y suppared or increased in polit or species that on y suppared or increased in polit or species in both 1935 and perennialII II II IInativeSporabolas informationFadoceace perennialII II IInativeFadoceace PerennialII II II II IIICommon species in both 1935 and CorperatorPost Paracella II III III IIIIII III III III III III III IIIII IIIII IIIIII IIIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIIII IIIIII IIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIIIIIIII IIIIII IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Paspalum plicatulum	Poaceae	perennial	I	native					
	Schizachyrium condensatum	Poaceae	perennial	ш	native	Species that only ap	opeared or increa	sed in plot i) Ш	notivo
Adecmin bicolarFabaceaeperennialInativeFinhestriktio ordatCyperaceaeperennialIInativeBynchosis serumFabaceaeperennialInativeSitne pagnosaPoaceaeperennialInativeTotol pagno pagnosaCyperaceaeperennialIInativeSitne pagnosaPoaceaeperennialIInativeButhorytis cargificationCyperaceaeperennialIIInativeSoloandhes montparisFabaceaeperennialIIInativeCares homariensisCyperaceaeperennialIInativeGalacian merginalisFabaceaeperennialIInativeAcompas suffiliansPoaceaeperennialInativeCipocacea selaginoidesEnaceaeperennialIInativeColorhachis selloanaPoaceaeperennialInativeCipocacea selaginoidesAfaiceaeperennialIInativeColorhachis selloanaPoaceaeperennialInativeMercharis selloanaAsteraceaeperennialIInativeColorhachis selloanaPoaceaeperennialInativeSignafora tenuifoliaAsteraceaeperennialIInativeColorhachis selloanaPoaceaeperennialInativeSignafora tenuifoliaAsteraceaeperennialIInativeColorhachis selloanaPoaceaeperennialInativeSignafora tenuifoliaAsteraceaeperennialIIn	Sporodolus maicus Juncus imbricatus	Iuncaceae	perennial	п	native	Aspita selosa Convza hlakej	Asteraceae	perennial	III	native
Rhychosis semanFabaccaeperennialInativePhychositis sipilales xar, purpurasersPaaceaeperennialInativeToflaun polymorphumFabaccaeperennialIInativeSipip purpoisaPaaceaeperennialIInativeRuber Still collianPaaceaeperennialIIInativeSolacalities sipilales xar, purpursasersPaaceaeperennialIInativeRuber Still collianPaaceaeperennialIIInativeSolacalities sipilales xar, purpursasersPaaceaeperennialIInativeRuber Still collianPaaceaeperennialIIInativeSolacalities sipilales xar, purpursasersPaaceaeperennialIIInativeRuber Still collianPaaceaeperennialIIInativePaaceaeperennialIIInativeRuber Still collianPaaceaeperennialIIInativePaaceaeperennialIIInativeRuber Still collianPaaceaeperennialIIInative<	Adesmia hicolor	Fahaceae	perennial	I	native	Fimbristylis ovata	Cyperaceae	perennial	III	native
Trifolium polymorphumFabaccaepereminialInativeShipa paposiPoaceaepereminialIInativeCumon species in both 1325 and 1990Trachyngon monufariPoaceaepereminialIInativeCarbo choariensisCyperaceaeereminialIInativeTrachyngon monufariPoaceaepereminialIInativeCarbo choariensisCyperaceaepereminialIInativeSolvanthes monufariPoaceaepereminialIInativeCarbo choariensisPoaceaepereminialIInativeSolvanthes monufariPoaceaepereminialIInativeCarbo choirs selfonaPoaceaepereminialIInativeSolvanthes monufariPoaceaepereminialIInativeColorhachis selfonaPoaceaepereminialIInativeBrokosta termifoliaAsternaceapereminialIInativeDanthonia cirrataPoaceaepereminialIInativeSplatuhes decoumbersAsternaceapereminialIInativeEvasalum rotataPoaceaepereminialIInativeSplatuhes decoumbersAsternaceapereminialIInativeStaria signicalicaPoaceaepereminialIInativeSplatuhes decouhris sp.AsternaceapereminialIInativeStaria signicalicaPoaceaepereminialIInativeRigorotis termifoliaAsternaceapereminialIInativeStaria s	Rhynchosia senna	Fabaceae	perennial	I	native	Piptochaetium stipoides var. purpurascens	Poaceae	perennial	I	native
Strap subsets in both 1935 and 199Strap subsets in advisePoaceaeperenniai1Bulboxylis capillarisCyperacceaeperenniai111nativeGalactia marginalisFabaceaeperenniai111nativeCarex honarinerisCyperacceaeperenniai111nativeGalactia marginalisFabaceaeperenniai11nativeAcompus affinisPoaceaeperenniai11nativeGalactia marginalisFabaceaeperenniai11nativeCoelorhachis selloanaPoaceaeperenniai11nativeGalactia marginalisFabaceaeperenniai11nativeCoelorhachis selloanaPoaceaeperenniai11nativeSpecies that only appeared or increasedin aliveColladiaPoaceaeperenniai11nativeSpecies that only appeared or increasedin aliveCoelorhachis selloanaPoaceaeperenniai11nativeSpecies that only appeared or increasedin aliveEleusino intainPoaceaeperenniai11nativeSpecies that only appeared or increasedperenniai11nativeSpecies that ontainPoaceaeperenniai11nativeSpecies that only appeared or increasedperenniai11nativeCoelorhachis selloanaPoaceaeperenniai11nativeSpecies that only appeared or increasedperenniai11nativeSpecies that ong and anotatiaPoa	Trifolium polymorphum	Fabaceae	perennial	Ι	native	Stipa papposa	Poaceae	perennial	II	native
Common species in both 1935 and 1990Track-program montifariPoaceaeperennialIInativeCarec honariensisCyperaceaeperennialIInativeSplosanthesimsisFabaceaeperennialInativeCarec honariensisPoaceaeperennialInativeSplosanthesimsisFabaceaeperennialInativeAxonopus siffuitusPoaceaeperennialInativeEryngiam serraApiaceaeperennialIInativeColorachais selloanaPoaceaeperennialInativeApiaceaeperennialIInativeColorachais selloanaPoaceaeperennialInativeMortosia tenufolioAsternaceaeperennialIInativeColorachais selloanaPoaceaeperennialInativeSploathesis sp.AsternaceaeperennialIIInativeCataria vaginataPoaceaeperennialInativeRipuchospora laculiformisCyperaceaeperennialIIInativeStatria vaginataPoaceaeperennialInativeRipuchospora laculiformisPoaceaeperennialIInativeStatria vaginataPoaceaeperennialIInativeRipuchospora laculiformisPoaceaeperennialIInativeStatria vaginataPoaceaeperennialIInativeRipuchospora laculiformisPoaceaeperennialIInativeStatria vaginataPoaceaeperennial <t< td=""><td></td><td></td><td>-</td><td></td><td></td><td>Stipa pauciciliata</td><td>Poaceae</td><td>perennial</td><td>Ι</td><td>native</td></t<>			-			Stipa pauciciliata	Poaceae	perennial	Ι	native
Balbasylis capillarisCyperacceeannualIIInativeGalactian marginalisFabacceeperennialIInativeAcoropus affinisPoaceaeperennialInativeClioocca selaginoidesFabacceaeperennialInativeAconopus affinisPoaceaeperennialInativeClioocca selaginoidesApiaceaeperennialIIInativeBohriochloa laguroidesPoaceaeperennialInativeSpecies that only appeared or increased in plot anativeCoeloradchis selloanaPoaceaeperennialInativeSpecies that only appeared or increased in plot anativeCoeloradchis selloanaPoaceaeperennialInativeSpilonthes decumbensAsteraceaeperennialIIInativeCatrata geniculataPoaceaeperennialInativeSpilonthes decumbensAsteraceaeperennialIIInativeStaria geniculataPoaceaeperennialInativeEreqoratis balinsisPoaceaeperennialIInativeVapia australisPoaceaeperennialIInativeEragrosits balinsisPoaceaeperennialIInativeVapia australisPoaceaeperennialIInativeEragrosits balinsisPoaceaeperennialIInativeVapia australisPoaceaeperennialIInativeEragrosits balinsisPoaceaeperennialIInativeVapia australis <td< td=""><td>Common speci</td><td>es in both 1935 ar</td><td>nd 1990</td><td></td><td></td><td>Trachypogon montufari</td><td>Poaceae</td><td>perennial</td><td>II</td><td>native</td></td<>	Common speci	es in both 1935 ar	nd 1990			Trachypogon montufari	Poaceae	perennial	II	native
Careck bonariensisCyperaceaeperennialIInativeStylinities monicvalensisPabaceaeperennialInativeAxonopus suffilitusPoaceaeperennialInativeCliooccac asleginoidesLinaceaeperennialIInativeAxonopus suffilitusPoaceaeperennialInativeEryngium serraApiaceaeperennialIInativeColorbachis selloanaPoaceaeperennialInativeThe acceaeperennialIInativeColorbachis selloanaPoaceaeperennialInativeMibrosia tenuifoliaAsteraceaeperennialIInativeEleusine tristachyaPoaceaeperennialInativeSpialonthes decumbensAsteraceaeperennialIInativeSetaria segniculataPoaceaeperennialInativeSpialonthes decumbensAsteraceaeperennialIInativeSetaria vegnianPoaceaeperennialInativeRispachesis terinensPoaceaeperennialIInativeSigs stiegraPoaceaeperennialIInativeEragrosis bahanesis terinensPoaceaeperennialIInativeSigs stiegraPoaceaeperennialIInativeEragrosis bahanesis terinensPoaceaeperennialIInativeSigs inductatiApiaceaeperennialIInativeEragrosis bahanesis terinensPoaceaeperennialIInative <t< td=""><td>Bulbostylis capillaris</td><td>Cyperaceae</td><td>annual</td><td>III</td><td>native</td><td>Galactia marginalis</td><td>Fabaceae</td><td>perennial</td><td>III</td><td>native</td></t<>	Bulbostylis capillaris	Cyperaceae	annual	III	native	Galactia marginalis	Fabaceae	perennial	III	native
Acomopus gininksPoaceadeperennialInativeChoceade selighnolaesLindiceadeperennialIInativeBohriochloa laguroidesPoaceadeperennialInativeEryngium seraApiaceadeperennialIInativeCocloritachis selloanaPoaceadeperennialInativeSpecies that only appeared or increased in plot aDamhonia cirrataPoaceadeperennialInativeApiaceadeperennialIIIMelica rigidaPoaceadeperennialIInativeSpecies that only appeared or increased in plot aMelica rigidaPoaceadeperennialIInativeSpecies that only appeared or increasedin antiveSetaria vaginataPoaceadeperennialInativeSpinochospora lacalformisCyperaceaeperennialIIStaria vaginataPoaceaeperennialIInativeEragrostis hahiemisPoaceaeperennialIInativeSupa setigeraPoaceaeperennialIInativeStyrinchum flatenseIridaceaeperennialIInativeValpia australisPoaceaeperennialIInativeStyrinchum flatenseIridaceaeperennialIInativeSpecies that were absentorraticaeaeperennialIInativeStyrinchum flatenseIridaceaeperennialIInativeSpecies that were absentorraticaeaeperennialIInativeStyrinchum flatenseIridacea	Carex bonariensis	Cyperaceae	perennial	III	native	Stylosanthes montevidensis	Fabaceae	perennial	1	native
Actomptis singlinitisFourceaepercentialInativeDynamiseriaApriceaepercentialIInativeCoelorhachis selloanaPoaceaepercentialInativeSpecies that only appeared or increased in plot aControlachis selloanaPoaceaepercentialIInativeMabrosia tenuifoliaAsteraceaepercentialIIIBenkinci ciritataPoaceaepercentialIInativeHypotheoris sp.AsteraceaepercentialIIInativeRaspandum notatumPoaceaepercentialInativeHypotheoris sp.CyperaceaepercentialIIInativeStearia geniculataPoaceaepercentialInativeEragrostis bahiensisPoaceaepercentialIInativeStearia sericulataPoaceaeperennialIInativeEragrostis bahiensisPoaceaeperennialIInativeStearia sericulataApiaceaeperennialIIInativeEragrostis bahiensisPoaceaeperennialIInativeSteps stigeraPoaceaeperennialIIInativeEragrostis bahiensisPoaceaeperennialIIInativeSteps stigeraApiaceaeperennialIIInativeEragrostis bahiensisPoaceaeperennialIIInativeEryngium nolaculateApiaceaeperennialIIInativeHydrocryle sp.ApiaceaeperennialIInativeSpecies that were absent or rare in 19	Axonopus affinis	Poaceae	perennial	I	native	Chococca selaginoides	Linaceae	perennial	Ш Ш	native
Colorhachis selloanaPoaceaeperennialInativeSpecies that only appeared or increased in plot aDanthonia cirrataPoaceaeperennialInativeAsteraceaeperennialIIIDanthonia cirrataPoaceaeperennialIInativeHypochoeris sp.AsteraceaeperennialIIIMelica rigidaPoaceaeperennialIInativeEleocharis sp.CyperaceaeperennialIIInativeSetaria geniculataPoaceaeperennialInativeEleocharis sp.CyperaceaeperennialIInativeSetaria vaginataPoaceaeperennialInativeEragrostis hahiensisPoaceaeperennialIInativeSetaria vaginataPoaceaeperennialIInativeEragrostis retinensPoaceaeperennialIInativeSetaria vaginataPoaceaeperennialIInativeEragrostis retinensPoaceaeperennialIInativeSetaria vaginataApiaceaeperennialIInativeEragrostis retinensPoaceaeperennialIInativeSetaria vaginataApiaceaeperennialIInativeHydrocotyle sp.ApiaceaeperennialIInativeSetaria vaginataApiaceaeperennialIInativeHydrocotyle sp.ApiaceaeperennialIInativeSetaria vaginataApiaceaeperennialIInativeHydrocotyle sp.Apiace	Rothriochlog laguroides	Poaceae	perennial	п	native	Eryngium serra	Ариссеие	perenniai	111	nauve
Danhonia cirrataPoaceaeperennialInativeAmbrosia tenuifoliaAsteraceaeperennialIIInativeEleusine tristachyaPoaceaeperennialIInativeMpochoeris sp.AsteraceaeperennialIIInativePaspalum notatumPoaceaeperennialInativeSpilanthes decumbensAsteraceaeperennialIIInativePaspalum notatumPoaceaeperennialInativeElecharis sp.CyperaceaeperennialIInativeStaria gonicultaPoaceaeperennialInativeEragrostis bahiensisPoaceaeperennialIInativeStaria setigeraPoaceaeperennialIInativeEragrostis bahiensisPoaceaeperennialIIInativeEryngium chinatumApiaceaeperennialIIInativeBisystrichum platenseIridaceaeperennialIInativeSpecies that were absent or rare in 1935 and are now commonPaffia tuberosaAmaranthaceaeperennialIIInativeHypoxis decumbensAmaralitaceaeperennialIIInativeFiglia tuberosaAsteraceaeperennialIIInativeCyperaceaeperennialIIInativenativeFiglia tuberosaAsteraceaeperennialIInativePaffia tuberosaAmaranthaceaeperennialIIInativeFiglia tuberosaAsteraceaeperennialIInativeCyperaceaepere	Coelorhachis selloana	Poaceae	perennial	I	native	Species that only a	opeared or increa	sed in plot a	1	
Elessine tristachyaPoaceaeperennialIInativeHypochoeris sp.AsteraceaeperennialIIInativeMelica rigidaPoaceaeperennialInativeSplanthes decumbensAsteraceaeperennialIIInativeSetaria riginataPoaceaeperennialInativeEleocharis sp.CyperaceaeperennialIIInativeSetaria riginataPoaceaeperennialInativeEragrostis bahiensisPoaceaeperennialIInativeSitaria riginataPoaceaeperennialInativeEragrostis bahiensisPoaceaeperennialIInativeValpia custralisPoaceaeperennialIIInativeSits/inchumplatensePoaceaeperennialIIInativeFrygium cchinatumApiaceaeperennialIInativeHydrocotyle sp.ApiaceaeperennialIInativePoffai tubberosaAmarenthaceaeperennialIInativeHydrocotyle sp.ApiaceaeperennialIInativePacelas returesAsteraceaeperennialIInativeSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatenseSistrichumplatense	Danthonia cirrata	Poaceae	perennial	Ι	native	Ambrosia tenuifolia	Asteraceae	perennial	III	native
Melica rigidaPoaceaeperennialIInativeSpilanthes decumbensAsteraceaeperennialIIInativeBaspalun notatumPoaceaeperennialInativeElecoharis sp.CyperaceaeperennialIInativeSetaria geniculataPoaceaeperennialInativeEragrostis bahiensisPoaceaeperennialIInativeSetaria vaginataPoaceaeperennialInativeEragrostis bahiensisPoaceaeperennialIInativeSetaria vaginataPoaceaeannualIIInativeEragrostis retinensPoaceaeperennialIIInativeSipa setigeraPoaceaeannualIIInativeBraceaeperennialIIInativeEryngium echinatumApiaceaeperennialIIInativeBraceaeperennialIIInativeEryngium nudicauleApiaceaeperennialIIInativesisyrinchum platenseIridaceaeperennialIInativePfaffa tuberosaAmaranthaceaeperennialIIInativesisyrinchum platensesisyrinchum platensesisyrinch	Eleusine tristachya	Poaceae	perennial	II	native	Hypochoeris sp.	Asteraceae	perennial	III	native
Paspalum notatumPoaceaeperennialInativeEleocharis sp.CyperaceaeperennialIIInativeSetaria geniculataPoaceaeperennialInativeRhynchospora luzulformisCyperaceaeperennialIInativeSetaria geniculataPoaceaeperennialInativeEragrostis trainensPoaceaeperennialIInativeSipa setigeraPoaceaeperennialIInativeEragrostis retinensPoaceaeperennialIIInativeVulpia australisPoaceaeperennialIIInativeSiyrinchum platenseIridaceaeperennialIInativeEryngium echinatumApiaceaeperennialIIInativeHydrocotyle sp.ApiaceaeperennialIInativePsposis decumbensAmaranthaceaeperennialIInativenativeNateraceaeperennialIInativeFacelis retusaAsteraceaeperennialIIInativenativeNateraceaenativeNateraceaenativeFacelis retusaAsteraceaeperennialIIInativenativeNateraceaenativeNateraceaeNateraceaenativeGamochaeta spicataAsteraceaeperennialIIInativeNateraceaenativeNateraceaeNativeNateraceaeNativeSporbolus platensisPoaceaeperennialIIInativenativeNateraceaeNativeNateraceaeNative <t< td=""><td>Melica rigida</td><td>Poaceae</td><td>perennial</td><td>Π</td><td>native</td><td>Spilanthes decumbens</td><td>Asteraceae</td><td>perennial</td><td>III</td><td>native</td></t<>	Melica rigida	Poaceae	perennial	Π	native	Spilanthes decumbens	Asteraceae	perennial	III	native
Setaria geniculata Poaceae perennial I native Khynchospora luculdjormis Cyperaceae perennial II native Setaria vaginata Poaceae perennial I native Eragrostis balinensis Poaceae perennial III native Stipa setigera Poaceae annual III native Eragrostis setinensis Poaceae perennial III native Eryngium chinatum Apiaceae perennial III native Hydrocotyle sp. Apiaceae perennial II native Eryngium nudicaule Apiaceae perennial II native Hydrocotyle sp. Apiaceae perennial II native Psposis decumbens Amaranthaceae perennial II native Hydrocotyle sp. Apiaceae perennial II native Psposis decumbens Amaranthaceae perennial II native Hydrocotyle sp. III native Chevreulia sarmentosa Asteraceae perennial II native III native IIII IIII I	Paspalum notatum	Poaceae	perennial	I	native	Eleocharis sp.	Cyperaceae	perennial	III	native
Statiant vaginata Poaceae perennial I native Eragrostis trainens Poaceae perennial III native Statia serigera Poaceae annual III native Sisyrinchum platense Iridaceae perennial III native Eryngium echinatum Apiaceae perennial III native Hydrocotyle sp. Apiaceae perennial III native Species that were absent or rare in 1935 and are now common Poaceae perennial III native Species that were absent or rare in 1935 and are now common Poaceae perennial II native Plaffa tuberosa Amaranthaceae perennial II native Poaceae perennial II native Chavreulia sarmentosa Asteraceae annual III native Poaceae perennial II native Chavreulia sarmentosa Asteraceae perennial III native Poaceae perennial II native Sportocaly Convolvulaceae perennial II native II II na	Setaria geniculata	Poaceae	perennial	I	native	Rhynchospora luzuliformis	Cyperaceae	perennial	11	native
Supergent Podecate perclinial I native Display in the principal in the principal in the percential III native Eryngium chinatum Apiaceae perennial III native Sixyrinchum platense Iridaceae perennial II native Species that were absent or rare in 1935 and are now common Pidfat tuberosa Amaranthaceae perennial II native Pidfat tuberosa Amaranthaceae perennial II native No	Setaria vaginata	Poaceae	perennial	I	native	Eragrostis baniensis	Poaceae	perennial	Ш Ш	native
InductionInductionInductionInductionInductionParticularParticularParticularEryngium chinatumApiaceaeperennialIIInativeHydrocotyle sp.ApiaceaeperennialIInativeSpecies that were absent or rare in 1935 and are now commonPlaffa tuberosaAmaryllidaceaeperennialIInativeHypoxis decumbensAmaryllidaceaeperennialIInativeBaccharis coridifoliaAsteraceaeperennialIIInativeFacelis retusaAsteraceaeperennialIIInativeFacelis retusaAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeCyperus sp.CyperaceaeperennialIIInativeCynodon dactylonPoaceaeperennialIIalienPaspalum dilatatumPoaceaeperennialIInativePiorobauti dilatatumPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSityrinchum minusIridaceaeperennialIInativeSityrinchum minutIridaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSityrinchum minusIridaceaeperennialIInativeJuncus capillaceusJuncaceaeperennialIInativeCuphea glutinosaLythraceae<	Supu sengeru Vulnia australis	Poaceae	annual	ш	native	Sisvrinchum platense	Iridaceae	perennial	III	native
Eryngium nudicauleApiaceaeperennialIIInativeSpecies that were absent or rare in 1935 and are now commonPfaffa tuberosaAmaranthaceaeperennialIIInativeHypoxis decumbensAmaryllidaceaeperennialIIInativeBaccharis coridifoliaAsteraceaeperennialIIInativeBaccharis coridifoliaAsteraceaeperennialIIInativeFacelis retusaAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeCyperus sp.CyperuceaeperennialIIInativeCynodo dactylonPoaceaeperennialIInativePiptochaetium montevidensisPoaceaeperennialIInativePiptochaetium montevidensisPoaceaeperennialIInativeSporoblas platensisPoaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeSituetaaJuncaceaeperennialIInativeCyperaceaeperennialIInativeSporobalus platensisPoaceaeperennialIIInativeSisyrinchum minusIridaceaeperennialIIIInativeSizerinchar acenosaLamiaceaeperennial	Ervngium echinatum	Apiaceae	perennial	ш	native	Hydrocotyle sp.	Apiaceae	perennial	Ш	native
Species that were absent or rare in 1935 and are now commonPfaffa tuberosaAmaranthaceaeperennialIIInativeHypoxis decumbensAmaryllidaceaeperennialIIInativeBaccharis coridifoliaAsteraceaeperennialIIInativeChevreulia sarmentosaAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeannualIIInativeGamochaeta spicataAsteraceaeperennialIIInativeCyperus sp.ConvolvulaceaeperennialIIInativeKyllinga odorataCyperaceaeperennialIIalienColoun ductylonPoaceaeperennialIInativePaspalum dilatatumPoaceaeperennialIInativePiptochaetiam montevidensisPoaceaeperennialIInativePiptochaetiam montevidensisPoaceaeperennialIInativeStayrinchum minusIridaceaeperennialIInativeStayrinchum minusIridaceaeperennialIInativeJuncus capillaceusJuncaceaeperennialIInativeStuerinchara racemosaLamiaceaeperennialIInativeCuphea glutinosaLutaceaeperennialIInative	Eryngium nudicaule	Apiaceae	perennial	III	native	,	1	1		
Species that were absent or rare in 1935 and are now commonPfaffia tuberosaAmaranthaceaeperennialIIInativeHypoxis decumbensAmaranthaceaeperennialIIInativeBaccharis coridifoliaAsteraceaeperennialIIInativeChevreulia sarmentosaAsteraceaeperennialIIInativeFacelis retusaAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeDichondra microcalyxConvolvulaceaeperennialIIInativeCyperaceaeperennialIIInativeSyllinga odorataCyperaceaeperennialIIalienLolium multiflorumPoaceaeperennialIIalienPatoetaitaPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeSucuellaria racemosaLamiaceaeperennialIInativeSucuellaria racemosaLamiaceaeperennialIIInativeSucuellaria racemosaLamiaceaeperennialIIInativeSucuellaria racemosaLamiaceaeperennialIIInativeSucuellaria racemosaLamiaceaeperennialIIInativeSucuellaria racemosaLamiaceaeperennialIIInativ										
Platfia luberosaAmaranthaceaeperennialIIInativeHypoxis decumbensAmaryllidaceaeperennialIIInativeBaccharis coridifoliaAsteraceaeperennialIIInativeChevreulia sarmentosaAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeCyperus sp.ConvolvulaceaeperennialIIInativeCyperus sp.CyperaceaeperennialIIInativeCyndon dactylonPoaceaeperennialIIalienLolium multiflorumPoaceaeperennialIInativePapalum dilatatumPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSizyrinchum minusIridaceaeperennialIInativeSizyrinchum minusIridaceaeperennialIInativeSizyrinchum minusIridaceaeperennialIInativeSizyrinchum minusIridaceaeperennialIInativeSizyrinchum minusIridaceaeperennialIIInativeSuteration caremosaLamiaceaeperennialIInativeSizyrinchum minusIridaceaeperennialIInativeSuteration caremosaLamiaceaeperennialIIInativeSuteration caremosaLamiaceaeperennialIII	Species that were absent o	r rare in 1935 and	d are now co	mmon						
TypOx3 acclumbensAndryliadeeaeperennialIInativeBaccharis coridifoliaAsteraceaeperennialIIInativeChevreulia sarmentosaAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeCyperacealperennialIIInativeCyperaceaeperennialIIInativeCyperaceaeperennialIIInativeCynodo dactylonPoaceaeperennialIILolium multiflorumPoaceaeperennialIPatoeaeperennialInativeSporobolus platensisPoaceaeperennialIPitochaetius montevidensisPoaceaeperennialIIIIInativeSizvinchum minusIridaceaeperennialIIIurcus capillacusJuncus capillacusJuncus capillacusJuncus capillacusLamiaceaeperennialIINurcus capillacusLamiaceaeperennialIICuphea glutinosaLythraceaeperennialIINurusLamiaceaeperennialIINurusIridaceaeperennialIINurusIridaceaeperennialIINurusLamiaceaeperennialIINurusLamiaceaeperennialIINurusLamiaceaeperennialIINurusLamiaceaeperen	Pfaffia tuberosa	Amaranthaceae	perennial	III	native					
Datcharts ConjourdAsteraceaepercunialIIInativeFacelis retusaAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeGamochaeta spicataAsteraceaeperennialIIInativeCyperas sp.ConvolvulaceaeperennialIIInativeKyllinga odorataCyperaceaeperennialIIInativeCynodo dactylonPoaceaeperennialIIalienPaspalum dildatumPoaceaeperennialInativePiptochaetium montevidensisPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeHerbertia lahue ssp.amoenaIridaceaeperennialIInativeStayrinchum minusIridaceaeperennialIInativeSuzuellaria racemosaLamiaceaeperennialIInativeCuphea glutinosaLythraceaeperennialIInative	Baccharis coridifolia	Amaryillaaceae	perennial	m	native					
Facelis retusaAsteraceaeannualIIInativeGamochaeta spicataAsteraceaeperennialIIInativeDichondra microcalyxConvolvulaceaeperennialIIInativeCyperaceaperennialIIInativeKyllinga odorataCyperaceaeperennialIIalienCynodon dactylonPoaceaeperennialIIalienColum multiflorumPoaceaeperennialIalienPaspalum dilatatumPoaceaeperennialIInativePiptochaetium montevidensisPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeJuncus capillaceusJuncaceaeperennialIIInativeSuuesaLamiaceaeperennialIInativeJuncus capillaceusLucaceaeperennialIInativeCuphea glutinosaLamiaceaeperennialIInative	Chevreulia sarmentosa	Asteraceae	perennial	III	native					
Gamochaeta spicataAsteraceaeperennialIIInativeDichondra microcalyxConvolvulaceaeperennialIIInativeCyperus sp.CyperaceaeperennialIIInativeKyllinga odorataCyperaceaeperennialIIalienCynodon dactylonPoaceaeperennialIIalienPaspalum dilatatumPoaceaeperennialIalienPaspalum dilatatumPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeSuctellaria racemosaLamiaceaeperennialIIInativeSuctellaria racemosaLythraceaeperennialIIInativeCuphea glutinosaLythraceaeperennialIIInative	Facelis retusa	Asteraceae	annual	Ш	native					
Dichondra microcalyxConvolvulaceae perennialperennialIIInativeCyperaceae Syllinga odorataCyperaceae perennialperennialIIInativeKyllinga odorataCyperaceae perennialIIInativeCynodon dactylonPoaceae perennialIIalienLolium multiflorumPoaceae perennialIInativePaspalum dilatatumPoaceae perennialIInativePiptochaetium montevidensisPoaceae perennialIInativeSporobolus platensisPoaceae perennialIInativeSisyrinchum minusIridaceae Juncus capillaceusperennialIInativeScutellaria racemosaLamiaceae perennialIIInativeCuphea glutinosaLythraceaeperennialIIInative	Gamochaeta spicata	Asteraceae	perennial	III	native					
Cyperus sp.CyperaceaeperennialIIInativeKyllinga odorataCyperaceaeperennialIIalienCynodon dactylonPoaceaeperennialIIalienLolium multiflorumPoaceaeperennialIalienPaspalum dilatatumPoaceaeperennialInativePiptochaetium montevidensisPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeHerbertia lahue ssp.amoenaIridaceaeperennialIInativeSixyrinchum minusIridaceaeperennialIInativeScutellaria racemosaLamiaceaeperennialIIInativeCuphea glutinosaLythraceaeperennialIIInative	Dichondra microcalyx	Convolvulaceae	perennial	III	native					
Kyllinga odorata Cyperaceae perennial II alien Cynodon dactylon Poaceae perennial II alien Lolium multiflorum Poaceae annual I alien Paspalum dilatatum Poaceae perennial I native Piptochaetium montevidensis Poaceae perennial II native Sporobolus platensis Poaceae perennial II native Herbertia lahue ssp.amoena Iridaceae perennial II native Sisyrinchum minus Iridaceae perennial II native Scuellaria racemosa Lamiaceae perennial II native Scuellaria racemosa Lythraceae perennial III native	Cyperus sp.	Cyperaceae	perennial	III	native					
Cynodon dactylonPoaceaeperennialIIalienLolium multiflorumPoaceaeannualIalienPaspalum dilatatumPoaceaeperennialInativePiptochaetium montevidensisPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeJuncus capillaceusJuncaceaeperennialIIInativeScutellaria racemosaLamiaceaeperennialIIInativeCuphea glutinosaLythraceaeperennialIIInative	Kyllinga odorata	Cyperaceae	perennial	II	alien					
Locum mutujurumFoaceaeannualIaltenPaspalum dilatatumPoaceaeperennialInativePiptochaetium montevidensisPoaceaeperennialIInativeSporobolus platensisPoaceaeperennialIInativeSisyrinchum minusIridaceaeperennialIInativeJuncus capillaceusJuncaceaeperennialIIInativeScutellaria racemosaLamiaceaeperennialIIInativeCuphea glutinosaLythraceaeperennialIIInative	Cynodon dactylon	Poaceae	perennial	II	alien					
Piptochaetium montevidensis Poaceae perennial II native Sporobolus platensis Poaceae perennial II native Sporobolus platensis Poaceae perennial II native Sisyrinchum minus Iridaceae perennial II native Juncus capillaceus Juncaceae perennial III native Scutellaria racemosa Lamiaceae perennial III native Cuphea glutinosa Lythraceae perennial III native	Lottum multiflorum Paspalum dilatatum	Poaceae	annual	I T	alien					
Sporobolus platensis Poaceae perennial II native Sporoblus platensis Poaceae perennial II native Herbertia lahue ssp.amoena Iridaceae perennial II native Juncus capillaceus Juncaeae perennial III native Scutellaria racemosa Lamiaceae perennial III native Cuphea glutinosa Lythraceae perennial III native	r aspaium anaiaium Pintochaetium montevidensis	r ouceue Poaceae	perennial	П	native					
Herbertia lahue ssp.amoena Iridaceae perennial II native Sisyrinchum minus Iridaceae perennial II native Juncus capillaceus Juncaceae perennial III native Scutellaria racemosa Lamiaceae perennial III native Cuphea glutinosa Lythraceae perennial III native	Sporobolus platensis	Poaceae	perennial	II	native					
Sisyrinchum minus Iridaceae perennial III native Juncus capillaceus Juncaceae perennial III native Scutellaria racemosa Lamiaceae perennial III native Cuphea glutinosa Lythraceae perennial III native	Herbertia lahue ssp.amoena	Iridaceae	perennial	П	native					
Juncus capillaceus Juncaceae perennial III native Scutellaria racemosa Lamiaceae perennial III native Cuphea glutinosa Lythraceae perennial III native	Sisyrinchum minus	Iridaceae	perennial	III	native					
Scutellaria racemosa Lamiaceae perennial III native Cuphea glutinosa Lythraceae perennial III native	Juncus capillaceus	Juncaceae	perennial	III	native					
Cuphea glutinosa Lythraceae perennial III native	Scutellaria racemosa	Lamiaceae	perennial	III	native					
	Cuphea glutinosa	Lythraceae	perennial	ш	native					