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Original Article

Conservation of Nature

Vegetative and Environmental Components in a Secondary Riparian Forest in the Southern Plateau of Santa Catarina, Brazil

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ABSTRACT

This study investigated the vegetation and environmental variable of fragments at different successional stages in a secondary riparian forest in the municipality of Ponte Alta, Santa Catarina state, Brazil (27°29'00" S and 50°17'11" W, WGS84), aiming to list priority variables for monitoring forest succession in riparian forests. For this, two areas were identified: "Reference" (conserved secondary forest) and "Restoration" (secondary forest under passive restoration). The Principal Component Analysis (PCA) indicated the existence of differences in the arboreal community diversity with lower values for the "Restoration" synthesized by PC1. The ground coverage by *Ocellochloa rudis* (Nees) Zuloaga & Morrone (Poaceae) was mainly in places with higher pH values and ability for effective cation exchange, with no preference of occurrence in either evaluated site. The composition of arboreal diversity was a relevant variable for monitoring passive restoration in this environment.

Keywords: araucaria forest, shannon index, *Ocellochloa rudis*.

1. INTRODUCTION

Monitoring forest succession is a complex process since it involves the successional characteristics of the species and several interactions with biotic and abiotic ecosystem factors. Many ecological processes facilitate successional advancement. However, in some cases thye can act as barriers or strong filters, delaying the balance and services of the system (Rydgren et al., 2013).

The existence of propagule sources, active participation of the soil's seed bank, the seedling bank and the absence of certain species such as superabundant grasses and allochthonous species are highlighted among biotic factors mainly related to the vegetative variables (Martins et al., 2012; Magnago et al., 2012; Rodrigues et al., 2015).

Thus, the remaining floristics of a forest has an important ecological role, creating a structure capable of maintaining environmental services such as the propagule supply (Daronco et al., 2013). The soil seed bank can be determinant in the future of the vegetation of an area, since it is primordial in reestablishing tropical forests, in maintaining and restoring diversity richness after natural or anthropic disturbances, and being mostly composed of pioneer species (Uhl et al., 1988; Matías et al., 2010).

On the other hand, species of late succession naturally have seeds with shorter natural viability, which often present absence or little dormancy germinating soon after dispersion, without remaining in the seed bank (Vale et al., 2009). These species instead remain in the seedling bank comprising the forest's regenerating stratum, awaiting favorable conditions for their development (Chami et al., 2011), and when they are often more vulnerable to abiotic and biotic conditions (Milhomem et al., 2013).

The interspecific competition is one of the main ecological processes involved in forest succession, with emphasis on ruderal species that are cited as ecological filters for the reestablishment of native species (Brancalion et al., 2010), for example, representatives of the Poaceae family, which are superabundant in altered forests (Schmidt & Longhi-Wagner, 2009).

The canopy cover is another factor that interferes in the successional dynamics since it represents a filter to the energetic flow for the lower sectors of the forest, thereby determining the spatial distribution of species, forest dynamics, and biomass production among other processes (Vilani et al., 2007). Places with little canopy cover favor the presence of species with pioneering characteristics (Martins, 2001).

In addition to the aforementioned factors, the chemical and physical characteristics of the soil should also be considered for monitoring the succession since they form microhabitats that influence the floristic composition (Baylão et al., 2013; Holl, 2013). Besides to biotic and abiotic factors, external factors are also involved in the reestablishment of the communities such as ecological flow, regional species composition and landscape connectivity (Suding & Hobbs, 2009).

Considering the performance of the different factors involved in forest succession, the complexity of performing "artificial" regeneration of a forest by planting seedlings is highlighted. Therefore, the passive restoration is important as an efficient way of recomposing degraded areas. In order to verify the efficiency of passive restoration in recomposing riparian forests in the Southern Plateau region of Santa Catarina, this study aimed to characterize and investigate some vegetative and environmental variables of preserved secondary forest fragments and those under passive restoration, determining the priority variables for monitoring forest succession.

2. MATERIAL AND METHODS

2.1. Study site

The study was conducted in areas of riparian forests of the Poço Grande silvicultural farm (Figure 1). The study site was an area of Araucaria Forest (IBGE, 2012) in the municipality of Ponte Alta, Santa Catarina, Brazil (27°29'00" S and 50°17'11" W, WGS84) under an average altitude of 880 m. The small tributaries and springs that permeated the farm contribute to the Canoas river basin (Santa Catarina, 1997). The relief of the region is classified as wavy/hilly to slightly wavy/hilly relief of hapless cambisol soil with a clay texture (Morales et al., 2012). The climate of the region is classified as humid subtropical mesothermic of "Cfb" type according to Köppen-Geiger, with cool summers and no dry season, frequent severe frosts, average temperature of the hottest months below 22°C and annual rainfall ranging from 1600 to 1900 mm (Alvares et al., 2014).

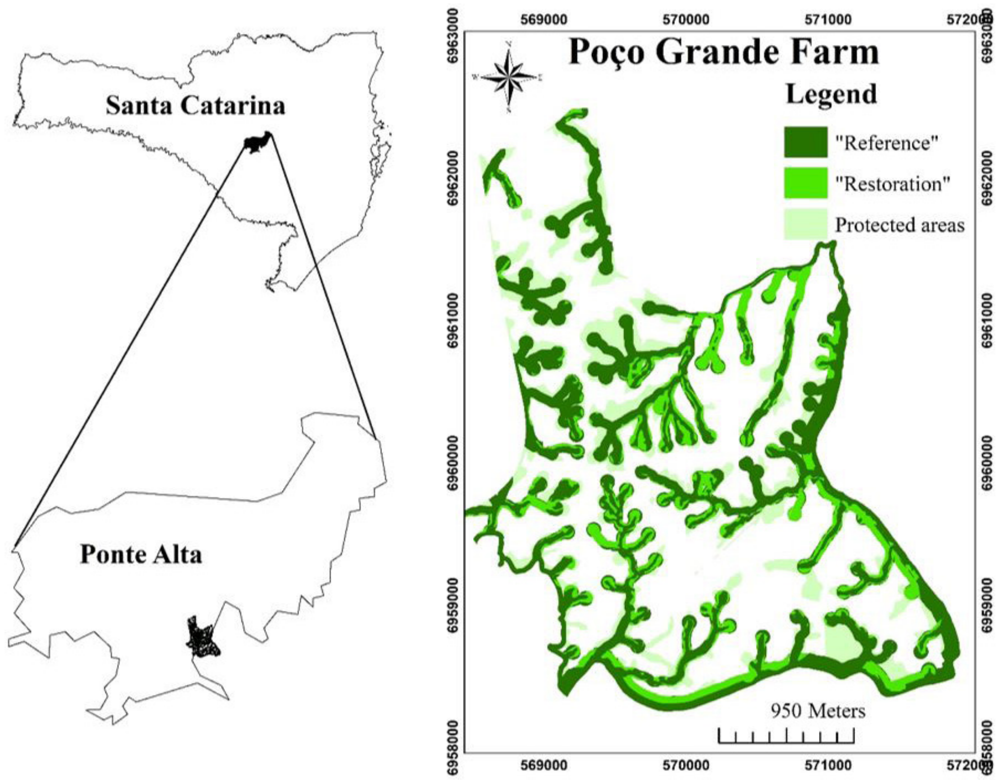

Figure 1. Location of riparian forests (areas "Reference" and "Restoration") and other native areas of the Poço Grande farm, Ponte Alta municipality, Santa Catarina state, Brazil.

Two historically defined sites were used (Ferreira, 2011) (Figure 1): 1) "Reference" - a riparian forest of 176 ha under conserved secondary succession for approximately 40 years without anthropic intervention and with previous selective exploitation in the past; 2) "Restoration" - a secondary riparian forest under passive restoration for 10 years since the removal of forest plantations, seeking environmental adequacy and with a total area of 88 ha. The Southern Plateau of Santa Catarina is characterized by small forest remnants under secondary formation and expressive forestry activity (Rochadelli et al., 2008).

2.2. Data collection

For the arboreal stratum sampling, 20 sample units with dimensions of 10 x 20 m (200 m^2) were randomly allocated, 10 in each area. All individuals with diameter at breast height (DBH) measured at 1.30 m above ground ≥15.7 cm were identified. For the regenerating stratum sampling, six subunits of 1 m^2 were systematically allocated in each 200 m^2 sampling unit totaling 60 subunits per area, in which tree individuals with height ≥ 0.1 and ≤ 1.5 m were evaluated. The sampling sufficiency of the arboreal and regenerating strata was verified by species accumulation curves, using the permutation method for each area (Efron & Tibshirani, 1993).

Specialized literature was used and/or specialists were consulted for the species identification. Scientific names were based on the MOBOT Tropicos® (MOBOT, 2017). The species belonging to the arboreal stratum were categorized into dispersal syndromes: zoochorous, anemochorous and autochorous, proposed by Van der Pijl (1972), based on propagule observations and citations in scientific works (e.g. Rondon et al., 2001; Giehl et al., 2007), as well as into ecological groups: pioneer, secondary initial, late secondary and climax, according to the descriptions proposed by Budowski (1965) after consulting the literature (Reitz, 1971; Reitz et al., 1978).

Along with a survey of the tree community in each 200 m^2 plot, quantification of *Merostachys multiramea*

Hack (popularly known in Brazil as taquara) was conducted according to an adaptation of the Fournier index (Fournier, 1974), assigning scores to different intensities of the event "occupation by taquara". According to this method, soil cover measurement of *Ocellochloa rudis* (Nees) by Zuloaga & Morrone was also carried out as well as height, performed together with the forest regenerating stratum.

The soil seed bank evaluation was performed with collections in the center of the units (200 m^2) using a template (0.3m×0.3m×0.05m (0.0125 m^3)). The substrate was placed in trays stimulating the seed bank germination under 50% shading. Germination monitoring was conducted biweekly (every 14 days) over a period of six months by counting and identifying the arboreal species seedlings.

Determining the chemical and physical variables of the soil, there were 100g of soil samples systematically collected from four points of the sample unit in the superficial layer (up to 20 cm) and then sent to the Soil Analysis Laboratory (Centre of Agroveterinary Sciences, State University of Santa Catarina, Lages, SC, Brazil) according to Tedesco's methodology (Tedesco et al., 1995) for clay determination using the densimeter method. The Canopy cover assessment was carried out according to the methodology proposed by Lemmon (1956), using a convex spherical densitometer placed systematically at two points of the sample unit (200 m^2).

2.3. Data analysis

After the sufficiency of the sampling strata to estimate floristic diversity, the Shannon index (Ludwig & Reynolds, 1988), the basal area (m^2. ha^{-1}) and percentage of zoochorous and pioneer individuals per sampling unit were calculated. A mean comparison was carried out for all variables obtained in the "Reference" and "Restoration" areas according to the nature of the data (parametric and non-parametric), and then, the Student's t-test and Mann-Whitney U test were used, respectively,with the exception of the diversity index, which was compared by the Hutcheson t-test (Hutcheson, 1970).

The variables were subsequently standardized and submitted to the Principal Component Analysis (PCA), allowing visualization of the dispersion of the sample units as a function of the Principal Component scores (PC) (Kent & Coker, 1992). A Scree Plot graph was generated to determine the axes to be used in interpreting the results. For the interpretation of the diagram, significant PC scores were considered as those that synthesize a number of variables superior to a model of random distribution (*broken-stick*). Then, selection of the most important variables in the formation of the PC axis was verified by the *loading* values (Pearson correlation between the scores of each axis and the variables), where *loading* values higher than 0.3 were considered as significant in the analysis (Mcgarigal et al., 2000). The Vegan library version 2.3-0 (Oksanen et al., 2015) and R software version 3.2.2 were used for data analysis (R Development Core Team, 2015).

3. RESULTS

The arboreal stratum of the "Reference" area had 39 species with 33 genera and 18 botanical families. The family with the highest specific richness was Myrtaceae (8 spp.) followed by the *Myrcia* genus (3 spp.). Regarding this stratum in the "Restoration" area, the samples of 28 species belonging to 25 genera and 15 botanical families were found, in which the Lauraceae family (3 spp.) and the *Ilex* genus had the highest specific richness (2 spp.) (Table 1).

The regenerating stratum composition of the "Reference" area had 24 species belonging to 19 genera and 12 families, where the Myrtaceae family had highest specific richness (7 spp). Fifteen (15) species were found in the "Restoration" area, distributed into 15 genera and 14 families, in which the Lauraceae family (2 spp.) had the highest specific richness. Considering the floristic composition of soil seed bank, *Mimosa scabrella* Benth. was the only tree species sampled in both areas.

Most of the evaluated variables were similar between the areas, with the exception of the average values of zoochorous tree abundance (zoo), Shannon index of trees species (H.arb), tree richness (arbR), available potassium (K) and organic carbon (OC), which were higher for the "Reference" area. Only the percentage of clay (cla) was lower in this area (Table 2).

The interpretation of the Scree plot graph considered the interpretation from PCA up to PC4 to be safe. PC1 was responsible for explaining 27.5% of the data variation. In this axis, the Shannon index of trees variable (H.arb) is considered significant (*loading*= -0.31), with

Table 1. Arboreal and regenerative floristic components, “Reference” (ref) and “Restoration” (res) areas, presence (+) or absence (-) of the species, followed by ecological grouping (EG) (Where: Pio= pionner; Sei= initial secondary; Sel= late secondary and Cli= climax) and dispersal syndrome (DS) (Where: Ane=anemochorous; Aut= autochorous; Zoo= zoochorous) in riparian forests, Ponte Alta, SC, Brazil.

Families	Species	Arboreal		Regenerative		EG	DS
		ref	res	ref	res		
Anacardiaceae	*Schinus terebinthifolia* Raddi	+	-	-	-	Sei	Zoo
Aquifoliaceae	*Ilex microdonta* Reissek	-	-	-	+	Sei	Zoo
	Ilex paraguariensis A. St.-Hill.	+	+	+	-	Pio	Zoo
	Ilex theezans Mart. ex Reissek	+	+	-	-	Sei	Zoo
Araucariaceae	*Araucaria angustifolia* (Bertol.) Kuntze	+	-	-	-	Pio	Zoo
Arecaceae	*Syagrus romanzoffiana* (Cham.) Glassman	-	-	+	-	Sei	Zoo
Asteraceae	*Piptocarpha angustifolia* Dusén ex Malme	+	+	-	+	Pio	Ane
	Symphyopappus compressus (Gardner) B.L.Rob.	-	+	-	-	Pio	Ane
	Vernonanthura discolor (Spreng.) H.Rob.	+	+	-	-	Pio	Ane
Bignoniaceae	*Jacaranda puberula* Cham.	-	+	-	+	Pio	Aut
Cannabaceae	*Celtis iguanaea* (Jacq.) Sarg.	-	-	-	+	Sei	Zoo
Clethraceae	*Clethra scabra* Pers.	+	+	-	+	Pio	Aut
Cunoniaceae	*Weinmannia paulliniifolia* Pohl ex Ser.	-	-	+	-	Sei	Aut
Cyatheaceae	*Alsophila setosa* Kaulf.	+	+	-	-	Cli	Ane
Dicksoniaceae	*Dicksonia sellowiana* Hook.	+	+	+	+	Cli	Ane
Euphorbiaceae	*Gymnanthes klotzschiana* Müll. Arg.	+	+	-	-	Sei	Aut
Fabaceae	*Dalbergia frutescens* (Vell.) Britton	+	-	+	+	Sei	Ane
	Inga lentiscifolia Benth.	+	-	+	-	Sei	Zoo
	Inga virescens Benth.	-	-	+	-	Sei	Zoo
	Mimosa scabrella Benth.	+	+	-	-	Pio	Aut
Lauraceae	*Cinnamomum amoenum* (Nees) Kosterm.	+	-	-	-	Sei	Zoo
	Cinnamomum glaziovii (Mez) Kosterm	-	+	-	-	Cli	Zoo
	Cryptocarya aschersoniana Mez	+	-	-	-	Set	Zoo
	Ocotea puberula (Rich.) Nees	+	+	-	+	Pio	Zoo
	Ocotea pulchella (Nees & Mart.) Mez	+	-	-	-	Pio	Zoo
	Nectandra lanceolata Nees	+	+	-	-	Sei	Zoo
	Nectandra megapotamica (Spreng.) Mez	-	-	-	+	Sei	Zoo
Meliaceae	*Cedrela fissilis* Vell.	+	+	-	-	Sei	Ane
Myrtaceae	*Calyptranthes concinna* DC.	+	-	+	-	Sei	Zoo
	Campomanesia rhombea O.Berg	-	-	+	-	Sei	Zoo
	Campomanesia xanthocarpa Mart. ex O. Berg	+	-	+	-	Sei	Zoo
	Eugenia pluriflora DC.	-	-	+	-	Sei	Zoo
	Eugenia subterminalis DC.	+	-	-	-	Sei	Zoo
	Myrcia hatschbachii D.Legrand	+	-	+	-	Sei	Zoo
	Myrcia palustris DC.	+	-	-	-	Sei	Zoo
	Myrcia splendens (Sw.) DC.	+	+	-	-	Sei	Zoo
	Myrceugenia miersiana (Gardner) D. Legrand & Kausel	+	-	+	-	Sei	Zoo
	Myrceugenia myrcioides (Cambess.) O.Berg	+	-	-	-	Cli	Zoo
	Myrtaceae sp1	-	-	+	-	-	-
Pinaceae	*Pinus taeda* L.	-	+	-	-	Pio	Ane
Primulaceae	*Myrsine coriacea* (Sw.) R.Br. ex Roem. & Schult.	+	+	+	-	Pio	Zoo
	Myrsine lorentziana (Mez) Arechav.	-	-	+	+	Sei	Zoo
Proteaceae	*Roupala montana* Aubl.	-	+	-	-	Sei	Ane
Rhamnaceae	*Rhaminus sphaerosperma* Sw.	-	-	-	+		
Rosaceae	*Prunus myrtifolia* (L.) Urb.	-	-	-	+	Sei	Zoo

Table 1. Continued...

Families	Species	Arboreal		Regenerative		EG	DS
		ref	res	ref	res		
Rutaceae	*Zanthoxylum* sp.	-	-	-	+	Sei	Zoo
Salicaceae	*Banara tomentosa* Clos	-	-	+	+	Sel	Zoo
	Casearia decandra Jacq.	+	+	+	-	Sei	Zoo
	Casearia obliqua Spreng.	+	-	-	-	Sei	Zoo
Sapindaceae	*Allophylus edulis* (A.St.-Hil. et al.) Hieron. ex Niederl.	+	-	+	-	Sei	Zoo
	Cupania vernalis Cambess	+	-	-	-	Sel	Zoo
	Matayba elaeagnoides Radlk.	+	+	+	+	Sei	Zoo
Solanaceae	*Aureliana fasciculata* (Vell.) Sendtn.	+	+	-	-	Pio	Zoo
	Cestrum corymbosum Schltdl.	-	+	-	-	Pio	Zoo
	Solanum sp1	-	-	+	-	Pio	Zoo
	Solanum pseudoquina A. St.Hill	-	+	-	-	Pio	Zoo
	Solanum variabile Mart.	+	+	-	-	Sei	Zoo
Styracaceae	*Styrax leprosus* Hook. & Arn.	+	-	+	-	Sei	Zoo
Symplocaceae	*Symplocos tenuifolia* Brand	+	+	-	-	Sei	Zoo
Undetermined	Not identified 1	+	-	-	-	-	-
	Not identified 2	+	-	-	-	-	-
Winteraceae	*Drimys brasiliensis* Miers	+	-	-	-	Sel	Zoo

Table 2. Average values of the analyzed variables followed by the mean test, Ponte Alta, SC, Brazil.

Acronym	Variable	Reference	Restoration	*p*
		Mean ± standard deviation		
	Non-parametric variables (Mann-Whitney U test)			
arbA	arboreal abundance (n° ind.)	22.6±7.9	20.5±11.6	0.925^{ns}
G	basal area arboreal (m^2/ha)	31.4±19.5	18.8±10.3	0.143^{ns}
T	effective cation exchange capacity (cmol$_c$.dm^3)[1]	5.5±1.6	6.7±1.8	0.196^{ns}
zoo	abundance of zoochorous arboreal (%)	63.2±21.4	26.9±16.7	0.003*
	Parametric variables (t-test)			
H.arb	H' arboreal (nats.ind^{-1}) (Hutcheson t-test)	1.9±0.4	1.4±0.4	<0.001*
cov	coverage by *Ocellochloa rudis* (%)	30.2±29.6	41.1±36.6	0.474^{ns}
pH	potential of hydrogen[2]	3.5±1.1	3.8±0.3	0.366^{ns}
hGra	average height of *Ocellochloa rudis* (cm)	23.5±20.1	40.8±51.3	0.333^{ns}
Mer	occupation by *Merostachys multiramea* (%)	24.5±24.5	30.3±36.1	0.682^{ns}
arbR	arboreal richness (n° spp.)	9.3±2.6	6.3±2.7	0.022*
regR	regenerating richness (n° spp.)	3.6±3.2	2.4±1.8	0.314^{ns}
regA	regenerating abundance (n° ind.)	5.6±6.0	3.1±2.5	0.239^{ns}
can	canopy opening (%)	7.4±4.9	23.0±30.1	0.139^{ns}
K	available potassium (mg/dm^3)[3]	0.8±0.2	0.4±0.1	<0.001*
Ca	exchangeable calcium (cmol$_c$.dm^3)[4]	0.8±0.8	0.4±0.3	0.197^{ns}
Mg	exchangeable magnesium (cmol$_c$.dm^3)[5]	1.0±2.1	0.2±0.2	0.246^{ns}
Al	exchangeable aluminum (cmol$_c$.dm^3) [6]	4.5±1.6	5.7±1.9	0.147^{ns}
OC	organic carbon (mg/dm^3)[7]	1.5±0.3	1.0±0.2	0.002*
SB	saturation by bases (%)[8]	5.7±3.1	3.4±2.3	0.070^{ns}
OM	organic matter (%)[9]	1.5±0.3	1.8±0.4	0.131^{ns}
pio	abundance of pioneer arboreal (%)	26.5±22.8	80.6±26.1	0.691^{ns}
banA	seed bank abundance (n° ind.)	0.4±1.0	0.4±0.7	0.930^{ns}
cla	clay (%)[10]	23.1±3.8	28.7±5.5	0.010*

p = probability of the test; ns = not significant; *= significant for α: 0.01. Interpretation of the results according to Tedesco et al. (2004): [1] high; [2] very low; [3] high; [4] low; [5] medium (Reference) and low (Restoration); [6] high; [7] low; [8] very low; [9] low; [10] class 3 (21 - 40% of clay).

the formation of an evident separation between the evaluated areas (*p*= 0.0009). PC2 had 14% of the total variation of the data, having the following significant variables: pH (*loading*= -0.33), cov (*loading*= -0.34) and T (*loading*= -0.34).

4. DISCUSSION

The "Reference" and "Restoration" areas showed distinct floristic compositions, mainly reflected by the variable Shannon index of the tree community (H.arb). Myrtaceae, which presented greater specific richness for both strata of the "Reference" area, can be characterized as an important source of propagules for the "Restoration" area, as the species of this family present zoochory as an associated dispersion syndrome, enabling greater interaction with the fauna (Gressler et al., 2006), and fundamental for advancement of the successional dynamics and an increase in the environmental richness in secondary succession. In the "Restoration" area, the Lauraceae family presented greater specific richness for the arboreal and regenerating strata, contributing to more advanced succession species such as *Cinnamomum glaziovii*, and with important species in the initial structuring of the Araucaria Forest such as *Ocotea puberula, Nectandra lanceolata,* and *N. megapotamica*. Myrtaceae and Lauraceae are commonly described as formers of this phytophysiognomy, and they can be found in the richest families and in several studies (Reitz et al., 1978; Ferreira et al., 2012). *Dicksonia sellowiana* and *Matayba elaeagnoides* species are highlighted as they occur in the regenerating and arboreal strata of both areas, being common in both of these ecosystems.

The low representativeness of the species in the composition of the seed bank, confirmed by the restricted presence of *Mimosa scabrella* in both areas, corroborates the results by Chami et al. (2011), in which the low diversity of the seed bank is described as an intrinsic ecological characteristic of this phytophysiognomy (Araucaria Forest). However, it can also be attributed to the peculiar microhabitat of riparian ecosystems, which often restricts the presence of trees and shrubs in tropical regions prioritizing herb colonization (Araujo et al. 2004). Another relevant factor is the history of the evaluated site, which reflects the richness and historical diversity of the area's seed bank which may be poor where the vegetation has been suppressed or managed for long periods. In this case, plantations of exotic species carried out in the past in the "Restoration" area may negatively influence the seed bank.

Fragments of the "Reference" area were shown as an important source for successional advancement and maintenance of the "Restoration" environments, because the predominance of zoochory associated with greater richness and diversity of arboreal species in the "Reference" area may be able to promote functional connectivity between the two sites, allowing greater genetic flow through fauna action (Liebsch & Antonio Acra, 2007).

Significant differences among the "Reference" and "Restoration" areas were found for some edaphic variables as being non-relevant according to the interpretations suggested by Tedesco et al. (2004). Thus, "Reference" and "Restoration" areas had high values of available potassium (K), low organic carbon (OC) and a low percentage of class 3 clay (cla), which commonly characterizes dystrophic soils. Clay is a common characteristic for most soils found in the region of the Santa Catarina plateau (Morales et al., 2012).

According to the principal components analysis (PCA), the separation between the plots of the two areas presented by PC1 shows a clear variation in the floristic-structural composition, predictably occurring along an environmental or successional gradient, as described by Ashton (1989). This variation presented between the areas is of extreme relevance since there are "gains" in floristics and structure according to the time succession in established forests (Liebsch et al., 2007). Such gains in vegetation richness and structure are important aspects for monitoring areas under passive restoration, since the evaluation of variables such as them have been indicated for monitoring the restoration of biodiverse forests, and monitoring the ecological processes involved (Ruiz-Jáen & Mitchell Aide 2005; Brancalion et al., 2010; Rodrigues et al., 2015).

PC2 demonstrated a significant correlation of cover by *Ocellochloa rudis* at sites with higher soil pH and T values. In this axis, a lack of substitution pattern of the sample units in the evaluated areas was observed and when evaluating the ordering vectors, and a slightly larger association was noticed with some portions of the "Restoration" area (Figure 2). The occupation by *Ocellochloa rudis* (Poaceae) occurred at sites with higher soil pH and T values. However, a gradient with

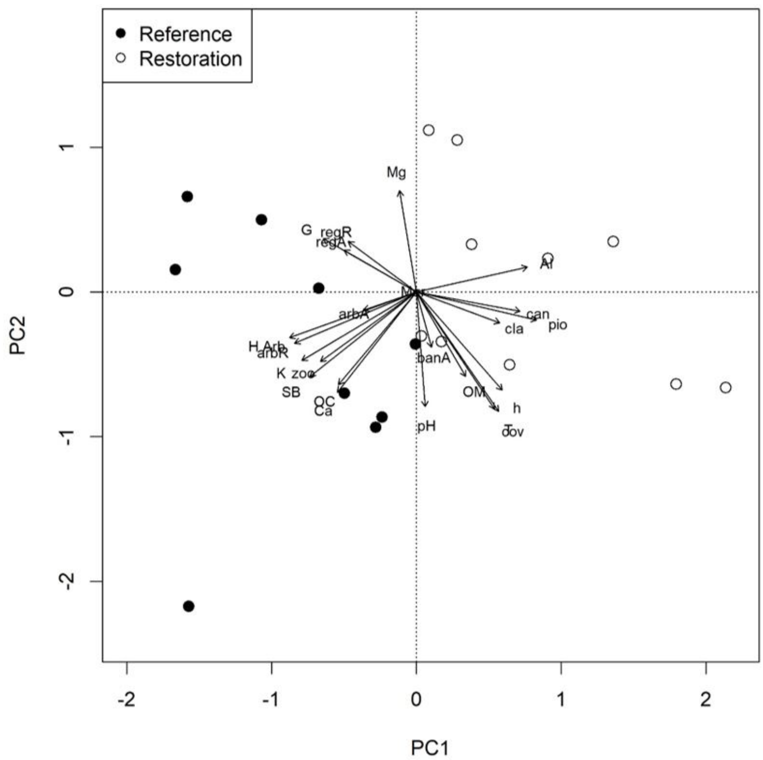

Figure 2. Distribution of plots ("Reference" and "Restoration" areas) and vegetation and environmental variables, survey conducted in the Araucaria Forest, Poço Grande farm, Ponte Alta - SC, Brazil, according to principal components analysis - PCA. Where: PC1= Principal Component 1 and PC2= Principal Component 2.

the presence of the species throughout the sampling is not evident. It is considered that grasses are generally able to form a dense biomass layer, making it difficult for sunlight to reach the soil surface, consequently hindering germination and recruitment of native species of the seed bank (Hughes & Vitousek, 1993). This physical barrier can also influence propagules from seed rain reaching the soil (Miriti, 1998).

According to the vectors obtained in the PCA analysis (Figure 2), there is a maximum angle formed between the vector coverage by *Ocellochloa rudis* (cov) with the variables regenerating abundance (arbR) and regenerating richness (regR), suggesting a strong negative association between these variables. *Ocellochloa rudis* is a native ruderal species, commonly sampled in the vegetation of the Planalto Catarinense region. According to Pastore et al. (2012), they are part of a group of plants that play an important role in ecological succession considering that they are able to assist in establishing secondary vegetation in degraded areas or clearings due to natural or anthropic impacts. For this reason, we can consider that the species showed an association with more fertile and less acidic soils. However, it is not yet known if this relation is formed by the presence of the species in the site, or if the presence of the species is preferentially due to favorable soil characteristics (higher fertility and lower acidity). Nonetheless, this relationship can establish tree species considering a temporal scale, promoting the arrival of more demanding species regarding the micro-habitat. Moreover, this Poaceae is common both inside the forests as well as on its edges (Zuloaga & Sendulsky, 1988); a fact confirmed in this study as the species did not present an evident relation with canopy opening (can) (Figure 2).

5. CONCLUSION

The diversity of the tree community is highlighte among the priority vegetative variables for monitoring areas in passive restoration, followed by the coverage of *Ocellochloa rudis* (Nees) Zuloaga & Morrone

(Poaceae). Regarding the evaluated environmental variables for monitoring passive restoration, they are not representative for the follow-up of successional progression.

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