Assessment of the natural regeneration of the forest (fragment) of the IF Goiano, Campus Rio Verde

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ABSTRACT. The regeneration succeeds from the interaction of natural processes of rebuilding the forest ecosystem, it is considered one of the most promising tactics for restoring areas that have been degraded. Thus, studying them allows us to know a little about the way the forest will develop, since it provides the number of species it has and their distribution in the area. The objective of this work was to evaluate the potential and characteristics of natural regeneration in the recovery process of the forest forest at the IF Goiano - Rio Verde campus. For this survey, 15 plots of 5x5m were allocated. All shrub-tree individuals that had at least 10 mm in diameter at ground height (DAS) were sampled; or height of at least 50 cm and that did not meet the criterion for inclusion of the tree extract (CAP ≥ 10 cm). Classic phytosociological parameters were calculated. A total of 707 individuals were sampled, belonging to 14 families and 23 species, with a predominance of the species *Senegalia polyphylla* (DC.) Britton & Rose, from the Fabaceae family, in almost all plots. Thus, it is concluded that the study area has low diversity and little species richness.

Keywords: Phytosociology, Regenerating component, RAD, Ecological fragments, Diversity.

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INTRODUCTION

The *cerrado* biome is predominantly constituted by the seasonal tropical climate, with rains in the summer and dry winters, it is located in the central plateau of Brazil, being the second largest biome (Ribeiro et al., 2008). Natural regeneration by sprouting is more successful in the process of recovering the vegetation cover of the *cerrado*. This peculiar ability of cerrado species to cover the ground from the regrowth of underground structures depends on the physical and chemical properties of the soil and the time elapsed after deforestation (Paulo et al., 2015).

Natural regeneration does not have an exact definition, it varies depending on the author. In a dynamic sense, it represents the renewal process of the vegetation cover of an area, with individuals in the young phase of a species or a group of species (Lima Filho et al., 2002; Maragon et al., 2008). Finol (1969) defines regeneration as all plants that have CAP less than 10 cm and height greater than 10 cm. Volpato (1994) conceptualizes all individuals with DBH less than 5 cm.

Natural regeneration is related to the initial phases of growth and development of the forest, this process is quite long and contributes to the reconstruction and maintenance of biodiversity (Klein, 1980). It refers to the abundance, frequency and cover value of species (Kosokawa, 1982). Therefore, regeneration analyzes provide an understanding of the conservation status of the analyzed site (Silva et al., 2007; Souto & Boeger, 2011), and an understanding of the continuations of forest populations (Redin et al., 2011).

Phytosociological methods are used to provide quantitative information on the size, basal area, biomass and structure of different biomes (Moro & Martins, 2011). According to Martins (1991) phytosociology is characterized as the quantitative ecology of plant communities which, in turn, comprise the interrelationships of plant species in space and time.

Thus, this work aimed to analyze the progress of the establishment of natural plants in the recovery process, the development of soil cover by competing vegetation and its influence on natural regeneration, in the forest in question.

MATERIAL AND METHODS

The study was carried out in a reserve forest fragment, which is located at Instituto Federal Goiano (17° 49'0.40" S; 50° 53'58.57" W), in the municipality of Rio Verde - GO.

For sampling the arboreal stratum, 15 systematized plots of 20 x 20m were opened, with a distance of 10m between them, they were distributed in five transects. In these plots, 15 subplots of 5x5m were allocated for sampling the regenerating stratum. The plots were opened with the aid of a measuring tape, and marked with pieces of pipe and string. Within these plots, all shrub-tree individuals were sampled that had at least 10 mm of DAS (diameter at ground height) or a minimum height of 50 cm, and that did not fit into the arboreal stratum, that is, with CAP (Circumference at chest height at 1.30 cm from the ground) < 10 cm.

All individuals analyzed received aluminum plates, with a progressive numbering, the plates were fixed with the aid of nylon thread. The evaluations of the diameter of the individuals were carried out with the aid of a digital caliper, and the height was estimated with the aid of a measuring tape. All individuals were identified at the family, genus and species level, some identifications were made in the field, and others were collected for comparison with specimens from the Herbarium of Rio Verde, located at the Instituto Federal Goiano – Rio Verde campus, comparisons with specialist literature and consultation with specialists. The botanical nomenclature was checked on the "flora do Brasil" website.

After collecting the data, the phytosociological parameters were calculated (Mueller-Dombois & Elen-Berg, 1974): absolute and relative density, absolute and relative dominance, absolute and relative frequency, and from these the value index was obtained. of importance (IVI) of each sampled species. The Pielou evenness and the Shannon diversity index were also calculated.

RESULTS AND DISCUSSION

707 individuals were sampled, distributed in 23 species, 20 genera and 14 families. Of the sampled species, 19 were identified at the species level, 2 at the genus level, 1 at the family level and 1 undetermined.

The families with the highest species richness in the sampled area were Fabaceae (4 species), Bignoniaceae (3 species), Rubiaceae, Anacardiaceae and Sapindaceae (2 species). Regarding the distribution of the number of individuals per species, the ones that stood out were Senegalia polyphylla (531 individuals), Randia armata (65 individuals), Genipa americana and Astronium urundeuva (14 individuals), they presented greater abundance and had approximately 88% of regenerating individuals (Table 1).

The species that stood out in relation to their distribution in the study area were: Senegalia polyphylla, Celtis iguanaea, Randia armata, Dipteryx alata, Cuspidaria sceptrum and Sterculia apetala. These, except S. apetala, also stood out in relation to the relative density parameter, with the species Serjania, G. americana and A. urundeuva representing 94.2% of the total. Analyzing the relative dominance parameters of the S. polyphylla species, it continues to show a higher value than the other species, as in the previous parameters, and this occurs due to the fact that the individuals of S. polyphylla have a greater basal area value, when compared to the other species. species. With regard to the coverage value, the species S. polyphylla and R. armata had the highest values.

The importance value parameters demonstrate the importance of species in natural regeneration (Arantes et al., 2012). Thus, the species that obtained the highest VI's were S. polyphylla and R. armata, with 154.83% and 31.48%, respectively, while the lowest value found was 1.77% for the species Handroanthus ochraceus. The species C. iguanaea (19.84%) and G. americana (11.53%) also obtained the highest results. The value of the Shannon Index (H') reached for the fragment was 1.15 nats/ind., much lower when compared to other works such as Silva et al., (2010) and Alencar (2009), 3.21 and 3.31 respectively, thus concluding that the studied area has a low floristic heterogeneity, since the Pielou evenness value obtained was 0.36, where the distribution of individuals has minimal uniformity (Table 1).

Of the 707 individuals sampled, 17 (2 species) are present in class 1 of natural regeneration diameter, 536 (18 species) in class 2, 127 (17 species) in class 3, 24 (6 species) in class 4 and 3 (3 species) in class 5. There is a predominance of individuals in class two, so the distribution of the number of individuals regarding the diameter class was C2 > C3 > C4 > C1 > C5. Of the sampled species, three are present in 4 classes, C. iguanaea, R. armata and S. polyphylla, and another three species are present in 3 classes, G. americana, Sapium sp. and S. apetala. Which correspond approximately to a percentage of 77% between species (Figure 1).

Table 1. Phytosociological parameters of the structure ofnatural regenaration sampled in the forest fragmente IF Goiano – Campus Rio Verde.

Species	IN	NP	BA	AD	RD	AD	RD	AF	RF	IV	CA	H
Anadenanthera colubrina var. cebil (Griseb.) Altschul	2	2	0,015	28,29	0,283	0,40	0,32	13,33	3,08	3,68	0,61	-0,02
Asteraceae sp.1	3	1	0,009	42,43	0,424	0,24	0,19	6,67	1,54	2,15	0,62	-0,02
Astronium fraxinifolium Schott	1	1	0,011	14,14	0,141	0,30	0,24	6,67	1,54	1,92	0,38	-0,01
Astronium urundeuva (M.Allemão) Engl	14	1	0,042	198,01	1,980	1,11	0,89	6,67	1,54	4,41	2,88	-0,08
Cardiopetalum calophyllum Schltdl.	2	2	0,010	28,29	0,283	0,27	0,22	13,33	3,08	3,58	0,50	-0,02
Celtis iguanaea (Jacq.) Sarg	13	8	0,265	183,88	1,839	7,06	5,70	53,33	12,31	19,84	7,54	-0,07
Cuspidaria sceptrum (Cham.) L.G.Lohmann	10	4	0,036	141,44	1,414	0,97	0,78	26,67	6,15	8,35	2,19	-0,06
Dendropanax cuneatus (DC.) Decne. & Planch.	2	2	0,005	28,29	0,283	0,14	0,11	13,33	3,08	3,47	0,40	-0,02
Dilodendron bipinnatum Radlk.	1	1	0,021	14,14	0,141	0,56	0,45	6,67	1,54	2,13	0,59	-0,01
Dipteryx alata Vogel	9	5	0,054	127,30	1,273	1,44	1,16	33,33	7,69	10,13	2,43	-0,06
Fridericia florida (DC.) L. G. Lohmann	6	2	0,012	84,87	0,849	0,32	0,26	13,33	3,08	4,19	1,11	-0,04
Genipa americana L.	14	1	0,372	198,01	1,980	9,92	8,01	6,67	1,54	11,53	9,99	-0,08
Guarea guidonia (L.) Sleumer	1	1	0,015	14,14	0,141	0,41	0,33	6,67	1,54	2,01	0,47	-0,01
Handroanthus ochraceus (Cham.) Mattos	1	1	0,004	14,14	0,141	0,11	0,09	6,67	1,54	1,77	0,23	-0,01
Indeterminada sp.1	3	1	0,008	42,43	0,424	0,22	0,18	6,67	1,54	2,14	0,60	-0,02
Ocotea odorifera (Vell.) Rohwer	3	2	0,037	42,43	0,424	1,00	0,81	13,33	3,08	4,31	1,23	-0,02
Piper arboreum Aubl.	1	1	0,072	14,14	0,141	1,93	1,56	6,67	1,54	3,24	1,70	-0,01
Platypodium elegans Vogel	6	1	0,033	84,87	0,849	0,89	0,72	6,67	1,54	3,11	1,57	-0,04
Randia armata (Sw.) DC.	65	7	0,535	919,38	9,194	14,27	11,52	46,67	10,76	31,48	20,71	-0,22
Sapium sp.	5	2	0,276	70,72	0,707	7,36	5,94	13,33	3,08	9,73	6,65	-0,04
Senegalia polyphylla (DC.) Britton & Rose	531	14	2,702	7510,6	75,11	72,06	58,19	93,33	21,54	154,8	133,3	-0,21
Serjania sp.	10	1	0,031	141,44	1,414	0,84	0,68	6,66	1,53	3,63	2,09	-0,06
Sterculia apetala (Jacq.) H. Karst	4	4	0,076	56,58	0,566	2,01	1,63	26,66	6,15	8,35	2,19	-0,02
	707		4,64		100			433,3	100	300	200	-1,15
												1,15
											J	0,36

On what: IN-individual number; **NP-**number of parcel; **BA-**basal area; **DA-**absolute density; **RD-**relative density (%); **AD-** absolute dominance; **RD-**relative dominance (%); **AF-**absolute frequency; **RF-**relative frequency (%); **IV-** importance value; **CA-**coverage amount (%); **H-**index value of Shannon; **J** – Pielou equability.

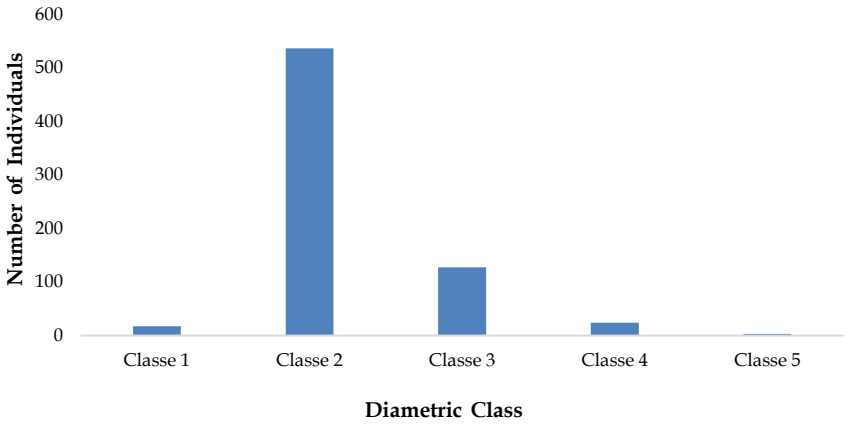

Figure 1: Diameter ratio of all species from the natural regeneration of sampled populations, in the Bosque do IF Goiano fragment – Rio Verde campus, (**class 1**: individuals with a diameter smaller than 3mm; **class 2:** individuals with a diameter smaller than 9mm; **class 3:** individuals with diameter smaller than 18mm; **class 4:** individuals with a diameter smaller than 36mm; **class 5:** individuals with a diameter equal to or greater than 36mm).

Of the 707 individuals sampled in the forest, 669 (23 species) are in class 1 of natural regeneration height, 32 (5 species) in class 2 and six (4 species) in class 3. height class, so the distribution of the number of individuals in terms of height class was from the lowest to the highest class (C1 > C2 > C3) at the study site. These results are similar to those obtained by Sousa Júnior (2006) who obtained 531 individuals in C1 and Lima et al., (2013) who obtained 131. This result can be attributed to an initial phase of succession, since, at the beginning of the process successional there are numerous individuals belonging to a few species (Figure 2).

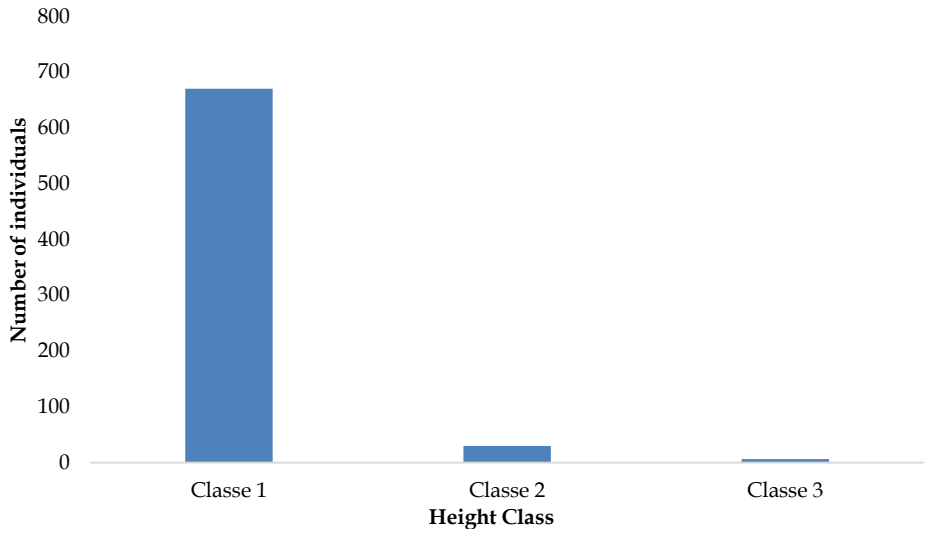

Figure 2. Ratio of the height of all species from the natural regeneration of the sampled populations, in the Bosque do IF Goiano fragment – Rio Verde campus, (**class 1**: individuals with a height of less than 2 m; **class 2**: individuals with a height of less than 4 m; **class 3**: individuals with a height of less than 8 m).

The six species that showed the greatest potential for natural regeneration, two of which are found in the three height classes, C. iguanaea and S. polyphylla, and four are found in two height classes, are C. sceptrum, G. americana, R. armata and S. appellata. They present a percentage of natural regeneration of approximately 80%, where four obtained higher values of importance. Species that have individuals in all height classes, have good conditions for their regeneration and establishment in the place, having a great potential to remain for a long period in the forest (Higuchi, 2003 and Pereira et al., 2001).

CONCLUSIONS

The Fabaceae, Bignoniaceae and Rubiaceae families are the most frequent in the sampled area, where the species S. polyphylla, C. iguanaea, R. armata, G. americana and D. alata stood out in all the analyzed parameters, thus being able to be considered indicators the formation of the future local forest. The species S. polyphylla, corresponds to 75% of the sampled species, its high number of individuals can be attributed to the fact that it is already reproducing in the area, it is pointed out as a pioneer plant because it has a great reproductive capacity and has a succession process Ecological, it reaches maturity and reproduces in a few years, and by producing large amounts of seeds annually, it guarantees its natural regeneration.

The species R. armata corresponds to 9.19%, found in few places and is a late secondary species. The species C. iguanaea, G. americana and D. alata correspond to 1.84%, 1.98% and 1.27% of the sampled species respectively. They are pioneer species that act in the initial processes of ecological succession, where the species C. iguanaea presents great value and high influence in the process of natural regeneration, the species D. alata has fast growth and low mortality rate and the G. americana is very frequent, the two, in addition to acting in initial secondary processes, can be late secondary.

Therefore, the species with the highest regeneration rates have good capacity due to the performance shown, and also due to the fact that most of them have a regeneration potential belonging to the initial stages of secondary succession.

CONFLICT OF INTEREST DECLARATION

The authors declare no potential conflict of interest in connection with the research, authorship, and/or publication of this article.

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