IMPACT OF *Bambusa tuldoides* MUNRO (POACEAE) ON FOREST REGENERATION

**ABSTRACT:** Bamboo grove may cause changes in the structure and floristic composition of natural regeneration. This study evaluated the impact caused by *Bambusa tuldoides* Munro at natural regeneration, in riparian forest in Rio Grande do Sul, south of Brazil. Two areas were evaluated: riparian forest without bamboos (SB) as the reference area, and riparian forest dominated by *Bambusa tuldoides* (CB). In 2014, ten plots (10x10 m) were installed in each area. All individuals belonging to classes I (30 ≤ H < 130 cm) and II (CBH ≤ 5 cm) were measured and identified. Floristic composition, phytosociological indexes, Shannon diversity index, Margalef richness, Simpson dominance, Sorensen similarity, and cluster analysis by Twinspan were evaluated. Richness and absolute density decreased in CB compared to SB. The areas presented low floristic similarity, and high dominance of one or more species in both classes. Myrtaceae was the predominant botanic family in SB, especially *Campomanesia xanthocarpa*. In CB most species were secondary, as *Myrsine umbellata*, *Cupania vernalis*, and *Ocotea puberula*. Due to the large differences between SB and CB, the groups formed were restricted mostly to the species of each area. Species such as *Myrsine umbellata* (class I and II) and *Strichnos brasiliensis* (class II) appear as indicators and former of groups in CB. We concluded that high density of *Bambusa tuldoides* affect the richness and diversity of regeneration natural, changing the establishment and perpetuation of the species. Secondary species show greater potential for adaptation to these environments and can act as key species in management and recovery actions.

IMPACTO DE *Bambusa tuldoides* MUNRO (POACEAE) NA REGENERAÇÃO FLORESTAL

**RESUMO:** Bambuzais podem acarretar alterações na estrutura e composição florística da regeneração natural. O presente trabalho avaliou o impacto causado por *Bambusa tuldoides* na regeneração natural de mata ciliar no Rio Grande do Sul, sul do Brasil. Foram avaliadas duas áreas: mata ciliar sem bambus (SB), como área de referência, e mata ciliar substituída por *Bambusa tuldoides* (CB). Em 2014, dez parcelas (10x10 m) foram instaladas em cada área. Todos os indivíduos pertencentes às classes I (30 ≤ H < 130 cm) e II (CBH ≤ 5 cm) foram identificados. Avaliaram-se composição florística, índices fitossociológicos, índice de diversidade de Shannon, diversidade de Margalef Dominância de Simpson, similaridade de Sorensen e análise de agrupamento por Twinspan. Riqueza e densidade absoluta foram menores em CB, comparativamente a SB. As áreas apresentaram baixa similaridade florística e alta dominância de uma ou mais espécies em ambas as classes. Myrtaceae foi a família predominante em SB, com destaque para *Campomanesia xanthocarpa*. Em CB, a maioria das espécies foram secundárias, como *Myrsine umbellata*, *Cupania vernalis* e *Ocotea puberula*. Devido às grandes diferenças entre SB e CB, os agrupamentos formados ficaram restritos, em sua maioria, às espécies de cada área. Espécies como *Myrsine umbellata* (classe I e II) e *Strichnos brasiliensis* (classe II) aparecem como indicadoras e formadoras de grupos em CB. Conclui-se que adensamentos de *Bambusa tuldoides* afetam a riqueza e diversidade da regeneração natural, alterando o estabelecimento e perpetuação das espécies. Espécies secundárias demonstram maior potencial de adaptação a estes ambientes, podendo atuar como espécies-chave em ações de manejo e recuperação.
INTRODUCTION

Natural regeneration is related to several processes to maintenance of vegetal communities as nutrients availability, opening of forest clearings and competition (MARIMON et al., 2010; SANTOS et al., 2012). Studies about natural regeneration are important to comprehend the forest dynamics and structure, helping in management and monitoring of environmental changes (LARPKERN et al., 2011; LIMA et al., 2012; FUKUSHIMA et al., 2015).

Dominance of invasive exotic species is one of the most evident impacts of anthropic changes in the distribution of vegetal communities. These species can interfere in ecological processes, such as seed rain, seed bank and species recruitment (TABARELLI; MANTOVANI, 2000; CAMPANELLO et al., 2007, ELIAS et al., 2015; LIMA et al., 2012). Bamboos are inhibitors of succession by model of Connell and Slatyer (1977).

Invasive species list from Rio Grande do Sul State (RS) presents bamboos species (SEMA, 2013). Nevertheless, there are other species, such as Bambusa tuloides Munro that, even not presenting invasive characteristics (SHIRASUNA et al., 2013), change the dynamics of natural ecosystems. In the RS, this species was introduced for productive purposes resulting in great densities, mainly in the metropolitan region (DA COSTA et al., 2015).

Bambusa tuloides is a species of medium-sized and pantropical distribution, forms clumps and is widely used in the production of cellulose and agglomerated panels (MORAIS et al., 2015; SPOLIDORO, 2008).

Current studies indicate that bamboos change forest structure, floristic composition and resilience of vegetal communities (ELIAS et al., 2015; FUKUSHIMA et al., 2015). Studies about natural regeneration in bamboo-dominated forest remnants allow show impacts in vegetal community and may to indicate restoration practices. These strategies are fundamental to ecosystems with low potential for natural regeneration, due to dispersal limitations (CHAZDON, 2012; HOLL; AIDE, 2011).

The present study aims to evaluate the impact of Bambusa tuloides in natural regeneration. The hypothesis of the research is that a natural regeneration in bamboo grove is reduced and its floristic composition altered.

MATERIAL E METHODS

Area

The study was carried out in areas of the company CMPC Celulose Riograndense, municipality of Eldorado do Sul, in Rio Grande do Sul, the southernmost state in Brazil. Two areas of riparian forest were evaluated, one area of reference without the presence of bamboos (SB) and the other dominated by bamboo grove (CB):

a) Reference area without bamboo (SB). Ecological corridor with approximately 10 ha, located at the coordinates 30° 9’14.51”S e 51°34’24.27”O. It presents advanced successional stage, with canopy of 18 to 20 m. It has eventual cattle grazing in the understory.

b) Bamboo grove (CB). Riparian forest degrade by bamboo grove. This area presents 2 ha and is located at the following coordinates 30° 9’26.89”S and 51° 35’31.78”W. The bamboos canopy presents in average 16 to 18 m, with an average density 1200 stems in each 10 m². This area presents solitary individuals of aldent trees.

The area of study is located in the Central Depression of Rio Grande do Sul and presents elements of Seasonal Forest, in area of contact between the Atlantic Forest and Pampa biomes. The soils are Haplic Cambisols of granite origin, with the presence of material of origin in the A and B horizons. The region presents humid Subtropical climate with dry summer (ST UMv) (ALVARES et al., 2013).

The bamboos were introduced in the region at the end of the 18th century for supply of raw material to Fábrica de Papel e Celulose Pedras Brancas (Paper and Pulp Mill Pedras Brancas), the first of this type in Rio Grande do Sul. The plantings extended until the 1960s, when the species was substituted by eucalyptus and black wattle. However, extensive areas dominated by the species remain until nowadays, taking the place of productive spaces and of permanent preservation areas (APPs).

Sampling

In 2014, ten sampling units of 10x10 m were systematically installed in the CB and SB areas. It was carried out the identification of all the individuals, present in the sample units of 10x10 m, belonging to two regeneration classes. In class I, individuals between 30 cm and 130 cm in height (30 ≤ H <130 cm) were sampled. For class II, individuals with circumference at the height of the breast (CBH) less than 5 cm (CBH≤5), regardless of height. Regenerating individuals of bamboo were not evaluated.

The identification of the species was performed directly in field and, when this was not possible, in the Herbarium of the Department of Forest Sciences (HDCF) of Universidade Federal de Santa Maria.

Data analysis

Density and absolute frequency for each sampled species were calculated, according to Mueller-Dombois and Ellenberg (1974). In determination of diversity, the
indexes of Shannon (H’) were used, submitted to the t- test of Hutescon (1970). Was calculated Margalef of richness (MAGURRAN, 1988) and Simpson dominance (BROWER; ZARR, 1984). For floristic similarity analysis throughout the environmental gradient it was used the Sorensen index (WOLDA, 1981).

For verification of group formation and indication of species for each cluster and sector, the method Twinspan was used (HILL, 1979), through matrix containing presence and absence data. The analysis was performed in PC-ORD program for Windows version 4.14 (McCUNE; MEFFORD, 1999).

RESULTS

The area with bamboos (CB) presented reduced number of individuals and species, comparatively with the area without bamboos (SB) (Table 1). The CB area did not present more than 10% of the total of sampled individuals, as well as it did not reach more than 50% of the richness verified in SB, for both classes of sampling.

### TABLE 1 Structure of natural regeneration between areas with and without bamboos (CB and SB).

<table>
<thead>
<tr>
<th>Variables</th>
<th>CLASS I</th>
<th>CLASS II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SB</td>
<td>CB</td>
</tr>
<tr>
<td>Total of individuals</td>
<td>1,408</td>
<td>85</td>
</tr>
<tr>
<td>Botanical families</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Species</td>
<td>62</td>
<td>27</td>
</tr>
<tr>
<td>DA (ind·ha⁻¹)</td>
<td>14,080</td>
<td>850</td>
</tr>
</tbody>
</table>

Where: SB = without bamboos; CB = with bamboo; class I = (30 ≤ H < 130 cm); class II = (CBH ≤ 5); DA = absolut density.

In SB/Class I, Campomanesia xanthocarpa presented the greatest number of individuals per ha (DA: 3230 ind·ha⁻¹, FA: 100), followed by Myrcya glabra (DA: 1730, FA: 80), Soroea bonplandii (DA: 1050, FA: 100) and Myrsine umbellata (DA: 980, FA: 100) (Tab. 2).

In CB/Class I, the species of greater importance was Cupania vernalis (DA: 140 ind·ha⁻¹, FA: 30) Ocotea puberula (DA: 130 ind·ha⁻¹, FA: 60) and Myrsine umbellata (DA: 120 ind·ha⁻¹, FA: 70) (Table 2).

For both areas, in class I, the Myrtaceae Family was the most representative, with 13 species in SB and six in CB.

In SB, in class II, Myrtaceae, again, was the most representative family (17 species). Species with the greatest distribution and density are Campomanesia xanthocarpa (DA: 2900 ind·ha⁻¹, FA: 100), Myrcya glabra (DA: 410 ind·ha⁻¹, FA: 80), m n (DA: 180 ind·ha⁻¹, FA: 70) and Trichilia elegans (DA: 160 ind·ha⁻¹, FA: 60) (Table 2).

In CB, the Sapindaceae family was the only one that presented two species and Myrsine umbellata was the most representative (DA: 60 ind·ha⁻¹ and FA: 40). We observe in this class, low richness, small quantity of individuals, with densities and frequencies well below the ones found in SB (Table 2).

Species dominance sensu Simpson exists in both areas (Table 3). For SB/Class I, species as Campomanesia xanthocarpa, Myrcya glabra, Soroea bonplandii and Myrsine umbellata presented together 47% of the total of individuals. In CB/Class I, Cupania vernalis, Myrsine umbellata and Ocotea puberula represented 45% of the sampled individuals. For the class II, Campomanesia xanthocarpa, represented 45% of the sampled individuals in SB and Myrsine umbellata, 23% in CB.

Based on the Margalef index, SB appears with greater diversity than CB in class I and II. Yet, when we analyze the diversity of Shannon we do not verify significant difference between areas (Table 3).

In relation to the floristic similarity we observe that for both areas, the similarity is low (0.36 in class I and 0.20 in class II) (Table 3).

In the formation of floristic groups, the class I (Figure 1) formed the group I (G1) in the first division, with self-value of 0.3248 and included only the parcels of SB area. Indicator species of this group was Trichilia elegans and Myrcia sp.

The second division presented self-value of 0.2261, and it did not represent ecological meaning, due to the homogeneity of data. The third division presented self-value of 0.6533, including only the parcels of CB area. Indicator species of this group was Myrsine umbellata, species that presented the greatest frequency in SB, presented in approximately 70% of the sampled area.

For the class II (Figure 2) the first division of self-value 0.5230 originated two groups. The first group gathered species belonging to the SB and CB areas. As preferable ones of this group there is species of the greatest occurrence in SB, such as Myrtaceae and Trichilia elegans in CB. In second division with self-value 0.5240, it was formed G2, with Strychnos brasiliensis as indicator species and also as preferable one. In G3, it was clustered only parcels and species of SB, with Campomanesia xanthocarpa as indicator and, as preferable ones, a great number of species of Myrtaceae.

DISCUSSION

The elevated importance of Myrtaceae, verified in both areas in class I, is characteristic of forest formations in Rio Grande do Sul, mainly in Seasonal Forest,
The impact of Bambusa tuldoides Munro (Poaceae) on forest regeneration

### TABLE 2: Species of class I (30≤H<130 cm) and class II (CBH≤5 cm) with greater representation in the areas.

<table>
<thead>
<tr>
<th>Species*</th>
<th>Family</th>
<th>DA</th>
<th>FA</th>
<th>DA</th>
<th>FA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campomanesia xanthocarpa (Mart.) O.Berg</td>
<td>Myrtaceae</td>
<td>3,230</td>
<td>100</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Cupania vernalis Cambess.</td>
<td>Sapindaceae</td>
<td>-</td>
<td>-</td>
<td>140</td>
<td>30</td>
</tr>
<tr>
<td>Eugenia uruguayensis Cambess.</td>
<td>Myrtaceae</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Maytenus dasyclada Mart.</td>
<td>Celastraceae</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Maytenus sp.</td>
<td>Celastraceae</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Myrcia globra (O.Berg) D. Legrand</td>
<td>Myrtaceae</td>
<td>1730</td>
<td>80</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Myrcia sp.</td>
<td>Myrtaceae</td>
<td>710</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Myrsine loefgrenii (Mez) Imkh.</td>
<td>Myrtaceae</td>
<td>440</td>
<td>90</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Myrsine umbellata Mart.</td>
<td>Primulaceae</td>
<td>980</td>
<td>100</td>
<td>120</td>
<td>70</td>
</tr>
<tr>
<td>Nectandra megapotamica (Spreng.) Mez</td>
<td>Lauraceae</td>
<td>350</td>
<td>90</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ocotea puberula (Rich.) Nees</td>
<td>Lauraceae</td>
<td>-</td>
<td>-</td>
<td>130</td>
<td>60</td>
</tr>
<tr>
<td>Psychotria carthaginesis Jacq.</td>
<td>Rubiaceae</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Psychotria sp.</td>
<td>Rubiaceae</td>
<td>750</td>
<td>90</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sorocea bonplandii (Baill.) W.C. Burger, Lanjouw &amp; Boer</td>
<td>Moraceae</td>
<td>1,050</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Strychnos brasiliensis Mart.</td>
<td>Loganiaceae</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Trichilia caesia C.D.C.</td>
<td>Meliaceae</td>
<td>750</td>
<td>70</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Trichilia elegans A. Juss.</td>
<td>Meliaceae</td>
<td>470</td>
<td>10</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Zanthoxylum rhoifolium Lam.</td>
<td>Rutaceae</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Total of plants**

<table>
<thead>
<tr>
<th>CLASS I</th>
<th>SB</th>
<th>CB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total of plants**</td>
<td>14,080</td>
<td>850</td>
</tr>
</tbody>
</table>

### TABLE 3: Floristic diversity and similarity of Class I (30≤H<130 cm) and II (CBH≤5 cm) in SB and CB.

<table>
<thead>
<tr>
<th></th>
<th>SB</th>
<th>CB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simpson</td>
<td>0.9084</td>
<td>0.9143</td>
</tr>
<tr>
<td>Shannon</td>
<td>3,013 a*</td>
<td>2,811 a</td>
</tr>
<tr>
<td>Margalef</td>
<td>5,627</td>
<td>2,900</td>
</tr>
<tr>
<td>Sorensen</td>
<td>0.36</td>
<td>0.20</td>
</tr>
</tbody>
</table>

*Values followed by the same letter in the line, by class interval, did not differ significantly by the Hutcheson test at the 0.05% error probability level.

Abbreviations: without bamboo (SB), with bamboo (CB).

Silvério et al. (2010) studying the impact of cluster of Actinocladum verticillatum bamboo over the woody vegetation of two physiognomies of Cerrado, also noted that the number of individuals, species, genera, families and densities were higher in areas without bamboos.

There are evidences that the bamboos inhibit the recruitment in all the classes of size, resulting of the low rate of incident luminosity, hydric stress, competition for humidity of soil and physical damages, caused by the excessive accumulation of litter in young plants (GRISCOM; ASHTON, 2002).

The low richness of species in CB indicates the difficult in formation of superior strata, affecting the local ecological succession, what hinders the reconstitution of the Permanent Preservation Area. The recruitment of individuals for superior classes is impaired, once that the presence of bamboos decreases the growth rate highlighting the riverside formations (MILANESI; LEITE, 2014; VENZKE, 2012).

The expressive difference in the structure and richness of vegetation between SB and CB can be related to the competition by resources (space, water and nutrients) (SILVÉRIO et al., 2010), reduction of incident luminosity (GRISCOM; ASHTON, 2002), among other alterations.
FIGURE 1 Groupings of forest regeneration present in class I (30 ≤ H < 130 cm) in areas SB and CB. Abreviations: Trichilia elegans (Tric ele); Myrcia sp. (Myrc sp); Actinostemon concolor (Acti conc); Allophylus edulis (Allo edu); Calliandra brevipes (Calli br); Campomanesia xanthocarpa (Camp xan); Cinnamomum amoenum (Cinnam); Cupania vernalis (Cupa ver); Dalbergia frutescens (Dalb fru); Myrcia glabra (Myr gla); Myrcia multiflora (Myrc mul); Myrsine loefgrenii (Myrs loe); Myrsine umbellata (Myrs umb); Nectandra megapotamica (Nect meg); Piper sp. (Pipe sp.); Psychotria sp. (Psyc sp); Gymnantes Kloetzianha (Seba bra); Sorococa bonplandii (Soro bon); Syagrus romanzoffiana (Syag rom); Symplocos uniflora (Symp uni); Trichilia caussenii (Tric cla); Trichilia sp. (Tric sp); Xylosma ciliatifolia (Xylo cil); Zanthoxylum rhoifolium (Zant rho); Melastomataceae (Melas);

FIGURE 2 Groupings of forest regeneration present in class II (CBH ≤ 5) in the areas SB and CB. Abreviations: Campomanesia xanthocarpa (Camp xan); Daphnopsis fasciculata (Daph fazz); Eugenia uruguayensis (Euge eru); Eugenia rostrifolia (Euge ros); Faramea montevidensis (Fara mon); Maytenus dasyclada (Mayt das); Myrcia glabra (Myr gla); Myrcia multiflora (Myrc mul); Myrciaria cuspidata (Myrc ca); Myrsine grandiflora (Myrs gig); Myrsine loefgrenii (Myrs loe); Myrsine umbellata (Myrs umb); Ocotea pulchella (Oco pulc); Gymnantes Kloetzianha (Seba bra); Sebastiania sp. (Seba sp); Sorococa bonplandii (Soro bon); Trichilia elegans (Tric ele); Strychnos brasiliensis (Stry bra); Nectandra megapotamica (Nect meg); Syagrus romanzoffiana (Syag rom); Xylosma ciliatifolia (Xylo sp).
Bamboo species may occupy the canopy of forest areas and hinder or hinder the development of native forest regeneration, causing a change in the structure and diversity of plant communities (CAMPANELLO et al., 2007, SANTOS et al., 2012, SANTOS et al., 2015, ELIAS et al., 2015) resulting in loss of biodiversity in tropical ecosystems (SILVÉRIO et al., 2009). Outside its natural habitat, the bamboos do not have natural predators, neither individuals that compete in equality for the capture of food and sun light, which can result in environmental imbalance in the place where this species was introduced (DA SILVA et al., 2011).

In relation to the ecological indexes, the dominance of Campomanesia xanthocarpa and Myrsine umbellata in SB and CB areas. The relevance of Myrsine umbellata in the inhospitable CB environment characterizes it as strongly tolerant and therefore valuable for use in ecological restoration in environments with inhibitory vegetation (CONNEL; SLATYER, 1977).

Margalef index, which has as basis the numerical distribution of different species, shows greater diversity of SB in class I and II. In relation to diversity, Margalef index, which has as basis the numerical distribution of different species, we observed greater diversity of WB in class I and II. Kaneski et al. (2012) obtained index of 3.81 for the forest regeneration and considered the area with low specific richness.

The diversity of Shannon probably was not significant due the expressive number of rare species in WB. The low similarity in areas of the same forest typology and spatially near with each other can be explained by the presence of bamboos, once that these ones change the establishment and development of a great number of native species (LIMA et al., 2007) generating competition for resources, continuous shading and allelopathic effects (GRISCOM; ASHTON, 2002).

Studies about the influence of bamboo in forest succession in China (TAYLOR; ZISHENG, 1988) and in Japan (TANAKA, 1988) attributed the low density of trees, seedlings and young plants to the reduced levels of occurring light in the low story of bamboo. The light is not the only factor of restriction of forest succession in these environments, factors as density of clumps, competition for nutrients and allelopathy can exert negative effect in floristic composition, micro-climate and structure of litter (GRISCOM; ASHTON, 2006).

In relation to the floristic groups, the indicator species of G1, Trichilia elegans and Myrcia sp., observed in great density and frequency throughout the whole WB sector belongs to abundant genera in low story of seasonal forest (VENZKE, 2012; BÜNDCHEN et al., 2015).

Trichilia elegans exerts influence in forest succession, and it is found with elevated density and frequency in the regeneration of seasonal forests (STAGGEMEIER; GALETTI, 2007). The preferable ones of G1 are abundant in low story of late forests (TABARELLI; MANTOVANI, 2000; KOCH et al., 2010).

In G2, Myrsine umbellata, the indicator species can be related to their ecological characteristics, which defines who understory species of great ecological plasticity (SANTOS et al., 2012), therefore adapted to the shaded environments. Densification of bamboos affects the development of pioneers and initial secondary species, as far as it causes the decreasing of light rate and closing of canopy in tropical forest (TABARELLI; MANTOVANI, 2000; CAMPANELLO et al., 2007).

In Montane Atlantic forest in southeast of Brazil, the more tolerant species to densification of bamboo belong to Ocotea and Myrsine, due to its characteristics of ecological adaptability (TABARELLI; MANTOVANI, 2000). Among the preferable species we highlight Cupania vernalis, occurring both within the forest, at a more advanced stage of forest succession (ÁVILA et al., 2011).

In class II, Myrsine umbellata presented significant occurrence in both areas, while Campomanesia xanthocarpa was the most representative species in SB, both indicators of G1. As preferable ones of this group there is species of greater occurrence in SB, such as Myrtaceae and Trichilia elegans in CB.

In G2, Strychnos brasiliensis, indicator and preferable species appears as the only species occurring in the parcels eight and nine of CB. Campanello et al. (2007) also found Strychnos brasiliensis in the regeneration of semi-seasonal forest dominated by bamboos and lianas, and it is one of the most representatives in this environment.

Species that is resistant to the shading environment such as Myrsine umbellata and Strychnos brasiliensis, can be important in the process of management and recovery of areas dominated by bamboo. Bitarhó and McNeilage (2007) highlight that secondary forest species contributed to the decrease of forest cover of bamboos in Bambuno, southwest of Uganda.

In G3, we highlight the importance of Campomanesia xanthocarpa in the formation of groups, which can be related to its good adaptation in environments with periodic flooding, typical of riparian forest (CARVALHO; NAKAGAWA, 2000). Besides that, the production of fruit in great quantity and very appreciated by the wild fauna (CARVALHO; NAKAGAWA, 2000) contributes to the species to have great dispersion in the area.
CONCLUSION

*Bambusa tuldoides* impacted the forest regeneration. Establishment and recruitment of native species were reduced.

The richness and diversity of natural regeneration were affected by the presence of bamboos. Secondary species demonstrates greater potential of adaptation in environments dominated by bamboo grove, and it can act as key-species in future actions of management and recovery.

REFERENCES


