BAMBOO IN THE AREA OF SUMATRA INSTITUTE OF TECHNOLOGY AND ITS POTENCY IN LANDSCAPE GARDENS

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ABSTRACT

A study to inventory the bamboo species that originally grew in about 275.52 Ha area of the campus Sumatra Institute of Technology (ITERA) Lampung conducted by the census method. The results obtained 17 clumps of bamboo that have been identified as three species and classified into two genera. They were *Bambusa* (*Bambusa glaucophylla* and *B. multiplex*), and *Dendrocalamus* (*Dendrocalamus asper*). However, there is also one more species, namely *B. vulgaris* var. *waminii*, that planted in a pottery in the nursery of the ITERA Botanical Garden. The information about bamboo species provided in the taxonomical descriptions and a determination key. The potency of those bamboos in a landscape garden was analyzed as a live fence, planted as a focal point, and canopy or giving shade effects. Each species has different potency since it has unique morphological features.

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1. Introduction

Bamboos belong to the family of grasses (Poaceae, Bambusoideae). Nevertheless, no one would argue that bamboo is one of the important economic grasses and has a million of potency. A total of 1439 species of bamboo in the world (Clark, 2012). Indonesia has more than 176 species of bamboo, including 140 native and 105 endemic species that only occur in the country (Widjaja, 2018). The data recorded by Widjaja (2017) showed that Indonesians regularly utilize 81 species of bamboos for their traditional daily requirements, and also for industrial purposes.

One of the increasingly popular uses of bamboo today is to build thematic gardens. The thematic gardens in Indonesia that using bamboo as the elements in landscape, such as Ecopark in the Campus of Cibinong Science Center (Center for Plant Conservation, Botanic Gardens LIPI, West Java) and Taman Eden 100 (Toba Samosir Regency, North Sumatra) (Damayanto *et al.,* 2019; Damayanto, 2018). The most favorite garden is built with an eco-friendly design. Bamboo seems to be matched to fulfill this purpose. Architects, designers, artists, botanists, and gardeners continue to develop their creative abilities in discovering further ways to utilize bamboo as an interior ornament as well as the ornaments in the landscape.

The Sumatra Institute of Technology (ITERA) is an educational institution that focused on developing a green forested campus and committed to builds the first botanical garden under a university in Indonesia. Before it was opened, this campus area was a rubber plantation in the 70s which was managed under PT. Perkebunan Nusantara. The habitat type of the campus ITERA is a dry lowland habitat. The flooded swamps in the basin are usually appeared during the rainy season due to poor drainage. Nowadays, there is no information about the bamboo species in the campus area, while this data needed as basic information, especially for ITERA botanical garden. The ITERA Botanical Garden has been designed to have a bamboo thematic zone, forthcoming.

The aim of this study is to observe and inventory of bamboo species that originally grew in the area of campus Sumatra Institute of Technology (ITERA), Lampung. In addition, it aims to analyze the potency of bamboo in a landscape garden. The information about bamboo species that suitable to grow in this area and their potency were useful for planning and developing a bamboo thematic garden.

2. Methods

The research conducted from September to October 2019. Inventarization of bamboo was carried out at the Sumatra Institute of Technology area about 275.52 Ha. This area spreads into three zones: the academic zone, plan site of botanical garden and arboretum zone, and the dormitory zone (Figure 1).

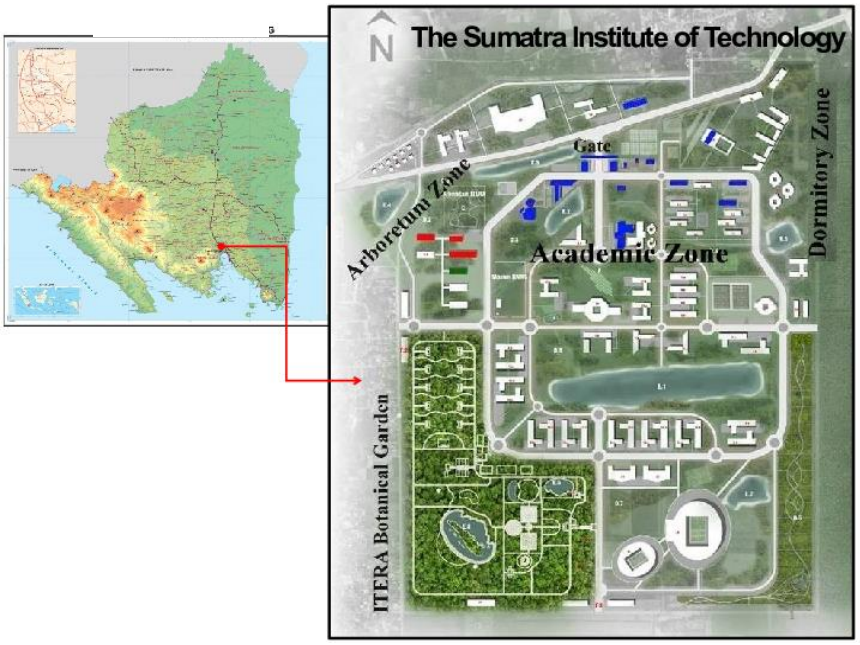


Figure 1. The area of campus Sumatra Institute of Technology (ITERA), Lampung.

The data of bamboo species were inventoried using the census method, which is counting all the bamboo clumps encountered (Rugayah, et al. 2004). The data were er, collector name, and some records supporting. information such as location, coordinates, collection date, local name, and morphological features.

A sampling of bamboo material is only done in one clump in a group of bamboo clumps that grow close together. The bamboo clumps are given a tagging with its scientific name, local name, and collection number. Identification of bamboo species carried out based on morphological characters and refers to Ervianti *et al.* (2019), Widjaja *et al.* (2005), Widjaja (2001a), Widjaja (2001b), and Widjaja (1997).

3. Results

Based on the results of the study obtained 17 clumps of bamboo in the area of campus Sumatra Institut of Technology (ITERA). They have identified 2 genera that consist of 3 species of Bamboo, namely *Bambusa* (*Bambusa glaucophylla* and *B. multiplex*), and *Dendrocalamus* (*Dendrocalamus asper*). However, there is also one more species, namely *B. vulgaris* var. *waminii*, that grew in pottery in nursery of the ITERA botanical garden. All species found are shown in Table 1.

Table 1. Bamboo species found in the area of campus Sumatra Institute of Technology (ITERA), Lampung

Genus	Scientific name	Local name	No. culms	Location
Bambusa	*B. glaucophylla*	Bambu Putih	1	5°21'48.2"S 105°18'40.2"E Arboretum zone
	B. multiplex	Bambu Cina /	15	5°21'37.5"S

		Bambu Pancing		105°18'37.9"E Arboretum zone
	B. vulgaris var. *waminii*	Bambu blenduk/Budha's belly	1	Nursery of ITERA Botanical Garden
Dendrocalamus	*D. asper*	Bambu Petung	1	5°21'28.5"S 105°18'53.6"E Academic zone

All of those clumps spread in two zones: academic zone and arboretum zone. The location of each bamboo species shown in figure 2. The academic zone located in Way Huwi village, District of Jati Agung, South Lampung. Meanwhile, the Arboretum zone located in Sabah Balau village, District of Tanjung Bintang, South Lampung.



Figure 2. The location of Bamboo species found in the Sumatra Institut of

4. Discussion

Landscape Architecture Perspectives

In any landscape gardens, bamboo can be used as a material to build hard elements of the garden or becoming a fascinating soft element of the garden. In this discussion, we would be focusing on the potency of bamboo as soft elements (landscape architecture perspectives). Based on its potency in landscape architecture, the bamboo clumps in the area of campus Sumatra Institut of Technology (ITERA) Lampung divided into three groups: live fence, planted as a focal point, and canopy / giving shade effects.

First is the bamboo that can be used as a live fence and hedges. *Bambusa multiplex* is the one that can be used as fencing in the border of the arboretum zone. Using the bamboo as a live fence will give multiple benefits because bamboo has ecological functions as pollutants absorbent and deliver more Oxygen to the environment. There is no information

about when this species has been planted, but it seems that they were originally grown since the beginning of the campus was built at 2012. The clumps are growing without maintenance and spread naturally until now the number of clumps achieved 15 clumps.

Second, the bamboo which potential as ornamental plants. They were *B. glaucophylla* and *B. vulgaris* var. *waminii*. *Bambusa glaucophylla* well-known as bambu putih, due to it has white stripes on the leaves. The clumps of *B. glaucophylla* is relatively small, short internodes, easy to pruned to build shape (as a topiary plant). Since it has a unique color, the topiary bamboo can be used also as an eye-catching focal point in the landscape. Whereas the *Bambusa vulgaris* var. *waminii* well-known as bambu blenduk or Budha's belly bamboo because its dwarf and swollen stem (internodes). Blenduk in the Javanese language means swollen. It looks like a Budha's belly and it absolutely has an aesthetic value. Those species of bamboo should not be planted together with other plants in the same pottery or in the range of 1 m^2 area.

Third, the bamboo which potential as shade and canopy plants. Some species have more ecological value rather than aesthetics. *Dendrocalamus asper* is too large to be planted in the main area of the garden, but it suits to be planted as a canopy on the edge of the garden. Its erect clump with drooping tips will give a good shadowing effect and match perfectly with a little pool.

Study of public perceptions against the value of bamboo thematic garden carried out using a questionnaire by Nabilah *et al. (*2020). The questionnaire spread to a total of 120 respondents from various backgrounds and analyzed using simple statistical methods. The results show that 95.1% of respondents agreed that a bamboo garden has good aesthetic value. The results that were led to the elucidation of the function of bamboo in the landscape elements showed 48% of respondents said bamboo makes a strengthen visual framework in a landscape (thus the selective species of bamboo should be planted as the main plants). Furthermore, 25% of respondents prefer bamboo used as hard elements of the garden (to build a bridge, shelters, and the frame of pergola), and 20% of respondents said that bamboo tends to be only a complement to the beauty of other plants (the existence of the bamboo itself, in the landscape, is not really mattered).

The responses of respondents seeing bamboo to be planted as a soft element of the garden for the very first time were also recorded. A total of 56% of respondents gave their assessment that bamboo greatly strengthened the natural impression to the garden, 23% of respondents assess that bamboo gave a classical impression to the garden, and the rest gave other assessments (mystics, dangerous, darkness).

Taxonomical Treatments

Key to the bamboo species that originally grew in the area of campus Sumatra Institut of Technology (ITERA), Lampung:

1. a. *Culm* erect, diameter around 1 – 2.5 cm, thin walls, branching just above the ground……..... 2
   b. *Culm* erect with drooping tips, diameter 10 to 15 cm, thick walls, branches on the middle culm……..……...……..... ***Dendrocalamus asper***

2. a. Internodes 8 – 10 cm long, *culm sheath* deciduous, covered by brown to black hairs, auricles rounded and slightly curved outward, ligule entire..... ***Bambusa glaucophylla***
   b. Internodes 30 – 50 cm long, *culm sheath* sometimes deciduous or persistent glabrous, auricles rim like, ligule laciniate..... ***Bambusa multiplex***

Description of genus and species:

***Bambusa* Schreb.**
Genera Plantarum ed. 8. (1789)

Closely tufted bamboo. Culms erect with a relatively thick wall. Branch complement with one dominant lateral branch and several secondary branches or subequal branches, usually smaller. Culm sheath glabrous or covered with brown to black hairs, with well-developed auricle, blades erect, triangular.

Distribution. Native to Southeast Asia, China, Taiwan, the Himalayas, New Guinea, Melanesia, and the North Australia. This genus also reported naturalized in other regions, e.g., Africa, Latin America, and various oceanic islands.
Habitat. Any soil from the limestone, river bank, dry to wet climate.

***a. Bambusa glaucophylla* Widjaja**
Reinwardtia 11: 59 (1997)

Shoots green, glabrous or covered by brown hairs. Culms 1.5 – 2 m tall, straight, green with brown hairs when young becoming old, glabrous, internodes 8 – 10 cm long, diameter around 1 cm; branching just above the ground, branches one dominant lateral branches with several smaller branches, branches 3 – 5 at each node. *Culm sheath* deciduous, covered by brown to black hairs; auricles small rounded and slightly curved outward, 2 – 3 mm tall, with long bristles, 2 – 3 mm long; ligule entire, until 1 mm tall, glabrous to minutely hairy on edge; blade erect, triangular, base narrow, adaxially glabrous. *Leaves* 15 – l7 cm x 1-1,4 cm, green with longitudinal white stripes, glabrous; *leafsheath* sometimes with black to white hairs, auricles rounded and out curved, glabrous; ligule entire, glabrous.

Location. Planted as a median garden in circle road through to the west gate (coordinate 5°21'48.2" S and 105°18'40.2" E). Grow in a fully open space and windy. However, it can be grown well in containers or indoors with adequate lighting also.
Vernacular name. Bambu Putih (Indonesia)
Uses. Ornamental Plants

b. *Bambusa multiplex* (Lour.) Raeusch. ex Schult.
Syst. Veg. 7: 1350 1830.

Shoots green, glabrous. Culms until 6 m tall, straight, green with white wax when young becoming glabrous when old, internodes 30 – 50 cm long, diameter up to 2.5 cm; branching near the ground, branches 5 – 6 at each node with subequal branches. *Culm sheath* sometimes deciduous or persistent, glabrous; auricles rim like, very small to

inconspicuous, with short bristles; ligule 1 – 1.5 mm long laciniate, glabrous; blade erect, triangular with broadly base. *Leaves* 1.6–16 × 0.3–1.6 cm, green with clearly white stripes on the adaxial, abaxial rare hairy; *leafsheath* small, bristles, ligule denticulate or laciniate, glabrous.

Location. In the South and East border of Arboretum (coordinate 5°21'37.5" S and 105°18'37.9" E). Grow in flooded place around gutter of laboratory complex buildings, sunny space.
Vernacular name. Bambu cina, bambu pancing (Indonesia)
Uses. Ornamental Plants, the hedges and fences

Dendrocalamus Nees
Linnaea 9: 476 (1835)

Culms erect never climbing. Young culm covered with velvety brown hairs, some with white wax, *branches* with one dominant lateral branches and several smaller branches. *Culm sheath* with blades deflexed, triangular; culm sheath auricles rounded; leafsheath auricles rounded.

Distribution. India, Indochina, southern China, Southeast Asia (Malay Peninsula, Philippines, Sumatra, Jawa, Borneo, Sulawesi, Moluccas, New Guinea).
Habitat. Secondary forest or in cultivation.

***c. Dendrocalamus asper* (Schult.) Backer**
Nutt. Pl. Ned.-Ind.ed. 2,1: 301 (1927)

Shoot green with velvety dark brown hairs. *Culm* erect with drooping tips, diameter 10 to 15 cm, thick walls. *Branches* one lateral dominant with several smaller branches, 4-7 branches on the middle culm. Lower young culm glabrous, Upper young culm covered with white wax. *Culm sheath* deciduous, hairy, hairs brown to black; auricles rounded with bristles 5-10 mm long; ligules 8-10 mm high, dentate irregular; blade deflexed, lanceolate. *Leaves* glabrous, apex acuminate, base rounded and briefly constricted; *leafsheath* auricles rounded, bristles absent; ligules entire. Inflorescence not seen.

Location. Nearby the gate, shading area (coordinate 5°21'28.5" S and 105°18'53.6" E).
Vernacular name. Bambu betung, petung.
Uses. Building material, the bridge, and hard element in landscape garden.

5. Conclusion

The bamboo species in Sumatra Institute of Technology has been recorded two genera and consists of three species. They were *Bambusa* (*Bambusa glaucophylla and B. multiplex*), and *Dendrocalamus* (*Dendrocalamus asper*). Those species of bamboo have a great potency as a soft element in the eco-design landscape garden. The bamboo clumps separated into three different groups of function: live fence, planted as a focal point, and canopy / giving shade effects. In the future, the authors recommend doing well-maintaining of the

bamboo clumps and planting more bamboo, both to ornament landscape or ecological purposes, to whom it may concern to develop green areas on campus.

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