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"The Project for Producing Biomass Energy and Material through Revegetation of Alang-alang (*Imperata cylindrica*) Fields"

Identification Tree Health in The Cimory Riverside Natural Tourism Development Area

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Abstract

Cimory Riverside is a natural scenery restaurant in Puncak Bogor. It has tourism development based of nature tracking priority that will soon be in open to public. The purpose of this research was to identify the tree health in the natural tourism development area. The method used is pursosive sampling based on vulnerability level tree with a Forest Health Monitory (FHM) and Picus Sonic Tormograph. The result showed 31 trees are identified proneness of different species. The average healthy tree condition grows normally, but is growing sloping and high canopy load. Two species of *Falcataria moluccana* (Miq.) Barneby & J.W.Grimes (Sengon laut) recomended for cut down. 13 trees are recommended for pruning to make the canopy lighter and minimize the risk fallen tree. The rest 16 trees otherwise normal but need to check routinely. While the results of checking used a Picus Sonic Tormograph, *Eucalyptus alba* Reinw. ex Blume tree experienced holes at the height of 0-120 cm vulnarable area to visitors. The final result of identification healthy tree is handling in accordance with recommendations and checking periodically to minimize the risk fallen tree.

Keywords: Tree Health, Forest Health Monitory, Picus Sonic Tormograph, Cimory Riverside

1. Introduction

Cimory Riverside is one of tourism sites which developing as natural ecotourism. It is managed by a private company. The area manager of Cimory Riverside develops this area become a tourism forest as one of natural attractions in Bogor, West Java. It is also designed as an environmental education. It has many heterogeneous trees collections which arranged multi-strata. Arrangement trees have varies in diameter and height, from small until large sizes tree.

Arboriculture is a sciences which related to trees management. One of the arboriculture focuses is tree health analysis technique. Tree health analysis is important factor for forest management, especially urban forest and tourism forest. Urban forests and tourism forests have high intensity visitor accessibility and more important function in environmental. Arboriculture has important role for minimizing tree risk damage, maintaining visitor safety and infrastructure. Arboriculture, trees cultivation and agroforestry are equally carried out through manipulating, forest ecosystems and forest resources [15] by a society, leave few, if any traditional archaeological remains. Successful research into arboriculture and agroforestry has used multiple lines of complimentary research in Pacific [1], [6]. Security and safety are important aspect in natural tourism management. Trees are routinely controlled for certain period to find out risks existence and minimizing fallen trees.

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Intensity trees with a large diameter and shape can influencing area microclimate. On the other hand, large trees also have high risk such as breaking, falling or collapsing. Broken, fallen or collapsed trees are dangerous threats to visitors. Intensity of community visits to tourism forest is quite high, especially on holidays. Large visitors number also increasing the risk of casualties in fallen tree accident. There are no trees that completely safe, considering the possibility of very strong wind damage or subvert trees mechanically. Therefore, it can be identified if there is some danger from defects or prone trees characteristics [8], [13]. Trees health inspection and monitoring in accordance with rules of culture to maintain the tree's health by performing steps of controlling, facilitating, protecting and salvaging [12]. Tree health analysis is key factor for maintaining safety. The purpose of this research was to identify the tree health in Cimory Riverside natural tourism development area.

2. Materials and Methods

The study was conducted in Cimory Riverside natural tourism area, Bogor Regency at July 2017. The method used was pursosive sampling based on the vulnerability level of the tree. Several criteria were used to choose the tree as the sample, such as have indications of damage, large diameter and located in high accessibility locations. Trees that have risk of collapse and potentially damage were also checked. So, samples observed in this research were 31 tree. Observations were done in two stages. First, visual observations were carried out using a tree health observation form (Appendix 1), a modification of the observation form introduced by International Society of Arboriculture (ISA). Observations divided into 3 visual sub-sections; i.e crowns, stems and roots. The second stage, the unhealthy trees were checked using the picus sonic tomograph to get more accurate observations. Then, the result was used for making a treatment recommendation to be taken on the trees.

Sonic Tomograph and Arborsonic are tools which can be choosen and develop for supporting tree health assessment. Some products and techniques used to help detect and assess tree damage. Some reviews this method can be seen in some literature [5], [7], [9], [10]. Tools and techniques such as resistographs, drilling and temporary increments are carried out by drilling on the bark to touch xylem [2], [14], this can cause damage to the skin and initiation pest or disease attacks [5]. Sonic Tomograph technique was developed as a method without damage to quantify and locate wood decay [4]. It produce images based on transmission of the sound wave.

3. Results and Discussion

The results shown the varied conditions 31 sample trees (Table 1). The sample consist of 11 different family members. Most tree samples are member of family Myrtaceae (23%), followed by Bignoniaceae (19%), Leguminoceae (10%), Moraceae (10%) and Pinnaceae (10%). Other families have a smaller percentage such as Araucariaceae, Meliaceae, Lamiaceae, Phyllantaceae, Rhamnaceae and Urticaceae (Figure 1).

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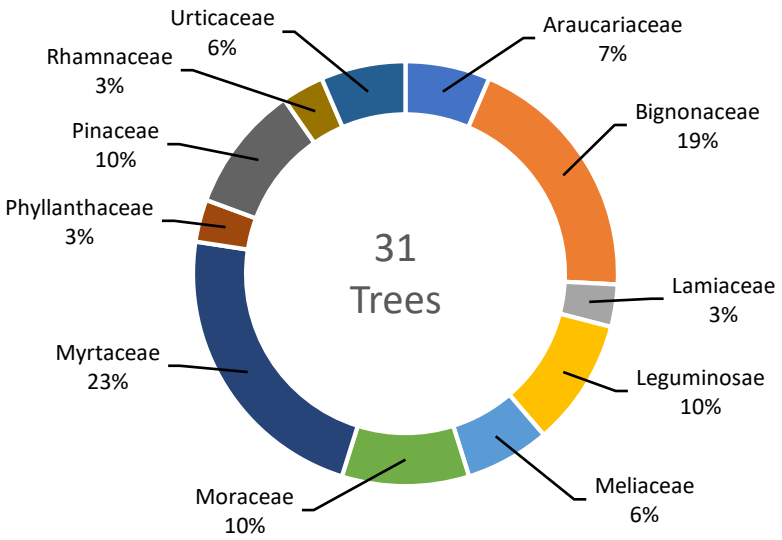

Figure 1. Family of sample trees in Cimory Riverside natural tourism developed area, Bogor.

Based on the visual observations using tree observation form, most sample trees are in good condition. The trees have normal condition on their canopy, stem and root. No signs of disease or damage were found (Table 1). Two *Falcataria moluccana* trees conditions are quite dangerous. They are recommended to be cutting down (Table 1). The first *F. moluccana* is tilted and attacked by pest. The other one is in good condition but the root is raised which maybe caused by soil instability. The other factor that make worsens situation are those two trees have large diameter and located in high visitor accessibility area.

Thirteen trees have unfavorable conditions but have a low level of danger (Table 1). The trees are advised to get light treatment such as pruning, cleansing pests and cleansing epiphytes. Those treatment are carried out to minimize fallen trees or broken branches. Sixteen trees have good conditions with a low level of danger. They only needs periodic checks to monitor the developing of their damage (Table 1).

Table 1. Tree samples condition in Cimory riverside natural tourism developed area, Bogor.

No	Species sample	Family	Condition	Management advice
1	*Falcataria moluccana* (Miq.) Barneby & J.W.Grimes	Leguminosae	roots lifted	Cut down
2	*Falcataria moluccana* (Miq.) Barneby & J.W.Grimes	Leguminosae	Main stem has many holes from pest attack, main stem has slope ± 75°	Pruning (load reduction) or cut down
3	*Antidesma bunius* (L.) Spreng.	Phyllanthaceae	Many holes at branch	Prune hollow branch
4	*Cecropia pachystachya* Trécul	Urticaceae	decay on branch	Prune decay branch

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No	Species sample	Family	Condition	Management advice
5	*Cecropia pachystachya* Trécul	Urticaceae	Normal, main stem has slope ± 84°	Pruning (load reduction)
6	*Eucalyptus alba* Reinw. ex Blume	Myrtaceae	Main stem hollow	Pruning (load reduction)
7	*Eucalyptus alba* Reinw. ex Blume	Myrtaceae	Indicated hollow main stem	Pruning (load reduction)
8	*Spathodea campanulata* P.Beauv.	Bignonaceae	Many epiphytes such as Araceae and Seflera	Epiphytes cleaning and pruning (lightly pruning)
9	*Spathodea campanulata* P.Beauv.	Bignonaceae	Many epiphytes such as Araceae and Seflera	Epiphytes cleaning and pruning (lightly pruning)
10	*Spathodea campanulata* P.Beauv.	Bignonaceae	Dangerous at upper side branch	Pruning (load reduction)
11	*Spathodea campanulata* P.Beauv.	Bignonaceae	V form branch	Pruning (load reduction)
12	*Spathodea campanulata* P.Beauv.	Bignonaceae	V form branch, Indicated hollow main stem	Heavy pruning (load reduction)
13	*Spathodea campanulata* P.Beauv.	Bignonaceae	Normal, main stem has slope ± 69°	Pruning (load reduction)
14	*Swietenia mahagoni* (L.) Jacq.	Meliaceae	Normal, Many epiphytes	Periodically checking and epiphytes cleaning
15	*Pinus merkusii* Jungh. & de Vriese	Pinaceae	Normal, termite attack (*Macrotermes* sp.)	Periodically checking and termites cleaning
16	*Swietenia mahagoni* (L.) Jacq.	Meliaceae	Normal	Periodically checks
17	*Agathis dammara* (Lamb.) Rich. & A.Rich.	Araucariaceae	Normal	Periodically checks
18	*Agathis dammara* (Lamb.) Rich. & A.Rich.	Araucariaceae	Normal	Periodically checks
19	*Artocarpus camansi* Blanco	Moraceae	Normal	Periodically checks
20	*Artocarpus camansi* Blanco	Moraceae	Normal	Periodically checks
21	*Artocarpus elasticus* Reinw. ex Blume	Moraceae	Normal, main stem has slope ± 82°	Periodically checks
22	*Eucalyptus alba* Reinw. ex Blume	Myrtaceae	Normal	Periodically checks
23	*Eucalyptus alba* Reinw. ex Blume	Myrtaceae	Normal	Periodically checks
24	*Eucalyptus alba* Reinw. ex Blume	Myrtaceae	Normal	Periodically checks
25	*Eucalyptus alba* Reinw. ex Blume	Myrtaceae	Normal	Periodically checks
26	*Eucalyptus alba* Reinw. ex Blume	Myrtaceae	Normal, cracked bark	Periodically checks

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No	Species sample	Family	Condition	Management advice
27	*Falcataria moluccana* (Miq.) Barneby & J.W.Grimes	Leguminosae	Normal	Periodically checks
28	*Gmelina* sp.	Lamiaceae	Normal	Periodically checks
29	*Maesopsis eminii* Engl.	Rhamnaceae	Normal	Periodically checks
30	*Pinus merkusii* Jungh. & de Vriese	Pinaceae	Normal	Periodically checks
31	*Pinus merkusii* Jungh. & de Vriese	Pinaceae	Normal	Periodically checks

Picus Sonic Tormograph analysis on *Eucalyptus alba* Reinw. ex Blume showed damage in its main stem. Sonic tomograph checks was carried out on *E. alba* trees because these trees have important values as ornamental tree and shading tree in the area. This check was carried out to get more detailed analysis. The main stem was estimated have a hole at 0-120 cm high. The given recommendation was major pruning to reduce tree loads and risk of collapse.

Table 2. Parameter observed on the tree samples in Cimory riverside natural tourism developed area, Bogor.

Stem Diameter (cm)	Amount	Tree High (m)	Amount	Tree Crown width (m)	Amount
<=30	5	<=10	1	<=5	3
31-40	5	11-15	6	6-10	19
41-50	5	16-20	15	11-15	7
51-60	5	21-25	9	16-20	2
61-70	5	>25	0	>20	0
71-80	5				
>80	1				
Total	31		31		31

Tree health analysis is very important for several reasons. Trees are one component of biotic factors which make important role for humans in ecosystems. The role of trees becomes greater in urban areas having functions as city identity, air pollution absorbers, noise absorbers, micro climate regulators, wind filters, soil conservation and city decorators [11]. Leaves can absorb noise up to 95%. The most effective types of plants that have thick canopy with shady leaves [3].

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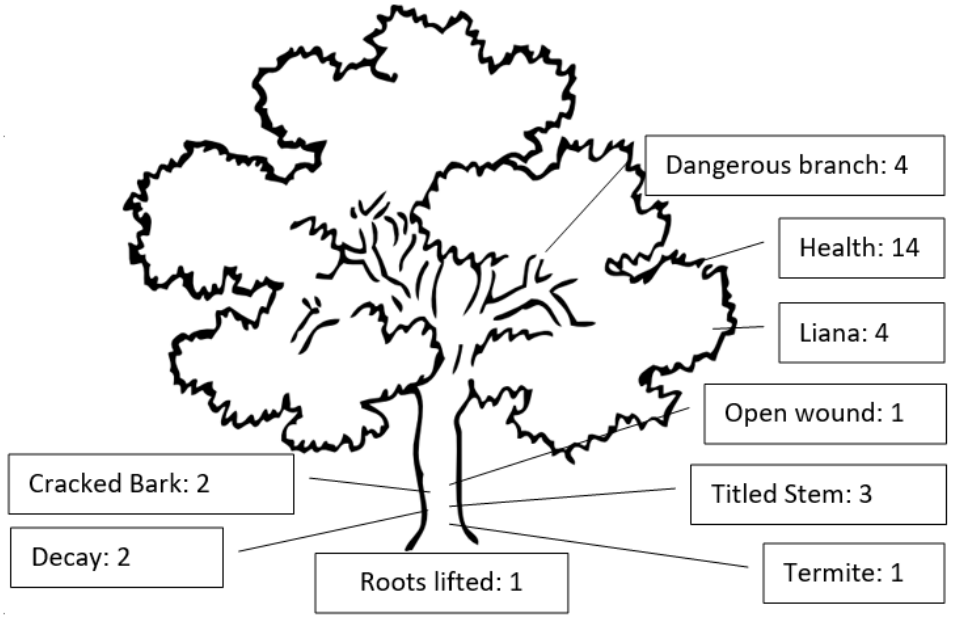

Figure 2. Map and number of tree damage locations

Correlation value analysis was carried out to determine the relationship between diameter, height, crown-width and tree health conditions (Table 3). Correlation values between any parameters vary between parameters. The strongest correlation is between height and tree diameter, which is 0.22. Besides correlation of these parameters is smaller. This value shown that correlation is not too strong. Four parameters can be stated as not having a close relationship. Trees which have larger diameter, higher tree and wider crown does not necessarily indicate more unhealthy.

Table 3. Correlation analysis between parameter observed on tree samples in Cimory riverside natural tourism developed area, Bogor.

Parameter	Stem Diameter	Tree High	Tree Crown width	Tree health Condition
Stem Diameter	1			
Tree High	0.22*	1		
Tree Crown width	0.13*	-0.01*	1	
Tree health Condition	-0.20*	-0.11*	0. 01*	1

* Correlation value is not too strong

Environmental based development is a very important factor on rapidly development of infrastructure and technology. The development of ecotourism areas such as Cimory riverside must continue to be supported. This is intended to increase green open space in urban area. Green open space is an important requirement for people living in urban areas. Green open space is one component of the landscape which serves as guardian of environmental balance in urban areas. Green open space is one of the people's choices in socializing, recreation and other activities. Green open space is also useful as an environmental quality indicator and comfort area indicator.

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4. Conclusion

There were 31 observed trees. Two *Falcataria moluccana* trees were recommended to be cut down, their condition were dangerous for the visitors in Cimory riverside natural forest development area. Pruning and cleansing of disease or pests were remommended on 13 trees. *Eucalyptus alba* tree indicated decay at 0-120 cm high.

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