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The Use Of Tree Architecture Models On The Landscape Arrangement Pattern To Manage Micro Environment In Universitas Tadulako

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ABSTRACT

Introduction : Microclimate is one of the environmental sciences related to plants in an area. This science describes the climatic conditions of the environment that have living organisms around it, either close to the surface of the earth or in confined environments such as a room, factory, and greenhouse. Measured the scale of studies of microclimate and environmental-climate vertically ranging from 1 meter to 2 meters. This research study used a field survey method by collecting environmental temperature data and observing tree architecture models growing in the campus area of Universitas Tadulako. The results of the study confirmed the most effective tree architecture models in minimizing the ambient temperature by investigating the aesthetic criteria of tree structures and characteristics in the campus environment of Universitas Tadulako. The researchers adopted the survey method by directly analyzing the conditions in the field using quantitative data to measure the tree architecture model existing. Mahogany tree seems to absorb more radiation on its leaves which are rather wide compared to other trees. Palm oil productive plants require water every day 10 liters per tree but does not have the effect of absorbing radiation from field measurements. For the average wind speed on campus based on observations with an average measuring instrument 12 m / sec, both morning and evening. Mahogany tree when seen from its branching regularly and good aesthetic shade. Mahogany tree also functions as a traditional medicine for its fruit, the shade of mahogany can be seen to absorb heat caused by solar radiation, besides the branching has leaf bones in absorbing or absorbing heat radiation around 80%.

1. Introduction

A campus is a place for all academic and non-academic learning activities. Universitas Tadulako is a state university located in Central Sulawesi Province with the formation of 11 Faculties and a Postgraduate Program. It shows the variation in the provision of educational

facilities at Universitas Tadulako. Besides, the campus also provides a learning standard building adjusted to each need with a broad total area compared to other campuses in Indonesia.

However, campus comfort is not evenly distributed to all faculties because trees do not grow in all areas. In empty areas without trees grow shrubs producing less fresh air, so it feels hotter there. Furthermore, the area is passed by the equator so many things seem to reflect heat radiation. Rapidly evaporating seawater also increases heat radiation and creates an even more arid and drier campus atmosphere. Although there are several trees near the road, it is unable to prevent high temperatures.

The campus should plant rain trees (Samanea saman) near the campus gate to shade and ward off the hot sun, so the air is not too hot during the dry season. Besides, the atmosphere will look fresh [1]–[3]. At the right gate, it should also have large trees. The entrance area of the Universitas Tadulako campus does not have a perfect landscape arrangement to prevent hot air, because the outside areas radiate heat that directly enters the campus.

2. Method

The researchers adopted the survey method by directly analyzing the conditions in the field using quantitative data to measure the tree architecture model existing in the campus environment of Universitas Tadulako. The researchers also compared macro air temperatures off-campus and on campus to ensure the effectiveness of landscape structuring. The measurements started in the morning, afternoon and evening.

The dividing of measurement periods was in the morning (08.00 - 12.00), afternoon (13.00-15.00), and evening (16.00-18.00) using a digital temperature gauge and anemometer. The researchers took the average and determined the difference between temperature and macro temperature in both locations. In addition to temperature, the researchers also measured the humidity of the environment and the speed of the wind blowing heat radiation potentially increase or decrease the ambient temperature due to the arrangement of landscape and tree architecture models on the campus of Universitas Tadulako. Observation of tree architecture model according to Halle considers the types and characteristics of trees on campus [4]–[6].

3. Results and Discussion

3.1 Description Of Tree Architecture Model In Campus Of Universitas Tadulako

The survey results conclude that the trees with architectural models within the Universitas Tadulako have the following characteristics:

Fig. 1. Architectural model of RAUH tree (Mahogany tree)

Table 1. Mahogany tree

Leaf Model	Aesthetics	Branch model	Tree height	Leaf density	Stem fragility
Wide	Beautiful	Branching increases beauty and shade	Seven to eight meters	Enough density in each branch	Not easy to brittle, hard stem, medium

stem diameter

Table 1 shows that the mahogany tree is very suitable for cultivation because this tree can grow very beautifully, has many branches so it can cool the pedestrian area on the sidewalk. Whereas in Table 2. Shows that between the angsana and rain trees have different tree shapes, where the angsana tree is wider than the rain tree, while from the shape of the branches, the rain neat tree with the distance between the branches and twigs is compared to the irregular angsana. structure with unraveled branches. This tree needs extra care to spruce up branches and twigs.

Table 2. Architectural model of the TROLL Tree (Rain tree and Angsana tree)

Leaf Model	Aesthetics	Branch model	Tree Height	Leaf density	Stem fragility
The leaf size is slightly wider for angsana tree, Small leaf size for rain tree	Beautiful	1. The shape of branches and twigs of the rain tree is neat with the distance between the branches and twigs 2. The angsana tree has an irregular structure with unraveled branches. This tree needs extra care to spruce up branches and twigs	Seven to eight meters	1. Leaves on a branch of a rain tree grow tightly together and are small in shape 2. The leaves on the angsana tree grow in a wide shape	1. A rain tree has a trunk of about 30 cm when it reaches the age of 3 years 2. The angsana stem is very sturdy or strong

Fig. 2 Rain Tree

Fig. 3 Angsana Tree

Table 3 shows that both of these plants are like giant umbrellas with wide branches so they look beautiful with a distance of one branch and another about 1 meter. This tree can also grow up to 6 meters so it is very easy to become a roadside canopy.

Table 3. Architectural Model of the Aubreville Trees

Leaf Model	Aesthetics	Branch model	Tree Height	Leaf density	Stem fragility
Terminalia mantaly tree has small size leaves, while wide sea ketapang Terminalia catappa	Both types of trees have a beautiful aesthetic	Between one branch and another has a wide enough distance so that the radiation is easy to pass through	5 meters to 6 meters.	The leaves grow tightly between tree branches	The trunk is pretty strong because on average it grows in arid or coastal sea areas

Fig. 4 Terminalia Mantaly

Fig. 5 Terminalia Catappa

3.2 Architectural Model Of RAUX Trees

Fig. 6 Mimusops Elengi Tree

The Architectural Model of the Tree is similar to RAUH and RAUX which grows mostly within the campus area of Universitas Tadulako. These trees are numerous because at that time only this species was able to grow in hot and minimal water environments. However, currently, the rainfall is high enough that it requires rejuvenation of the tree population because the tree does not look beautiful aesthetically and brittle quickly when it reaches a certain height.

There are also many Senna siamea trees around the campus, because of their ability to withstand dry and hot conditions. The breeding is also simple since it only utilizes fallen seeds. This tree has a weakness in the flowers that easily fall and often become waste.

The Senna siamea tree also has RAUX and RAUH architecture types. Its branches grow irregularly, dry quickly, and break easily. In the initial phase of its growth, this tree will look beautiful and fresh. But after about 2 meters in height, the tree will dry up and die.

Fig. 7 Senna Siamea Tree

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The campus of Universitas Tadulako has large and dry land since it is passed by the equator so that the microclimate on campus is directly affected by off-campus components. The microclimate occurs on campus is exacerbated by the ineffective layout of the campus environment, especially around the gate because of hot air from outside blows into the campus. The campus should plant a rain tree (Samanea saman) in front of the campus, so the conditions are shadier and cooler during the dry season [7], [8]. To facilitate the needs of the campus in the future, it is necessary to study the problem of temperature dynamics in certain lands to support the activities of the Tri Dharma of Higher Education in the present and future.

The uneven arrangement of campus settings of Universitas Tadulako is most striking at the campus entrance gate. This is due to many dwellings, roads, and sea breezes carry heat radiation into the campus area. Moreover, the arrangement of campus area vegetation has not been able to control the microclimate, so it may help campus activities. Some campuses have maximized the function. However, some others still do not place vegetation correctly by managing the campus landscape. Control of temperature dynamics of the area depends on the structure of vegetation, the arrangement of the distance between the canopy and the function of plants as a canopy. In addition to dispelling heat, landscape management also beautifies the appearance of the area in the form of a tree architecture model.

Lukman concluded in his research explaining plants or vegetation affects air temperature and has the potential to reduce from 5.5 ° C to 11 ° C when the temperature at that time is around 32 ° C. If the temperature is only 21 ° C, it will drop 2.5 ° C to 5.5 ° C [9], [10].

Ecological functions play an essential role in controlling air temperature. The leaves of the tree easily absorb and control the micro temperatures around the plant. The distinctive shape includes the canopy overshadow every object underneath, adding aesthetics and optimizing the function of horticulture.

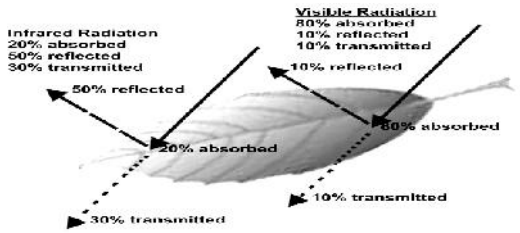

Fig. 6 Modified from Brown and Gillespie (1995)

Figure Information:

A leaf has absorption or reflection as follows:

1. InfraRed Radiation
   InfraRed radiation occurs at the tips of young leaves: 20% absorb; 50% reflect 30% transmit.
2. Visible Radiation
   80% of the radiation is absorbed; 10% of the radiation is reflected; 10% of the radiation is transmitted.

Based on the figure above, the older leaf stems on the initial branches of the growth of the leaf reinforcement are easy to absorb radiation. Sketches of leaf reinforcement affect the level of absorption (modified Brown and Gillespie, 1995). Some types of tree architecture grow in the campus area of the Universitas Tadulako are:

1. Rauh type (Mahogany tree)
2. Troll type (Rain and Angsana trees).
3. Ambrelle type (Terminalia mantaly and Terminalia catappa trees).
4. Raux type (Mimusops elengi tree).
5. Types of productive oil palm plantations cultivated as landscape plants on the campus of the Universitas Tadulako.

From the Table 4. Show observations indicated the average of environmental temperature radiation in plants explains the Mahogany tree is the most powerful in absorbing radiation because its leaves are wider than others. Palm oil productive plants actually wasteful to water because every day absorbs 10 liters of liquid and is not effective in absorbing radiation. Average wind speeds on campus range from 12 m/s starting in the morning, afternoon and evening.

Table 4. Environmental Temperature Radiation in Plants

Type of tree architecture	Tree / plant name	The results of the average ambient temperature measurement	Average wind speed on campus
Rauh type	Mahogany tree	33.3°C	12 m/s
Troll type	Rain /Angsana	33.7°C	12 m/s
Ambrelle type	Terminalia mantaly / Terminalia catappa	34°C	12 m/s
Raux type	Mimusops elengi	33.7°C	12 m/s
Productive Plants	Palm oil	34.2°C	12 m/s

Mahogany tree has a branching that is regular, beautiful and the fruit is useful as traditional medicine. Furthermore, its ability to absorb heat is truly great up to 80% as stated in the theory of Brown and Gispellie (1995).

4. Conclussion

Based on the results of this study concluded that Mahogany tree seems to absorb more radiation on its leaves which are rather wide compared to other trees. Palm oil productive plants require water every day 10 liters per tree but does not have the effect of absorbing radiation from field measurements. For the average wind speed on campus based on observations with an average measuring instrument 12 m / sec, both morning and evening. Mahogany tree when seen from its branching regularly and good aesthetic shade. Mahogany tree also functions as a traditional medicine for its fruit, the shade of mahogany can be seen to absorb heat caused by solar radiation, besides the branching has leaf bones in absorbing or absorbing heat radiation around 80%.

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