Global Forest Journal
Journal homepage: https://talenta.usu.ac.id/gfj

Analysis of tree quality on the green line using google earth in Tanjung Morawa District, Deli Serdang Regency

Samsuri[1], Esterlina Napitupulu[1], Alfan Gunawan Ahmad[1], Anita Zaitunah[*1]
[1]*Faculty of Forestry, Universitas Sumatera Utara, Kampus 2 Bekala, Deli Serdang, 20353, Indonesia*
[*]Corresponding Author: anita@usu.ac.id

ARTICLE INFO
Article history:
Received 13 July 2023
Revised 27 July 2023
Accepted 28 July 2023
Available online 29 July 2023

E-ISSN: 3024-9309

How to cite:
Samsuri, E. Napitupulu, A.G. Ahmad, A. Zaitunah, "Analysis of tree quality on the green line using google earth in Tanjung Morawa District, Deli Serdang Regency," *Global Forest Journal*, vol. 01, no. 01, July 2023

https://doi.org/10.32734/gfj.v1i01.13253

ABSTRACT
City development with unfriendly development causes the quality and quantity of open green space to decrease. Google Earth is an interactive mapping application released by google, which displays a digital visualization of the geographical shape of the earth. This study aims to determine the type and quality of trees on the urban forest in the Tanjung-Morawa sub-district and to map the quality of trees on the urban forest in the Tanjung-Morawa sub-district. This study uses a modified method of tree quality assessment with two criteria: tree health and technically criteria. From the observation result, there are 18 trees, Glodokan (*Polyalthia longifolia*) with the highest number, as many as 842 trees, and Dadap Merah (*Erythrina crista* goly) as the tree with the least amount. The quality of the trees in the urban forest shows a moderate good quality, where the highest health is in the medium category and for the technical in the low category. Trees that are recommended to be cut have a cumulative ≥ 2,5 Angsana trees with a total of 129 trees, and the highest cumulative percentage is the Banyan tree at 66,67%. The Mango tree has the lowest rate at 8,70%. Google Earth can't be used optimally because of the low-resolution image quality. Image capture data in google earth has not been updated; the unstable internet connection and the time of the retrieval and processing of field data are not the same as the time retrieval and processing.
Keyword: Google Earth, Urban Forest, Tree Health, Tree Quality Assessment

1. Introduction

Urban development that is not environmentally friendly causes the quality and quantity of Green Open Space (RTH) to decrease. The role of trees in absorbing air pollution produced by urban activities, it is necessary to assess the quality of trees in the green lane. Various indications of tree damage, such as diseased trunks and headers, and the existence of trees that pose threat in the environment where they grow can be used to determine the quality of these trees.

The city as the center of civilization of human life and human culture continues to improve itself towards a green city. Indonesian cities are currently heading towards ecological suicide and urban suicide. The city seems unable to get out of floods, landslides, clean water crises, traffic jams, air pollution and environmental diseases. Now is the time for the city and we rise to improve ourselves, the environment and the city, starting from housing (green buildings), residential environments (green properties), cities where we live (green cities). Green referred to here is the concept of environmentally friendly and sustainable life.

Tanjung Morawa District is one of the sub-districts in Deli Serdang district. Based on the provisions of the North Sumatra Provincial Establishment Organizing Committee (P4SU) Number 50 dated August 19, 1950, Deli Serdang regency is divided into 6 districts and 32 sub-districts. One of the sub-districts determined by the committee is Tanjung Morawa, where Tanjung Morawa sub-district is located in Serdang Hilir wedaan located in Lubuk Pakam. Tanjung Morawa which is a Sumatran traffic lane and a path that is widely traveled by vehicles who want to go to Kualanamu airport causes air pollution.

Green lanes are green areas around urban environments that aim to control development growth, maintain green areas. The green strip is mainly vegetation that naturally functions as an atmosphere cleaner by absorbing pollutants in the form of gases and particles through its leaves. Vegetation functions as a living filter that lowers pollution levels by absorbing, detecting, accumulating and or regulating metabolism in the air so that air quality can improve with the release of oxygen in the air [1,2].

Green lanes in urban areas can also cause accidents for road users. One of the accidents caused by trees along the green lane is a fallen tree that will hit motorists, pedestrians and buildings near the green lane. Accidents can occur due to lack of maintenance and checking of trees along the green line. Given the importance of trees in urban areas, tree health must be considered to prevent accidents caused by trees along the road [3].

Trees are said to be healthy or normal when the tree can still carry out its physiological functions. Conversely, it is said to be unhealthy if the tree is structurally damaged either in whole or in part of the tree. The main cause of plant diseases can be potogenic living organisms or physical environmental factors. Such indicators are growth, header conditions, damage and mortality, biological indicators of air pollution levels, plant chemistry, dendrochronology, root conditions, radiation levels used in photosynthesis, vegetation structure, wildlife habitats and linchen. The RTH created is used as a balancer for urban ecosystems, hydrology, climatology, biodiversity, and other ecological systems that aim to improve the quality of the environment, city aesthetics, public health and welfare. The existence of RTH and the additions made are expected to create better conditions in the future.

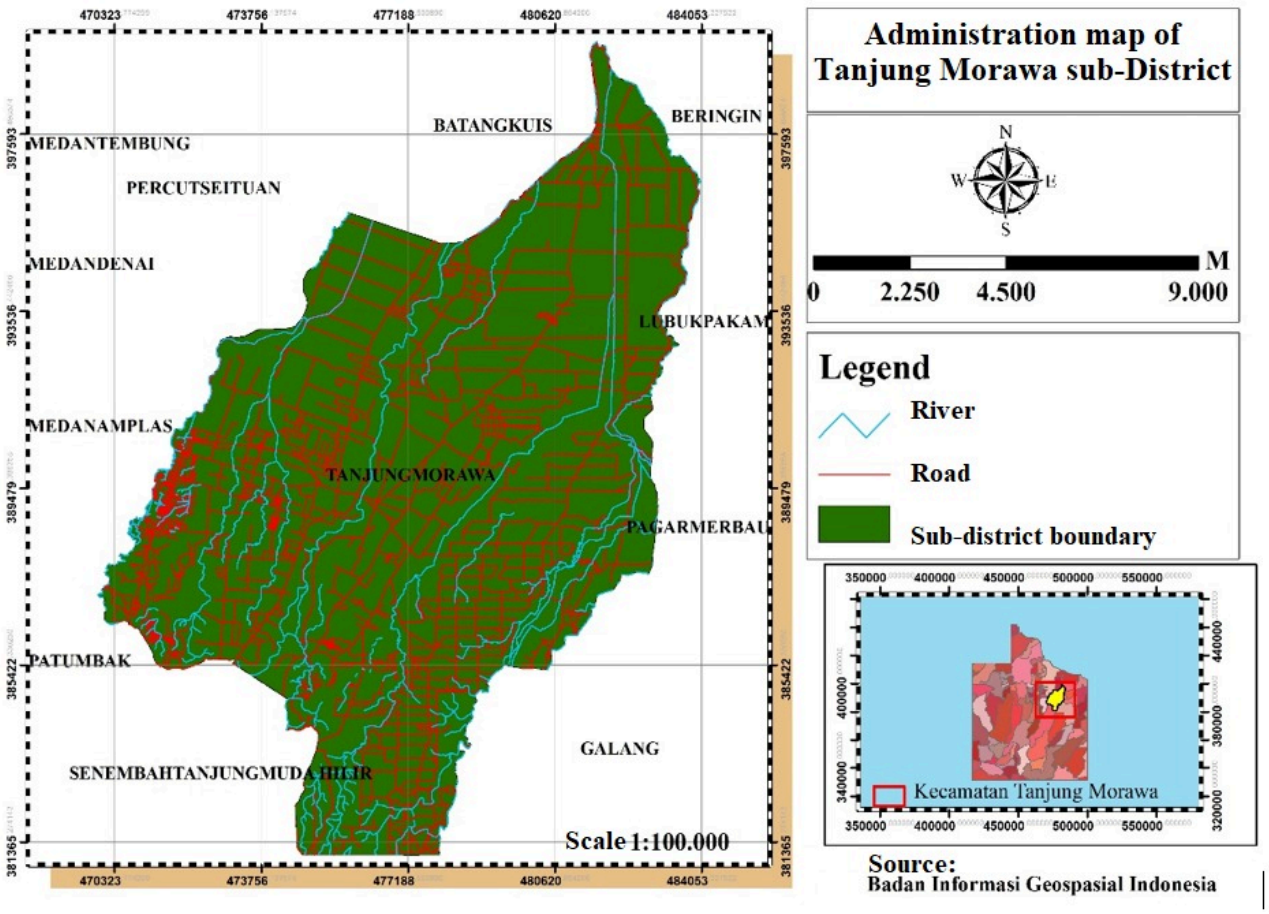
One easy way to learn about geography is through interactive learning media that is able to display digital visualizations of the geographical shape of the earth. Google earth as one of the interactive mapping applications that is able to display the digital form of a globe that has many features such as data updates and historical map storage. The image processing method on Google Earth maps emphasizes the image enchancement process in the form of noise reduction so that better image quality is obtained to be studied [4].

Google earth is an interactive mapping application issued by Google that displays a globe map in 3D, topographic conditions, satellite photos, terrain that can be overlaid with roads, buildings, locations or other geographical information. In this study, what is meant by google earth is google earth (free version) which can be downloaded for free [5]. This research aims to (1) Determine the type and quality of trees on the green line in Tanjung Morawa sub-district, (2) Map the quality of trees on the green line in Tanjung Morawa sub-district.

2. Method

2.1. Time and Place

This study was conducted from December 2019 to February 2020. This research was conducted on the green line on the Medan-Pematang Siantar Cross Road, Tanjung Morawa District, Deli Serdang Regency, North Sumatera.



2.2. Materials and Tools

The material used in this study was a tree located on the green lane on the Medan-Pematang Siantar Cross road, Tanjung Morawa district, Deli Serdang district, North Sumatra. The tools used in this study were GPS (Global Positioning System), cameras, tally sheets, laptops, Microsoft Word software, Microsoft Excel and Google Earth applications to manage data.

2.3. Research Procedure

2.3.1. Data Collection

Field survey activities aim to obtain and collect field check data and data on tree species in the field, identify tree quality with predetermined criteria, identify tree quality with google earth based on elements of image interpretation, marking field point positions and input data into tally sheets. The method used in this study is the census and scoring method to analyze all tree species in the green line.

2.3.2. Tree Quality Assessment

Assessment of tree quality is carried out by looking at indicators consisting of tree health and technical. Then identify the level of quality of trees contained in the research site with predetermined criteria. For tree health assessment, a modified method of tree quality assessment based on [6] and assessment criteria according to [7] is used as follows:

1. Tree Health Weight (60%)
   - Stem Health (50% weight)
   - Header Health (50% weight)

2. Technical (value weighting 40%)
   - Threat to the house (40% weight)
   - Threats to roads, sidewalks and drainage (30% weight)
   - Threats to power lines and telephones (30% weight)

Each factor from both criteria is assessed with grades 1-4 with the following assessment levels:

1. Very heavy with a value of 4
2. Weight with a value of 3
3. Medium with a value of 2
4. Light weight with a value of 1

The guidelines for factor values of both criteria are as follows:

1. Tree health criteria
   - Trunk health includes assessment of urban forest tree trunks, namely the presence of rows, hollow trunk bases, stem and branch cancer, and pest attacks.
   - The assessment rate of the stem is very heavy (value 4) which is characterized by the presence of holes in the rod or rowong.
   - The level of heavy stem assessment (value 3) is characterized by the presence of stem and branch cancer which can be seen by swelling of sporadic trunks and branches and on swollen, peeling and darker-colored bark and branches.
   - The assessment level of medium stems (value 2) is characterized by pest and disease attacks with boring holes on the trunk and branches that are easily visible, there is dirt of sawdust and dark-colored sap coming out of the bored holes.
   - Light assessment level (value 1) which is characterized by the presence or absence of pest and disease attacks on the stem in the form of borer holes and dirt and sap coming out of the bored holes.
   - Canopy health includes an assessment of whether the tree canopy is degenerating (dead) or whether it is dead dead.
   - The header rating rate is very heavy (value 4) when half or more of the dead tree canopy is characterized by evenly distributed, dry, molted (not during leaf shedding or dry season).
   - Weight header rating rate (value 3) when less than half of the tree canopy is dead or there is dieback (main shoots).
   - The header assessment rate is medium (value 2) when there are several dead branch shoots.
   - The level of light header assessment (value 1) if there is a leaf attack which can be seen by the presence of yellow spots on the leaves evenly or there is chlorosis on the leaves in the form of yellowish-green leaves.

2. Technical Criteria
   - Threats to homes or other buildings: include an assessment of urban forest trees vulnerable to falling and hitting homes or other buildings.
   - The level of threat assessment to the house is very severe (value 4) if the condition of the tree and the tree is very vulnerable to falling and hitting the house and other buildings. This can be seen from the level of tree slope reaching ≤600 towards the house or heavy canopy leading to the house or symptoms of trees collapsed (uprooted) with the presence of circular cracked soil around the root.
   - The level of threat assessment to the house is heavy (value 3) with a slope level of 60-700 towards the house or there is a small amount of soil in the cracked root system.
   - Threat rating level to the house is medium (value 2) with a slope level of 70-800 towards the house or a medium header thickness towards the house.
   - Threat assessment level to light houses (value 1) with a slope level of 80-900 towards the house or medium header thickness towards the house.
   - Threats to roads, sidewalks or drainage networks include assessing whether the lateral root system of trees in greenways has caused damage to road bodies, sidewalks, ditches or drainage channels or building foundations.
   - The level of threat assessment to roads, sidewalks or drainage networks is very heavy (value 4) if lateral roots have damaged the facility which can be seen by the presence of bumpy cracked road bodies, damaged sidewalks, damaged ditches, drainage networks and foundations of houses and other buildings damaged.
   - The level of threat assessment to roads, sidewalks or heavy drainage networks (value 3) if lateral roots have damaged pavements and ditches.
   - The level of threat assessment to roads, sidewalks or drainage networks is moderate (value 2) when lateral roots of 3-4 roots have appeared on the soil surface.

- Threat assessment level to roads, sidewalks or light drainage networks (value 1) when lateral roots of 1-2 have appeared on the ground surface.
- Threats to power lines and telephone lines include assessing whether trees are vulnerable to falling and hitting power and telephone networks.
- The level of threat assessment to power lines and telephones is very heavy (value 4) if the slope of trees and the intersection is very vulnerable to falling and hitting the network. The slope of the tree ≤600 towards the network or the heavy header points to the network or there are symptoms of a tree collapse.
- The level of threat assessment to heavy power and telephone wires (value 3) with a tree slope level of 60-700 towards the network or the thickness of the header is quite heavy or there is part of the soil in the cracked root system.
- The threat assessment level to power lines or telephone is medium (value 2) with a tree slope level of 70-800 or medium header thickness.
- Threat assessment level to power lines or light telephones (value 1) with a tree slope level of 80-900 or light header density towards the cable network.

2.4. Data Analysis

The tree quality criteria assessed for tree health are trunk health (A1) and leaf health (A2) and tree technical criteria are threats to homes (B1), threats to roads, sidewalks or drainage networks (B2) and threats to power lines and telephones (B3). The values are listed in the data column with a range of values 1-4 according to the given tree assessment level.

After an assessment in the field, the calculation of tree quality was carried out with the criteria values for each factor are:

Value A = Weight A1 x Criteria score A x Value A1

Value B = Weight B1 x Criteria score B x Value B1

The assessment results of each factor will obtain a cumulative value, where if the cumulative value is ≥ 2.5, the tree can be recommended for logging because it has poor quality, both in terms of tree health and technical aspects of the tree.

2.5. Interpreting Imagery

Visual interpretation of imagery is carried out based on spatial recognition of object features. Object characteristics can be recognized based on elements of interpretation such as color, shape, size, pattern, texture, shadow, location and association of the appearance of the object.

In the recognition of objects depicted on the image there are three stages needed, namely detection, identification and analysis. Detection is the observation or existence of objects, identification is an effort to characterize objects that have been detected using sufficient information, while analysis is the stage of collecting further information.

2.6. Mapping

The stages of mapping tree quality in the green lane of Tanjung Morawa sub-district are (1) mapping is carried out by taking tree coordinates using GPS, (2) each tree is then given a score according to the specified tree criteria, (3) each tree is given a notation according to the quality of the tree and (4) the map is made with a scale of 1:100,000.

The flow of tree quality analysis stages on the green line in Tanjung Morawa sub-district, Deli Serdang regency can be seen in Figure 2.

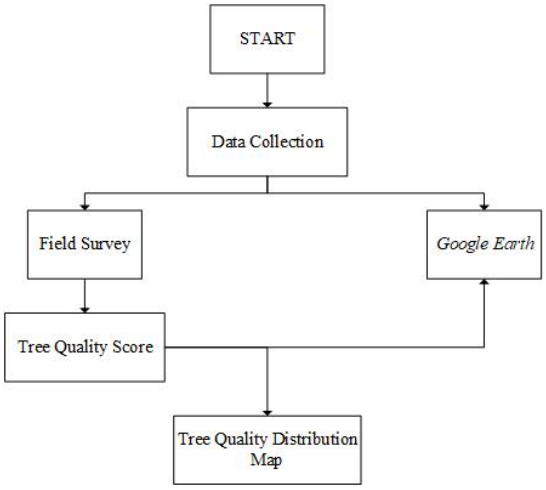


Figure 2. Flow of tree quality analysis stages on the green line in the sub-district Tanjung Morawa

3. Result and Discussion

The results of observations along the green line after counting the number of trees were 1,539 trees with 18 different tree species. The distribution of trees can be seen in figure 3. The type and number of each tree can be seen in Table 1.

Table 1. Trees along the green lane of Medan-Pematang Siantar road

No.	Tree Species	Local name	Number of Trees
1	S*wietenia mahagoni*	Mahoni	207
2	*Pterocarpus indicus*	Angsana	380
3	*Artocarpus heterophyllus*	Nangka	8
4	*Mimusops elengi*	Tanjung	17
5	*Tamarindus indica*	Asam Jawa	17
6	*Plumeria rubra*	Kamboja	8
7	*Annona muricata*	Sirsak	3
8	*Mangifera indica*	Mangga	23
9	*Polyalthia longifolia*	Glodokan	842
10	*Syzygium alquem*	Jambu Air	6
11	*Ficus benjamina*	Beringin	3
12	*Psidium guajava*	Jambu Biji	2
13	*Multingia calabura*	Talok	5
14	*Erythrina crista goli*	Dadap Merah	1
15	*Terminalia catappa*	Ketapang	4
16	*Casuarina equisetifolia*	Cemara	3
17	*Phyllantus acidus*	Ceremai	3
18	*Alstonia scholaris*	Pulai	7
	Total		1539

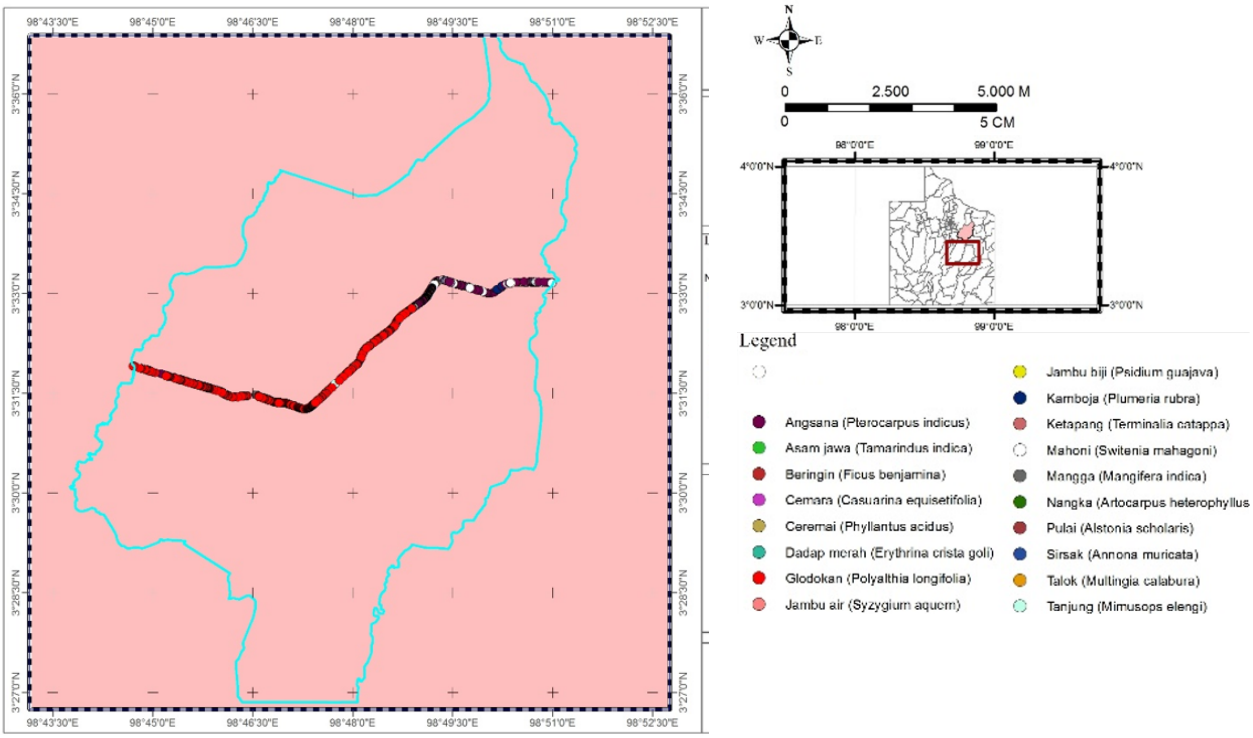


Figure 3. Map of tree distribution on the green line

The most dominating species is Glodokan (*Polyalthia longifolia*) numbering 842 trees. The second most Angsana (*Pterocarpus indicus*) amounted to 380 trees, then Mahogany (*Switenia mahagoni*) amounted to 207 trees, then Mango (*Mangifera indica*) as many as 23 trees. Tanjung (*Mimusops elengi*) and Tamarind (*Tamarindus indica*) numbered 17 trees, jackfruit (*Artocarpus heterophyllus*) and Cambodian (*Plumeria rubra*) as many as 8 trees.

According to [1] glodokan and angsana trees are plants that have roots that can withstand damage caused by vehicle vibrations, easily grow in hot areas and are resistant to wind so they are suitable for use as road shade plants to absorb pollution / pollution elements that come from smoke from vehicles passing along green roads. This is what makes glodokan and angsana very much found in green lane areas, especially on the Tanjung Morawa green lane.

Apart from glodokan and angsana, mahogany plants are also found on green lanes, because mahogany has heat resistance and good adaptability to various soil conditions so that many are planted as protective trees decorating the roadside in several green lanes. Mahogany wood also has a high enough economic value to be cultivated as an industrial raw material. According to [8], basically mahogany is also a plant that is suitable for planting on the green lane of the road because it has strong roots and branches so as to provide a sense of security and comfort to road users.

And in addition, there are not too many types of trees, namely Water Guava (*Syzygium aquem*) as many as 6 trees, Talok (*Multingia calabura*) as many as 5 trees, Ketapang (*Terminalia catappa*) as many as 4 trees, then Soursop (*Annona muricata*), Banyan (*Ficus benjamina*), Cemara (*Casuarina equisetifolia*) and Ceremai (*Phyllantus acidus*) as many as 3 trees, Guava (*Psidium guajava*) as many as 2 trees and the least Red Dadap (*Erythrina crista* goli) as many as 1 tree.

Ideally, the type of tree planted does not only have one benefit but has many benefits, such as ecological aspects, aesthetic aspects, safety aspects and comfort aspects. In addition, tree planting on the green lane road can be used as a mascot of a distinctive area and can only live and develop in certain areas.

3.1. Total Tree Quality

Table 2. The overall number of quality trees in the Tanjung Morawa green lane

Judging Criteria	Factor	Number of Trees	Percentage Amount							
			Light		Keep		Heavy		Very Heavy	
			n	%	n	%	n	%	N	%
Tree Health	Stem	1539	92	5.98	638	41.46	592	38.47	212	13.78
	Canopy	1539	510	33.14	685	44.51	253	16.44	91	5.91
Technical Tree	Threats to houses	1539	1159	75.31	346	22.48	29	1.88	6	0.39
	Threats to sidewalks	1539	1149	74.66	306	19.88	59	3.83	24	1.56
	Threats to Wiring/ Power	1539	1169	75.96	337	21.90	28	1.82	5	0.32

n=number of trees

The quality of trees in the Tanjung Morawa green line when viewed from Table 3 shows quite good quality because the highest percentage of tree health, both trunk health and tree canopy health, is in moderate condition. Where the percentage of medium tree trunk health is 41.46% and tree canopy health is 44.51%. As for the quality of trees in terms of tree technicality, good quality is included in a mild state with the highest percentage of technical quality of trees included in the light category. Where technical threats to homes as much as 75.31%, technical threats to sidewalks/roads as much as 74.66% and technical threats to cables/electricity as much as 75.96%.

Table 3. Total quality of trees in the green lane that have a cumulative value of ≥ 2.5

Tree Name	Recommended trees cut down	Preserved trees	%
Mahogany (Switenia mahagoni)	40	167	19.32
Angsana (*Pterocarpus indicus*)	129	251	33.95
Mango (*Mangifera indica*)	2	21	8.70
Tanjung (*Mimusops elengi*)	4	13	23.53
Tamarind (*Tamarindus indica*)	4	13	23.53
Pulai (*Alstonia scholaris*)	1	6	14.29
Talok (*Multingia calabura*)	2	3	40.00
Manyan (*Ficus benjamina*)	2	1	66.67
Rose apple (*Syzygium aquem*)	1	5	16.67
Beach she-oak (*Casuarina equisetifolia*)	1	2	33.33

From table 4 above, it can be seen that banyan has the highest percentage of trees with a cumulative value of ≥ 2.5, which is 66.67% with a total of 2 trees. This is due to the condition of the tree that is old and no care is carried out such as tree branching. While the type of mango tree has a percentage of 8.70% with the number of trees as many as 2 trees. This is because the tree is planted near residential housing that will be useful and productive so that residents will not hesitate to care for the tree.

The most recommended species to be cut down is Angsana (*Pterocarpus indicus*), which is 129 trees. This is due to the large number of old angsana trees, parts of the trunk experiencing pests and diseases and being cut down without further treatment. Trees that have a cumulative ≥ of 2.5 should be replaced or cut down immediately. Trees that must be cut down are trees that are subject to pests and diseases such as rows, dead or dry headers, 600 slopes that threaten houses and power lines and whose roots have damaged roads, sidewalks and drainage.

According to [9], the type of tree planted should ideally be a tree that has many benefits and not just one benefit. The part that is considered in the selection of trees is seen in terms of stems, leaves, flowers, fruits and roots. The selected tree must have aesthetic aspects, ecological aspects, safety aspects and comfort aspects.

3.2. Tree Quality

The quality of trees in the green lane can be known from 2 assessment criteria, namely in terms of tree health which includes trunk health and header health, as well as from a technical point of view which includes threats to houses, threats to roads, sidewalks and drainage and threats to power and telephone lines. Tree quality is determined after a final assessment in terms of tree health and tree technical aspects, so that a cumulative value of each research factor will be obtained. If the cumulative value is ≥ 2.5, the quality is low. So that the tree will be cut down.

Tree damage caused by pests and diseases in the form of ants, termites, fungi, caterpillars and insects. Termites usually attack the roots and base of the main stem by eating and making holes as nests for breeding. This causes the tree trunk to become weathered and easily fall (rowong) (Figure 4). As for actions to reduce the impact of pest and disease attacks by cutting the affected parts of the tree.

Figure 4. A hole at mahogany (*Swetenia mahogani*)

The root system of mahogany, angsana, glodokan and other trees planted on the roadside is taproot, so many roots propagate into roads, sidewalks or drainage around trees. Mahogany roots have damaged the road, because the pavement has been damaged and the ground is bumpy (Figure 5) so that the tree can breathe. One of the factors that cause tree roots to damage the sidewalk is the narrowness of the soil where the tree grows. Open ground for tree growth is mostly only 10 cm from the tree trunk. This is in accordance with [10] which states that trees need space to grow so that tree growth does not stop and tree roots do not come out of the ground.

Figure 5. Rooting of mahogany (*Swetenia mahagoni*) yang merusak trotoar

Tilts and alignments are very prone to collapse and disrupt cable and telephone networks. In (Figure 6) mahogany trunks and headers have penetrated the roof/tile of people's houses. The slope of mahogany trees has also reached ≤ 60° towards cable and electricity networks or collapsed trees that will disturb residents. This tree must be cut down immediately to avoid falling trees on people's homes which will cause damage to buildings or threaten lives. And provide counseling for residents around trees with symptoms of collapse not to erect buildings around trees with a slope of ≤ 60° and heavy headers.

Figure 6. Mahogany trees (*Swietenia mahagoni*) pose a threat to the home and cables

Direct pruning by cutting branches from top to bottom directly and pruning scars are also not sprayed or smeared with disinfectants, so this makes the plant susceptible to pests and diseases that cause damage to all parts of the tree (Figure 7).

Figure 7. Red sandalwood (*Pterocarpus indicus*) which have been felled without further treatment

In choosing plants to be planted on the green lane, it is expected to function as a wind breaker so that the impact effect on road users / motorists is reduced and provides a sense of security when crossing the road. Safety factors for road users are an important requirement in the selection of road protection tree species [11].

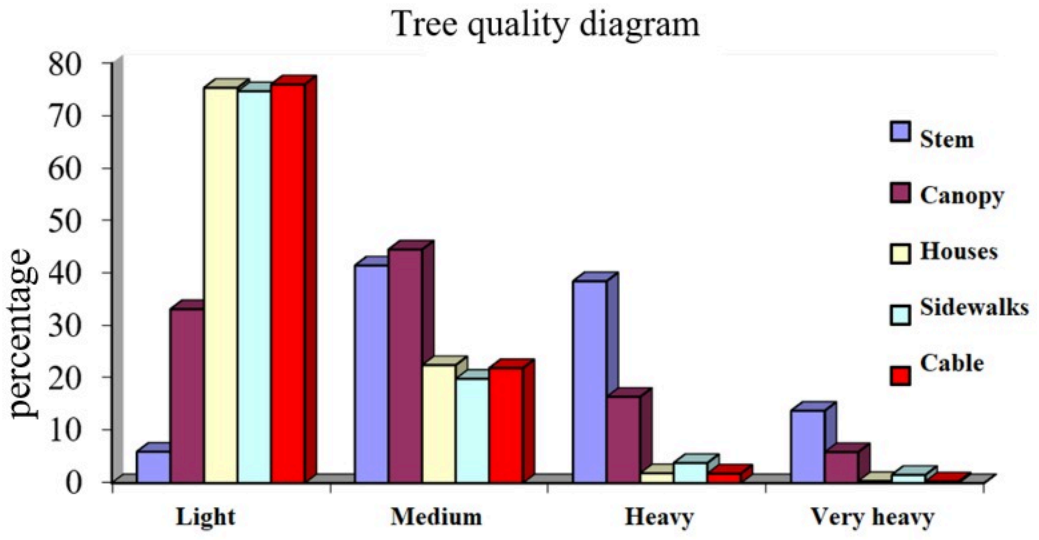


Figure 8. Tree quality diagram on the green line of Tanjung Morawa sub-district

The quality classes of trees on the green line are different (figure 8). This depends on the type of plant / tree and the adaptability of tree species to the surrounding environment. According [12] said that forest function is influenced by the quality of tree health. The optimal function of a forest runs if the constituent trees in the forest are in good condition.

4. Conclusion

The most dominant species type is Glodokan (*Polyalthia longifolia*) as many as 842 trees and the lowest is Red Dadap (*Erythrina crista* goli) as many as 1 tree. The quality of trees in the green lane shows quite good quality where the health of the highest trees is in the medium category and technical trees are in the light category. The recommended felled tree that has the highest cumulative ≥ 2.5 is the angsana tree with a total of 129 trees.

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