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Assessment of Tree Vandalism Level in Kuala Kangsar Urban Park, Perak, Malaysia

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Abstract

Landscape Architecture Agenda 2050 classified vandalism as a serious environmental threat. Vandalism incidence has a major impact on urban tree performances, such as health declines, poor appearance, and performance-related effects. Hence, there is a need for a tree vandalism assessment that can present the tree vandalism statuses to guide decision-makers and tree managers in the improvement and rectification of decisions. This study assessed the level of tree vandalism incidents in Kuala Kangsar Urban Park, Perak, Malaysia. The study used a quantitative approach by analysing the tree vandalism data from two sampling locations comprising commercial and recreational areas were accessed. The result indicates three major findings. The first is that the vandalism level of tree vandalism incidence in the commercial areas (362.68*v*) was generally higher than in the recreational (242.*82v*). Second, wounding tree stems due to construction work activity was the main factor for tree vandalism incidents. And finally, disservice trees were confirmed to be associated with intentional tree vandalism incidents that need to be considered in the tree vandalism issues. The study concluded that the tree vandalism status in Kuala Kangsar Urban Park is very low in classification. It was recommended that the level of tree vandalism in the urban area should be constant and closely monitored. Future studies should investigate and include qualitative inputs that incorporate human subjects to enable generalization within the comprehensive context.

Keywords: Ecosystem Disservices, Tree Performance, Tree Vandalism, Urban Park, Urban Tree

Introduction

Ecosystem disservices (EDS) of urban trees have received much attention in recent years due to their detrimental properties, which lead to critical human life and well-being impacts. Infrastructure conflicts, health and safety issues, aesthetic concerns, and environmentally harmful consequences are all part of the EDS of urban trees, as are management expenditures associated with ecological disturbances and risk management (Roman et al., 2020). Lyytimäki (2017) claims that the factors of disservice for urban trees stem from the location of the tree with other trees and built structures, species composition, the tree's growth patterns and life phase, external stressors, and the intensity of the maintenance schedule. Several studies have explained a variety of tree performance deficiencies that result in disservices such as aggressive roots or branches causing sewer pipe blockages and electric or other wires to short circuit (Slater & Chalmers, 2020), falling trees and branches causing safety risks for humans or property (Ball et al., 2020), and trees perceived as ugly as a result of poor health conditions with dead branches or pest and disease invasions (Hamzah et al., 2020a).

While scholars believe that tree performance deficiencies are the roots of the disservice of urban trees, vandalism is recognised as a major societal problem affecting tree performances in urban areas worldwide (Hamzah & Hussain, 2021). A considerable amount of research has been carried out on the factors affecting urban tree performance, but little research has been related to tree vandalism incidences. The questions remain as to the status and trend of key tree performance deficiencies concerning vandalism incidence. It is desirable to carry out surveys of tree vandalism levels.

The objective of this study was to quantify the tree vandalism level in Kuala Kangsar Urban Park, Malaysia. This study evaluates the tree vandalism incidence to understand its status and trend. The findings provide evidence for the tree's performance deficiencies from the tree vandalism subjects. The following is how this article is organized: first, some background and an introduction to EDS and tree vandalism are provided. Next, the existing literature concerning EDS and tree vandalism incidence in urban tree management fields and previous studies are reviewed. Details on the materials and methods are presented in the third section. Results from the quantitative analysis are presented and discussed in the fourth section, and finally, conclusions and recommendations for further research are provided.

Ecosystem Disservices (Eds) and Tree Vandalism

Ecosystem services (ES) are the benefits provided by ecosystem functions and structures for human well-being (Finlayson, 2018). Meanwhile, ecosystem functions that are harmful to human well-being are so-called ecosystem disservices (EDS) (Speak et al., 2018; Von Dohren & Haase, 2015). Wu et al (2021) classified two categories of EDS, which are direct negative effects and indirect negative effects on human well-being. Direct negative effects include decreased water quantity, diseases or injuries, infrastructure damage, decreased air quality, and unpleasant feelings (refer to the loss of goods, revenue loss, and financial costs). In contrast, indirect negative effects are situations in which effects are delivered indirectly by increasing the delivery of direct negative effects, such as when the wrong plant species are planted in the wrong place, resulting in infrastructure damage and high maintenance costs. Subject to the urban tree field, disservice trees are no exception as a significant contributor to EDS with both direct and indirect effects.

Disserviced trees occur when the functions of trees are a nuisance and harmful to human life and well-being. Injuries to humans and infrastructure caused by tree failure (falling tree or limb), obstructing views and passage, and harbouring pests or disease vectors are examples of tree disservice (Endreny, 2018). Referring to the EDS effects, studies by Lazim & Misni (2016) proved that most urban residents have experienced tree disservices, including damage to properties due to a tree falling, and fear of poor tree condition with overgrown and unhealthy trees. In-depth, studies explain that disservice trees suffer from many structural defects, such as mechanical damage (Hamzah et al., 2018; Norainiratna et al., 2013; Sreetheran et al., 2011) and being rejected by urban residents (Hamzah et al., 2017). Here, a significant tree disservice is the tree failure subjected specifically to poor tree performance due to various physical factors contributing to structural tree defects.

The structural defects experienced by urban trees occur in the roots, trunk, branches, and crown. The common structural defects are described by cracks, weak branch union, and decay indicators (Allison et al., 2020; Chau et al., 2020). Karlinasari et al. (2018) defined the defects that can be associated with wounding that occurred in the past. Such wounding events occur because of pest infestations and mechanical damage (Karlinasari et al., 2018; Morgenroth et al., 2015; Travelia & Arifin, 2018). According to anecdotal evidence, wounding-related mechanical damage is the most common concern for urban trees. Among them are wounds caused by negligent maintenance equipment used, such as lawnmowers and chain saws (Fickri & Siregar, 2018; Morgenroth et al., 2015). Others are human misconduct activities such as nailing tree stems for advertisements, snapping, and burning (Abdul Malek & Mariapan, 2009; Hamzah et al., 2020b; Richardson & Shackleton, 2014). Aligned with the most cited literature, Black (1978) described the situations mentioned above, defined as the tree vandalism incidents. It might well be concluded that the tree vandalism incidences were a starting point for urban tree defects that led to poor performance and significantly higher EDS contributors.

Materials and Methods

The study was carried out in Kuala Kangsar Urban Park. It is the only city park in Kuala Kangsar, the royal town of Perak, Malaysia, and is located at approximately 3° 46’ 30"N and 100° 56’ 39"E. It covers approximately 11 ha, comprising commercial and recreational activities. Referring to park categorisation from the Federal Department of Town and Country Planning Peninsular Malaysia (1997), it was categorised as a ‘Municipal Park’ *(Taman Bandaran)* that served urban communities for recreational purposes.

Based on land use categories, the study area was divided into eight sampling locations. The sampling points are four commercial areas (shop lot, food stall, parking lot, and roadside table) and three recreational areas (lawn, playground, and sidewalk). The area is known for its famous commercial and recreational areas in Kuala Kangsar town.

The tree vandalism level measurements were taken using the 'Tree Vandalism Model (TVM)' method established by (Hamzah et al., 2021). Following this TVM model, the tree vandalism incidence consists of related criteria from the three categories; specific motive and action (SMA), ideology and practises (IP), and victim of circumstance (VC) assessed. The quantity of vandalism incident data is collected and represented in the respective measurement units (e.g., 15 units of signage attached to a tree stem; 805 cm of tree stems wounded due to

construction work; 41 cm of tree stem slashed; and 11 kg of food waste dumped under the tree canopy). All data is organised according to the three (3) abovementioned categories. The indication of a damaged tree in a deliberate act intended to change tree conditions that fall under the SMA category. It is a sign that the tree's conditions are not satisfactory (e.g., breaking the tree branches that block the sidewalk). Meanwhile, the IP category classifies tree damage as a traditional regulation break without malicious intent and is caused by human error, such as poor skill and a lack of awareness (e.g., dumping surplus earthworks under the tree canopy). Finally, VC refers to any tree that is intentionally or unintentionally harmed as a result of anthropogenic activities to further other objectives without consideration for the tree (such as burning garden waste at the tree stem and layering concrete floors under the tree canopy).

Equation 1 is used to generate an index of tree vandalism throughout the area, whereas equation 2 is used in normalising all criteria scores. The data were entered into an excel spreadsheet and analysed with SPSS.

Equation 1

$$\sum_{k,t} a_k b_k c_t$$

k = 1,2,3… 32 and t = 1,2,3

where k = criteria, t = category, a = criteria normalized score of assessment area, b = criteria weighting, and c = category aggregate

Equation 2

$$A' = \left(\frac{A - \min\ value of\ A}{\max value of\ A - \min\ value of\ A} \right) * (D - C) + C$$

Where, A’ contains Min-Max Normalized data one, the pre-defined boundary is [C - 0, D - 1].

Results and Discussion

Data in Table 1 and Table 2 show the index of tree vandalism in Kuala Kangsar Urban Park, Perak. The sampling locations represent commercial and recreational (with intentional and unintentional tree vandalism activities).

Table 1
Index of tree vandalism in commercial areas, Kuala Kangsar Urban Park

Commercial Area									
Activities	**Number of Trees**	**Score (k)**		**Normalised Score (a)**	**Criteria Weighting (b)**	**Criteria Score Aggregation**			**Vandalism Index (v)**
		Score	**Unit**			**Specific Motive & Action**	**Ideology & Practices**	**Victim of Circumstances**	
Intentional Vandalism									
Breaking the tree branches that block the sidewalk	7	33	cm	0.2	3.6	33.9	0.0	0.0	**23.4**
Burning garden waste at tree stem	1	5	kg	0.0	3.8	0.0	0.0	33.3	**2.3**
Fluorescent lamp attachment at tree stem for lighting the business area	1	2	nos	0.0	3.7	0.0	0.0	33.3	**0.0**
Nailing for structure attachment	1	5	nos	0.0	3.7	0.0	0.0	33.3	**2.3**
Nailing electric cable at the tree structure	4	33	nos	0.2	3.7	0.0	0.0	33.3	**23.4**
Signage attachment at the tree structure	9	17	nos	0.1	3.7	0.0	0.0	33.3	**11.3**
Slashing tree stem	3	16	cm	0.1	3.2	33.9	0.0	0.0	**9.3**
Tree canopy removal	1	82	cm	0.5	3.2	33.9	0.0	0.0	**53.1**
Wounding tree stem due to construction work	8	164	cm	1.0	3.8	0.0	0.0	33.3	**126.0**
Unintentional Vandalism									
Dumping boulders under the tree canopy	1	35	kg	0.2	2.7	0.0	32.8	0.0	**17.8**
Dumping food waste under the tree canopy	2	11	kg	0.1	3.7	0.0	32.8	0.0	**6.7**
Layering concrete floor under the tree canopy	2	42	m2	0.2	3.8	0.0	0.0	33.3	**31.1**
Paving root zone	2	74	m2	0.4	3.8	0.0	0.0	33.3	**56.0**
Vandalism Index									**362.7**

Source: Authors, 2022

Table 2
Index of tree vandalism in the recreational area, Kuala Kangsar Urban Park

Recreational Area									
(v)Activities		**Score (k)**				**Criteria Score Aggregation**			
	Number of Trees	**Score**	**Unit**	**Normalised Score (a)**	**Criteria Weighting (b)**	**Specific Motive & Action**	**Ideology & Practices**	**Victim of Circumstances**	**Vandalism Index (v)**
Intentional Vandalism									
Burning garden waste at tree stem	6	33	kg	0.0	3.8	0.0	0.0	33.3	**4.0**
Nailing for structure attachment	3	14	nos	0.0	3.7	0.0	0.0	33.3	**0.4**
Nailing electric cable at the tree structure	12	151	nos	0.2	3.7	0.0	0.0	33.3	**26.0**
Signage attachment at the tree structure	6	12	nos	0.0	3.7	0.0	0.0	33.3	**0.0**
Slashing tree stem	4	25	cm	0.0	3.2	33.9	0.0	0.0	**2.1**
Tree canopy removal	1	23	cm	0.0	3.2	33.9	0.0	0.0	**1.8**
Wounding tree stem due to construction work	11	641	cm	1.0	3.8	0.0	0.0	33.3	**121.0**
Unintentional Vandalism									
Dumping surplus earthworks under the tree canopy	4	667	kg	1.0	2.7	0.0	32.8	0.0	**87.5**
Paving root zone	2	12	m2	0.0	3.8	0.0	0.0	33.3	**0.0**
Vandalism Index									**242.8**

Source: Authors, 2022

Index of Tree Vandalism at Kuala Kangsar Urban Park, Perak

The results show that the index of tree vandalism in the commercial area was generally higher than in the recreational area. The vandalism index ranges from 1.8*v* to 126*v*. For instance, the higher vandalism index is wounding tree stems due to construction work activity (126*v*) in the commercial area. The lowest was tree canopy removal activity (1.8*v*) in the recreational area.

This finding revealed that significant tree vandalism incidents are caused by anthropogenic activities in commercial areas rather than in recreational areas. The commercial area witnesses high intentional and unintentional tree vandalism activities as seen in the study locations, which include thirteen activities (refer to Table 1). There is a presence of vandalism incidence in the victim of circumstances (VC) category, which are key factors that constitute tree vandalism specifically for both commercial and recreational areas. The highest index of tree vandalism documented in both study areas is wounding tree stems due to construction

work activity, indicating the fact that there are many anthropogenic activities to further other objectives without consideration for the urban tree.

These findings align with Hamzah & Hussain (2021), who reported that tree vandalism in municipal localities is higher in commercial than in recreational areas. The current findings are also similar to the studies of Mojiol (2018); Richardson & Shackleton (2014), who reported higher tree vandalism incidence levels in commercial areas.

This study has addressed the subject of disservice trees by examining the level of tree vandalism incidence (Hamzah et al., 2021). In extension to this, the study contributes to the field by presenting a specific tree vandalism incident subject to disservice trees. Agree with Hamzah et al (2020b), a damaged tree in a deliberate act intended to change tree conditions as a result of disservice trees is explained by the three vandalism activities examined in this study. First, the breaking of the tree branches that block the sidewalk; second, the slashing of tree stems that interfere with the other activities; and finally, and third, overgrowth tree canopy removal). Thus, disservice trees are associated with the intentional tree vandalism incidents specified in this study. Therefore, the finding confirms the study by Hamzah et al (2020b); Hamzah et al (2018) that tree condition is a significant factor that needs to be taken into account in the issue of tree vandalism.

Determining the Tree Vandalism Level at Kuala Kangsar Urban Park, Perak

The level of tree vandalism in the commercial areas is higher than in the recreational areas. The index value examined is 362.7*v* for the commercial area and 242.8*v* for the recreational area. However, these values all fall into the level of 'very low classification (<630*v*)' as stated in the tree vandalism classification determination in the Tree Vandalism Model established by Hamzah et al (2019) (refer to Table 3). This demonstrates that Kuala Kangsar Urban Park's tree health issues are not primarily caused by the extent of tree vandalism present there. Nevertheless, vandalism is synonymous with mechanical wounds that serve as the initial stage for tree damage (Endreny, 2018; Lyytimaki, 2017). Hence, the assessment of tree vandalism levels is a proactive action to mitigate tree disservices from the beginning.

Table 3
Tree Vandalism Incidence Classification

Tree Vandalism Composite Index Score	**Tree Vandalism Percentage**	**Classification**
2,523 to 3,152	81% - 100%	Very High
1,892 to 2,522	61% - 80%	High
1,262 to 1,891	41% - 60%	Medium
631 to 1,261	21% - 40%	Low
< 630	< 20%	Very Low

Source: Hamzah et al(2019)

Conclusion and Recommendations

This study has ascertained key findings relating to the research objective underlying this study. By gathering and analysing the quantitative data from the study areas, the study has expressed that the tree vandalism status in Kuala Kangsar Urban Park is very low in classification. In terms of area and trends, the incidence of tree vandalism is higher in

commercial areas than in recreational areas. Analysing the tree vandalism index shows that wounding tree stems due to construction work activity was the main factor for tree vandalism incidents in both commercial and recreational areas. Moreover, the study has confirmed that the disservice trees are associated with intentional tree vandalism incidents. To tackle concerns with tree vandalism in urban tree management, decision-makers and tree managers can benefit from the study's findings. Theoretically, this study enhances the body of knowledge in vandalism studies by addressing the status and trend of urban tree vandalism incidence.

It is recommended that tree vandalism incidents in urban areas, especially in commercial areas, should be strictly monitored closely. Urban upgrading projects need to take into account the existence of trees and need to be implemented with tree-friendly methods. This will ensure the urban trees are in good condition and can provide benefits to the urban community. In addition, the level of tree vandalism in the urban area should be constantly monitored because of the rapid growth in anthropogenic activities in the city. The samples in this study are limited to quantitative data. This limits any generalisation that can be conducted in a quantitative context. To encourage generalisation within the entire context, future studies should look into and include the qualitative inputs that incorporate human subjects.

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