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ORGANISED BY

Gresafe_Cities RIG
The University of Queensland, Australia
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TREE REMOVAL IN DEVELOPMENT SITE: EXPERIENCE AND PERCEPTION OF LANDSCAPE PROFESSIONALS

Khalilah binti Hassan[1], Ramly bin Hasan[2]*, Wan Saiful Nizam bin Wan Mohamad[3]
***Corresponding Author**
[1,2,3]Department of Landscape Architecture, Faculty of Architecture and Ekistics, Universiti Malaysia Kelantan, 16300 Bachok, Kelantan, Malaysia

khalilah.h@umk.edu.my
*ramly.h@umk.edu.my
saifulnizam@umk.edu.my

Abstract

Tree removal in urban areas is among the activities that contribute to the loss of urban trees. An understanding of the motives for tree removal actions in development areas is necessary so that the loss of valuable urban trees can be avoided. The results of this study provide an initial overview of the retention practices and reasons for tree removal in development areas. A total of 30 landscape professionals including academicians, consultants, and public officials were questioned about their experience and perceptions of tree retention practices through surveys and interviews. Survey data were analyzed using SPSS software and descriptive statistics by finding each item statement's frequency and mean value. The results of the study showed that 80% of the respondents thought that existing trees were usually removed in development areas. This study found that the main reason for tree removal, based on the mean ranking, is that "not everyone understands and appreciates trees" (mean = 4.73, rank 1), followed by "transplanting trees requires expertise" (mean = 4.60, rank 2). The reasons of "lack of awareness and understanding of existing laws or regulations" and "fear of falling trees" (mean = 4.37, rank 3), respectively. The main finding of this study suggests that the tree removal decisions are influenced by the level of knowledge of trees and related legislation by the various professionals involved in a development project. The knowledge simultaneously affects the awareness and perception of the survival of the tree to be retained in the development site.

***Keywords**: Urban tree, Tree removal, Tree retention, Development site, Landscape professional.*

INTRODUCTION

Urban trees serve various tangible and intangible outputs and have been identified as significant contributors to high-quality urban settings, including environmental amenities in the form of ecosystem services, and health and well-being benefits (Hall & Dickson, 2011; Skoff & Cavender, 2019). Urban tree communities are anthropogenically produced systems since they are created by human planting and removal activities (Nowak & Greenfield, 2018, 2020; Roman, Fristensky, Lundgren, Cerwinka, & Lubar, 2022). Densification and redevelopment typically result in fewer trees and a decrease in the amount of urban tree canopy (Kanniah, 2017; Clark, Ordóñez, & Livesley, 2020; Pike, Herrin, Klimas, & Vogt, 2021). As urbanisation continues to expand, more trees have been cut down to make way for new construction (Brunner & Cozens, 2013; Haaland & Bosch, 2015), potentially exposing the urban area to environmental risks due to a decline in ecosystem services. Since 2000, Malaysia

has lost 23.1% of its tree cover, equivalent to 732 Mt of CO2 emissions (Susskind et al., 2020). Instead of retaining the tree, it is common practise to remove the trees to give way to new building (Nor Hanisah & Hitchmough, 2015). The previous study has reported that the permission given to remove trees in development sites is higher rather than vice versa (Hasan, Othman, & Ahmad, 2016).

While there is some study on attitudes and motives toward urban tree removal, very little has been researched from the perspective of landscape professionals. Landscape professionals play a role in considering how landscaping spaces can best meet the needs of the public. Therefore, it is important to take into account the views and perceptions of professional groups about the constraints to retain trees or reasons for tree removal at development sites. The present study aimed to provide an initial overview of tree retention practices and to learn more about why trees are removed on development sites. Two objectives have been formulated as follows (i) to investigate whether trees on tree development sites are typically removed, and (ii) to identify what factors influence the decision to remove trees at the development site. This was done through a online questionnaire survey and semi-structured interviews with landscape professionals in Malaysia. Nine representatives from the local council were interview participants and thirty landscape professionals were survey respondents to obtain information on tree retention and removal practices at the development site. The expected results of this study will aid in identifying issues associated with tree removal in development sites.

LITERATURE REVIEW

In recent years, there have been numerous studies identifying influencing factors and reasons for tree removal in development sites. Roman et al. (2022) classify the causes of tree removal into three groups, (i) removals due to tree health decline or risk management; (ii) human land use decisions, such as capital projects and other construction; and (iii) unknown. A study by Guo, Morgenroth, & Conway (2018) found that the removed trees from redeveloped properties are higher than the removed trees from non-developed properties. Croeser et al. (2020), who investigated tree removal patterns on private land in urban landscapes, indicate that trees that are close to construction sites are more likely to be removed. Aspects of conflict (including obstacles, damaging structures, and vandalism) are mentioned by (Hamzah, Othman, Huzeima, & Hussain, 2017) as the causes of tree removal. Despot & Gerhold (2003) highlight the main reason trees are removed on construction sites is because of space limitations. A survey study by Lavy & Hagelman (2017) which examined the site-specific characteristics that influence urban tree removal, and concludes that college graduates and owner-occupants are more likely to remove trees in densely populated areas, near major streets, and on properties with older structures. In contrast to previous findings, Pike et al. (2021) discovered that trees were less likely to be cut down near newly redeveloped buildings. In another study, Guo et al. (2018) revealed that the most influential explanatory variables for predicting tree removal at a property scale are economically connected to property value, spatially related to the distance between trees and renovated buildings or driveways, and land cover is associated with property size.

Recent research by (Klobucar, Ostberg, Wistrom, & Jansson, 2021) found that the main reason for tree removal is the poor selection of planting sites and Tan & Shibata (2022) discovered that tree health was significantly related to planting spaces. This is due to the fact that the environment is one of the elements that can be detrimental to the growth of urban trees. Additionally, safety risks are also closely related to tree health. When trees are placed incorrectly, they can damage nearby structures and turn into a liability rather than a benefit. Hamzah et al. (2017) claim that safety aspects (including overgrown, dead trees, broken branches, and venomous animals) are the causes of tree removal. It is possible to prevent a tree from becoming a hazard or a nuisance by carefully selecting its location and species. It is also

supported by Hasan, Othman, & Ismail (2017) who highlight that before planting a tree, factors including tree species, planting distance, and space suitability must be considered. On the other hand, this shows how the risk of cutting down healthy urban trees can be reduced by spreading useful information about how to choose the right sites and species.

Besides, various other factors also contribute to healthy and valuable tree removal. In the studies on the motivations of residents in removing trees on a residential scale, Kirkpatrick et al. (2013) identified two types of reasons for tree removal: (i) social reasons related to pleasing others, such as councils or neighbours; and (ii) financial reasons aimed at saving money on maintenance, repairs, heating, or lawsuits. The majority of the reasons were strongly tied to personal preferences. The emphasis on the possible threats provided by urban trees rather than their advantages provides more credence to arguments in support of their removal. This view is supported by Kronenberg (2014) who identifies lack of understanding or information, as well as incomplete preferences, as the causes of tree removal. Moreover, tree removal is frequently associated with insufficient risk assessment and can result in the removal of healthy trees (Kirkpatrick et al., 2013). The negative perception of trees has also been identified as a contributing factor to tree removal. Clark et al. (2020) claim that people's unrealistic views of risk have been a major cause of the continued decline of the tree canopy. Due to the perceived risks to people's safety and property, healthy trees are increasingly being removed. One underlying reason for tree removal is to avoid any decrease in property value that an overgrown tree may cause (Andrew & Slater, 2015). Besides, Kirkpatrick et al. (2013) suggest that people are typically risk-averse when it comes to trees and tree care, so they do not fully value the benefits of owning trees. However, Klobucar, Ostberg, Wistrom, & Jansson (2021) showed that favourably perceived benefits of trees to property owners did not necessarily result in a greater tree and shrub density on particular properties. Kronenberg (2014) conducted a more extensive study focusing on the institutional barrier to retaining urban trees, using questionnaires and interviews with experts. The study revealed the main important failures included insufficient finances and different issues relating to unprofessional tree maintenance and its supervision. Clark, Ordóñez, & Livesley, (2020), in reviewing constraints on retaining urban trees on private land, reached the conclusion that the mechanism used is too subjective, and undermined by exemptions, lack of enforcement, and insufficient penalties. Pike et al. (2021), on the other hand, say that tree ordinances can protect, manage, and control the removal of trees on both public and private land.

METHODOLOGY

The instruments comprised an online survey questionnaire and a semi-structured interview (including face-to-face and video conferencing). This study was conducted between February 2020 and December 2021, using purposive sampling for selecting respondents and participants.

Questionnaire survey

The distribution of the questionnaire is purposive which selected thirty respondents from landscape professionals, including academicians, landscape consultants, and landscape contractors. This selection is based on their background and knowledge regarding the study conducted. The study also utilised snowball sampling to enable participants to identify other willing participants. Some of the participants were asked to suggest individuals who met the criteria and would be available for the study. The questionnaire contained three sections. Section A was allocated for questions aimed at getting some information about the respondent's personal information and background. Section B is designed to explore the implementation of tree retention in a development site. Section C contained thirty-nine statements related to possible reasons for removing trees from development sites. The survey questionnaire used a

5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The data collected from the questionnaire survey was analyzed using Statistical Package for Social Sciences (SPSS) version 26 software. Cronbach's Alpha was used to measure the internal consistency of the construct in the study. Descriptive statistics were used to present each item's frequency and mean value. The main limitations of this study are the relatively small sample size and criteria of sample selection. This study only takes into account the knowledge base in landscape architecture and does not account for previous experience with tree management on the development site. Future study might include larger samples, and samples are selected based on their working experience at the development site.

Semi-structure interview

The interviews were conducted to determine the constraints and obstacles that the local authorities faced when implementing tree retention on a development site. The semi-structured interviews were carried out face-to-face from February to March 2020, and video conferencing (Google Meet applications) was conducted until October 2021 due to the Movement Control Order (MCO). Each interview session lasted about an hour. A letter was sent via email to obtain approval to conduct an interview with senior landscape architects in selected local authorities; Petaling Jaya City Council, Ipoh City Council, Alor Setar City Council, Kuala Terengganu City Council, Historical Malacca City Council, Johor Bahru City Council, Shah Alam City Council, Pasir Gudang City Council and Subang Jaya City Council. The selection of participants was based on experience and knowledge of tree retention practises in the development sites, and the choice of local authorities was based on the approval for data sharing from their landscape department. Although this study used a purposive sampling technique, their participation was voluntary. There were two main questions asked in this interview: what are the constraints on retaining trees on development sites? What are the reasons for removing trees on the development site? The data from the interviews were transcribed verbatim and analysed using content analysis.

RESULTS

Two sources provided the results, including an online survey questionnaire and semi-structured interviews.

Questionnaire survey results

Reliability test

The study showed Cronbach's alpha for the internal consistency of the overall constructed items was .912, which indicated a very good association as ruled by (Hair et al, 2016). This result demonstrated that the study instrument is valid and reliable for measuring the response.

Descriptive statistics

The 30 respondents whose surveys were used in the study included academicians, landscape consultants, and landscape contractors, as follows: academicians (50%), landscape consultants (37%), and landscape contractors (13%). The majority of the respondents (70%) were master's degree holders. About 53% of respondents were male and 47% were male. The respondents were aged between 31 and 40 years (43%), and between 41 and 50 years (53%). The detailed socio-demographic characteristics are presented in Table 1.

Table 1

The study used the socio-demographic characteristics of 30 respondents whose questionnaires were used in the study

Socio-demographic characteristics		Number	Percentage
Working	University/College	15	50.0
Organisation	Landscape Consultant Firm	11	36.7
	Developer/ Landscape Contractor Firm	4	13.3
Education level	Diploma	1	3.3
	Bachelor Degree	8	26.7
	Master's Degree	16	53.3
	PhD	5	16.7
Age range	Below 30	1	3.3
	31 - 40	13	43.3
	41 - 50	16	53.3
Gender	Male	16	53.3
	Female	14	46.7
Monthly income	Below 3,170	2	6.7
(RM)	3,171 - 4,850	10	33.3
	4,851 - 7,100	7	23.3
	7,101 - 10,970	8	26.7
	10,971 - 15,040	3	10.0

Table 2 summarises the online questionnaire responses to a closed question asking 'Is it common for existing trees on the development site to be cut down?' with 'yes' or 'no' response options. In the majority of cases (24 of 30), interviewees began their response with a definitive 'yes' or 'no' and then elaborated on their answer. The result shows that 80% of the respondents agree that trees in development areas are usually being removed.

Table 2

The practice of retaining trees on development sites

Is it common practice to remove trees on development sites?	Frequency	Percentage
Yes	24	80.0
No	6	20.0
Total	30	100.0

Table 3 shows the mean ranking of reasons for tree removal on development sites. The analysis shows the main reason for tree removal, based on the ranking of means, is "not everyone understands and appreciates trees" (mean = 4.73, rank 1), followed by "transplanting trees requires expertise" (mean = 4.60, rank 2). The reasons were "lack of awareness and understanding of existing laws or regulations" and "fear of falling trees" (mean = 4.37, rank 3), respectively.

Table 3
Ranking of reasons for tree removal in development sites

Reasons	Mean	Rank
Not everyone understands and appreciates trees	4.73	1
Tree transplantation requires the involvement of specialists	4.60	2
Lack of awareness of existing laws or regulations	4.37	3
Trees were cut down for fear of falling	4.37	4
No right to control tree removal on private land	4.33	5
Tree inventory requires the involvement of experts	4.33	6
Comprehensive tree monitoring is difficult to implement on private land	4.33	7
The trend of fallen trees in the surrounding area	4.23	8
There are no building design alternatives to retain existing trees	4.17	9
The preparation of tree retention reports only involves large projects	4.13	10
Lack of funds for the cost of tree protection	4.13	11
Cut down trees can be replaced with new trees	4.13	12
Constraints in changing existing policies	4.10	13
Trees have been felled on private property covertly	4.10	14
Tree removal for road widening projects is inevitable	4.10	15
The proximity of structures and utility cables made transplanting impossible	4.07	16
The prior tree species selection was not based on location and space suitability	4.07	17
Lack of funds for tree maintenance costs	4.07	18
Lack of technical guidance for tree protection	4.03	19
The procedure is complicated and time-consuming	4.00	20
There is no format set for the preparation of tree retention reports	4.00	21
Previous construction does not take into account future needs	3.93	22
Tree felling is worthwhile because the cost is lower than tree transplanting	3.93	23
Most of the city's trees have not been inventoried	3.87	24
Design and construction changes to retain the tree will involve higher costs	3.87	25
Lack of guidelines supporting tree conservation	3.87	26
Lack of tree information	3.83	27
The felling of trees to make way for construction sites is inevitable	3.80	28
The route to the construction site becomes more challenging if trees are retained	3.73	29
Lack of planting space for transplanting	3.73	30
Lack of specialized tools and equipment	3.67	31
Lack of staff	3.67	32
The distance of existing tree planting is very close	3.63	33
Preventing tree removal means preventing the development	3.63	34
There is no specific legislation for tree retention in development areas	3.63	35
The development area already has a big quantity of trees	3.60	36
Tree removal tends to occur in small-scale projects	3.47	37
Large or mature trees that are transplanted are usually unable to survive	3.40	38
Tree removal is more common in the redevelopment project	3.27	39

Notes: Scale 1=strongly disagree, 2=disagree, 3= moderate, 4= agree, 5=strongly agree

Semi-structure interview results

Interviews were carried out with nine senior landscape architects in selected local authorities; Petaling Jaya City Council, Ipoh City Council, Alor Setar City Council, Kuala Terengganu City Council, Historical Malacca City Council, Johor Bahru City Council, Shah Alam City Council, Pasir Gudang City Council and Subang Jaya City Council (identified below as R1 to R9). The interviews were conducted to identify the constraints and challenges faced by the local authority implementing tree retention in a development site. The issues highlighted during the interview are presented in Table 1.

Table 4

The response of tree retention implementation constraints based on interview data

Theme	Example responses from interviewees
Institutional barrier	*"No ordinance to control tree removal" [R1]* *"Lack of law to preserve trees" [R2]* *"No source of authority" [R8] [R9]* *"No strong act" [R9]* *"There are no specific guidelines" [R4]* *The guidelines do not give priority to tree retention [R9]* *... the tree is on private land [R2] [R8]* *... can only control reserve land under local authorities [R4]* *Control is limited to public land; private land is less so… [R1]* *Management is only focused on trees planted and maintained by the local authority [R3]* *No application for tree removal is required for development that does include private trees. [R7]* *No decision-making authority ..only get tree removal alerts [R7]* *After the design layout has been accepted, a tree removal application is submitted... [R1]* *..not through planning permission [R8]* *Complicated procedure [R9]*
Planning and trend	*There is no comprehensive planning that involves all of the agencies and departments. [R9]* *The previous tree selection was inappropriate [R3] [R6] [R9]* *Previous planting techniques were inappropriate [R6]* *The issue of a fallen tree [R5]*
Location and Space condition	*The location of the tree could be a security threat [R2]* *Safety factor [R8]* *Trees are on road reserves…there are indeed no landscape reserves [R1] [R7]* *The tree is in the middle of the road [R2] [R6]* *Limited space for tree transplanting, conflict with drains and other utilities. [R3] [R5]* *Planting space is limited. [R1]*
Tree condition	*Large tree size [R3]* *Large trees usually cannot survive [R4]* *A transplanted tree has a 50-50 chance of surviving [R9]* *Wild plants are not listed in tree maintenance and inventory [R9]* *Problematic tree species [R6] [R8][R9]*
Resources availability and cost incur	*Unable to monitor all the trees… it is more to the initiative of the appointed landscape architect [R2]* *Unable to control when a tree has been secretly removed [R2]* *Insufficient knowledge and equipment to transplant the trees. [R4]* *Expenses of tree inventory are high when involving specialists [R3]* *High tree maintenance costs [R9]* *High tree transplanting costs [R3]*
Awareness and	*...difficult to change the existing policy...has not yet reached that level (green*

preferences	*city) [R1]* *Superiors are unaware of the tree's importance [R4]* *It is up to the department head to make that decision [R6]* *Developers themselves are concerned about the retention of trees [R8]* *Depending on the developer's wishes through the concept and layout [R9]*

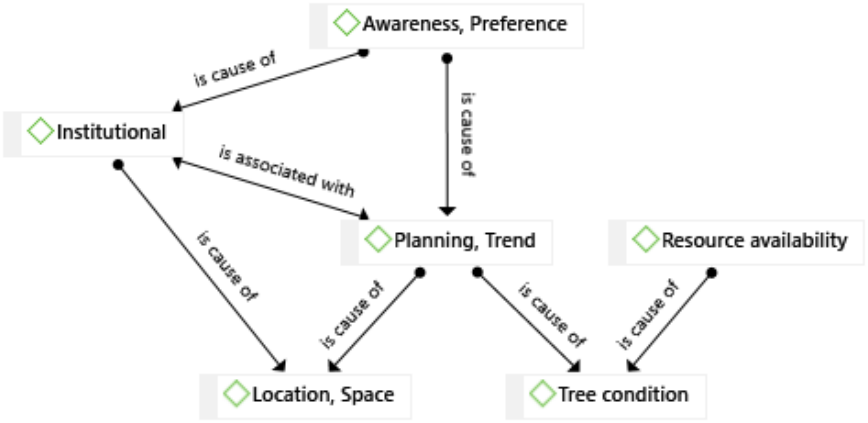
Notes: Each respondent is represented by the letters [R1] to [R9].

As can be seen from the table, the majority of respondents agreed that lack of authority is the primary obstacle to retaining urban trees on private land (n = 7). In response to the mentioned statement, other respondents indicated that it was due to the lack of robust legislation, ordinances to limit tree removal, and rules to encourage tree preservation (n = 4). Two respondents claimed that tree removal on development sites is linked to a lack of specific guidelines as well as current guidelines that do notprioritizee tree retention (n = 2). One of the respondents suggests that a lack of comprehensive planning, which involves all agencies and departments, influences the tree removal decisions (n = 1). Four of the respondents explained that the reasons for urging tree removal were related to previous tree selection and its inappropriate planting techniques (n = 4), which led to the issue of tree failure (n = 1). The location of trees in the road reserve that risks users' safety is also mentioned as a reason for tree removal (n = 3), and due to a lack of planting space and conflicts with building structures and utility cables, the trees could not be transplanted (n = 3). Problematic tree species, unlisted in the inventory and unclassified as to be retained, are often allowed to be removed (n = 3). Tree removal decisions are also associated with issues of a tree's ability to survive when it is transplanted, especially large trees (n = 3). Monitoring of trees at development sites is more the initiative of the appointed landscape architect. Additionally, the respondents also expressed their constraints to monitoring all trees since the tree was secretly removed (n = 2). According to other respondents, the procedure of tree transplanting and maintenance requires high costs (n = 2). Tree inventory procedures will also incur high costs when involving expert services (n = 1). The community's awareness and willingness to change existing policies, according to a respondent, were indirectly associated with the limitations on retaining trees as the community is not yet ready for a green city (n = 1). Respondents (n = 3) also said that the knowledge and preferences of superiors and developers played a role in the decision to retain trees on the development site.

DISCUSSION

The finding of this study indicates that trees at development sites are usually removed for development site activities. This study supports previous studies that found urban development is associated with tree loss (Koeser, Hauer, Norris, & Krouse, 2013; Lavy & Hagelman, 2019; Nowak & Greenfield, 2018). Figure 1 shows the six interconnected reasons why trees are not retained in development sites: (i) institutional, (ii) planning and trend, (iii) location and space, (iv) tree condition, (v) resource availability and cost, and (vi) awareness and preferences. As shown in Figure 1, tree removal in development sites is influenced by awareness and preference, which affects indirectly the landscape planning, trend, and institutions. Aspects of location, space, and tree condition are associated with institutions, planning, trends, and resource availability.

Figure 1
The conceptual diagram of landscape professionals' experience and perception of tree removal on the development site



Source: Authors

Awareness and preference

Most respondents to the questionnaire strongly agreed that not everyone understands and appreciates trees. This is in line with the findings of the interviews, which show the importance of awareness and preference of the community, including superiors, heads of departments, and developers, in influencing tree removal decisions at development sites. This finding further corresponds to the study by Clark et al. (2020), which found that consideration of trees in the planning process depends on an individual's motivation to protect them. One reason for insufficient individuals' awareness and appreciation of trees is a lack of knowledge. Heynen & Lindsey (2003) conclude that an individual's level of education is a reliable predictor of canopy cover in an urban landscape. The findings of this study also suggest that inaccurate perceptions, such as fear of falling trees, would influence tree removal decisions. This view is supported by (Judice, Gordon, Abrams, & Irwin (2021), who discovered that trees are removed due to an overestimation of the likelihood that a tree will fail based on the tree's proximity to the property, rather than the tree's health. In a previous study by Currell (2004), it was suggested that education is needed to correct common misconceptions about trees. Aversion or fear of the legal consequences of tree risk can also cause individuals and local authorities to overcompensate by removing large numbers of live trees or entire trees (Judice et al., 2021).

Planning and trends

This study indicates that there is no comprehensive planning between agencies and departments as one of the factors that influences tree removal in the development site. For example, (Clark et al., 2020) suggested that internal administration and the balance of views between arborists and planners ultimately determine tree protection. This issue is also associated with a variety of guidelines implemented among local authorities, which led to conflicting decisions, as mentioned by Ibrahim, Dali, Yusmah, & Yusoff (2013). Improper tree selection and planting techniques have resulted in tree removal at development sites and are closely related to planting trends and lack of tree knowledge. These findings are consistent with other studies which found that planting trends are influencing poor tree selection (Hasan et al., 2017). Besides, the trend of tree failure is one of the causes of tree removal, which however, leads to negative perceptions of all trees (Andrew & Slater, 2015; Clark et al., 2020; Kirkpatrick et al., 2013).

Institutional barrier

The institutional barrier in this finding study refers to insufficient laws, specific guidelines, and complicated procedures to retain trees on development sites. The complicated procedures of tree retention are due to present guidelines that do not prioritise tree preservation. Moreover, local laws vary significantly across countries and cities. Institutional diversity has resulted in fragmented and often conflicting decisions on retaining trees on development sites. As stated by Ibrahim et al. (2013), tree preservation laws differ among countries and the implementation of guidelines also varies among local authorities and each state. It is also difficult to retain trees on development sites due to limited power when involving private land. Profous & Loeb (1990), Coughlin, Mendes, & Strong (1988), and Hill, Dorfman, & Kramer (2010) explain that tree removal permits for private property are ineffective because tree removal permission is almost always granted. Moreover, local municipalities are primarily responsible for the management of urban trees, but their responsibilities are limited to the management of public spaces containing park and street trees. Consequently, privately owned trees are presumed to be a largely unknown and neglected source of urban ecosystem services from the perspective of local government. (Klobucar et al., 2021).

Condition of location and space

Location and space conditions, such as limited space for planting and transplanting trees, were explained by respondents as the common reasons for tree removal in development sites. These issues relate to landscape and road reserves, and previous planning that does not take into account future needs. This inference is also supported by a previous study which found that providing practical information on site and species selection could reduce the likelihood of healthy urban tree removal (Klobucar et al., 2021). Moreover, various guidelines implemented by local authorities have led to conflicting results, as mentioned by Ibrahim, Dali, Yusmah, & Yusoff (2013). This problem is also associated with non-comprehensive planning between the agencies and departments involved. This inference can be explained by the fact that there are institutional constraints in urban greening strategy and planning standards, such as lack of coordination and integration, no comprehensive territory-wide strategy, and limited requirements for the provision of green space outside of open space zoning (Jim, Bosch, & Chen, 2018).

Tree condition

This study found that tree-related characteristics such as species, size, and survival resistance affected tree removal decisions. Tree selection with a lack of knowledge of species characteristics and tree care has contributed to healthy tree removal. These findings further support the study by Klobucar et al. (2021) which highlighted that appropriate species-space selection could reduce the risk of healthy urban tree removal. Large trees would have been removed to provide a "blank canvas" for future development (Morgenroth, Neil-dunne, & Apiolaza, 2017). This study also suggests that uncertainty about a tree's life resilience, which is associated with losses to development projects, is the cause of removing trees on development sites. Conversely, Tan & Shibata (2022) demonstrate that the majority of species present in the city have a strong tolerance for restricted planting conditions. Hasan, Othman, & Ahmad (2016), on the other hand, say that some developers care more about making money than keeping trees alive on construction sites.

Resource availability and cost incurred

The findings of the study indicate that knowledge, equipment, and expert service are important in influencing tree removal decisions. However, expert service is indispensable, especially when involving tree transplant procedures. The services typically require specialised

equipment and expert knowledge to transplant trees safely, especially large trees. The need for specialised tools and expert services that involve high costs causes trees to be removed rather than transplanted. These findings further the discussion by Brunner & Cozens (2013) that trees might have been removed if they had the potential to increase the cost of the development project. Roman et al. (2020) also highlight the ability of stakeholders to maintain ecosystem services is influenced by management costs (or their response to disservices). This inference can also be explained by the fact that even municipal authorities have direct authority over urban environments, although this jurisdiction does not extend beyond private property lines (Klobucar et al., 2021). As a result, privately-owned trees are rarely included in urban tree inventories. Since, these trees are not registered, local authorities frequently are not aware that there are trees on private property.

CONCLUSION

This study offers insights into tree retention practise and reasons for tree removal in development sites. All trees are worthy of retention unless there are justifiable reasons to prove otherwise. Unfortunately, the major finding of this study reveals that the majority of trees are usually removed at development sites. This study also found six categories of reasons for tree removal on development sites, which are interrelated to each other. Awareness, preferences, and perceptions about trees are influenced by knowledge, which indirectly affects urban landscape planning. Issues in planning and trends have given problems with the space and condition of trees in urban areas that allow trees to be removed. Furthermore, the lack of institutional support and the lack of expertise and tools also affect the decision to remove trees in development sites. There are many reasons for tree removals that are not based on genuine risk to health or property, but rather on unfounded perceptions and fears of what might happen or where the tree is considered to be in the way of some other activity. The removal of trees for these reasons will pose a threat to the fabric of urban forests. Thus, this study demonstrates that these six categories of factors influence the removal of trees on development sites in Malaysia. This study clarifies the urban tree removal scenario at the development site as a whole. In addition, this study can provide insights for practitioners in their tree retention practices and decision-making.

REFERENCES

Andrew, C., & Slater, D. (2015). Why some UK homeowners reduce the size of their front garden trees and the consequences for urban forest benefits as assessed by i-Tree ECO. *Arboricultural Journal*, *36*(4), 197–215. https://doi.org/10.1080/03071375.2014.994388

Brunner, J., & Cozens, P. (2013). 'Where Have All the Trees Gone?' Urban Consolidation and the Demise of Urban Vegetation: A Case Study from Western Australia. *Planning, Practice & Research*, *28*(2), 231–255.

Clark, C., Ordóñez, C., & Livesley, S. J. (2020). Private tree removal, public loss : Valuing and enforcing existing tree protection mechanisms is the key to retaining urban trees on private land. *Landscape and Urban Planning*, *203*(July), 103899. https://doi.org/10.1016/j.landurbplan.2020.103899

Coughlin, R. E., Mendes, D. C., & Strong, A. L. (1988). Local Programs in the United States for Preventing the Destruction of Trees on Private Land. *Landscape and Urban Planning*, *15*, 165–171.

Croeser, T., Ordóñez, C., Threlfall, C., Kendal, D., Ree, R. Van Der, Callow, D., & Livesley, S. J. (2020). Patterns of tree removal and canopy change on public and private land in the City of Melbourne. *Sustainable Cities and Society*, *56*(September 2019), 102096. https://doi.org/10.1016/j.scs.2020.102096

Currell, A. (2004). Reviewing tree preservation orders: implications for local planning authorities. *Arboricultural Journa1*, *28*(May 2015), 21–43. https://doi.org/10.1080/03071375.2004.9747400

Despot, D., & Gerhold, H. (2003). Preserving trees in construction projects: Identifying incentives and barriers. *Journal of Arboriculture*.

Guo, T., Morgenroth, J., & Conway, T. (2018). Redeveloping the urban forest: the effect of redevelopment and property-scale variables on tree removal and retention. *Urban Forestry & Urban Greening*. https://doi.org/10.1016/j.ufug.2018.08.012

Haaland, C., & Bosch, C. K. Van Den. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: a review. *Urban Forestry & Urban Greening*. https://doi.org/10.1016/j.ufug.2015.07.009

Hair, J. F., Celsi, M., Money, A., Samouel, P., & Page, M., (2016). *The Essentials of Business Research Methods*, 3rd Edition. Faculty Bookshelf. https://digitalcommons.kennesaw.edu/facbooks2016/2

Hall, C. R., & Dickson, M. W. (2011). Economic, Environmental, and Health/Well-Being Bene fits Associated with Green Industry Products and Services : A Review. *Environ.Hort.*, *29*(June), 96–103.

Hamzah, H., Othman, N., Huzeima, N., & Hussain, M. (2017). *Tree Removal Application by Urban Dwellers : A Case Study of Kajang Local Authority*. *2017*, 2013–2017.

Hasan, R., Othman, N., & Ahmad, R. (2016). Tree preservation order and its role in enhancing the quality of life. *Procedia - Social and Behavioral Sciences*, 493–501. https://doi.org/10.1016/j.sbspro.2016.05.140

Hasan, R., Othman, N., & Ismail, F. (2017). Tree Species Selection in Street Planting: It's relationship with issues in urban area. *Environment-Behaviour Proceedings Journal*, *2*(6), 185–194. https://doi.org/10.21834/e-bpj.v2i6.951

Heynen, N. C., & Lindsey, G. (2003). Correlates of urban forest canopy cover. *PUBLIC WORKS MANAGEMENT & POLICY*, *8*(1), 33–47. https://doi.org/10.1177/1087724X03253604

Hill, E., Dorfman, J. H., & Kramer, E. (2010). Evaluating the impact of government land use policies on tree canopy coverage. *Land Use Policy*, *27*, 407–414. https://doi.org/10.1016/j.landusepol.2009.05.007

Ibrahim, P. H., Dali, M., Yusmah, S., & Yusoff, M. (2013). Implementation of Open Space: The Need for Uniform Policy. *Journal of Sustainable Development*, *6*(7), 16–25. https://doi.org/10.5539/jsd.v6n7p16

Jim, C. Y., Bosch, C. K. Van Den, & Chen, W. Y. (2018). Acute Challenges and Solutions for Urban Forestry in Compact and Densifying Cities. *Urban Plann. Dev.*, *144*(3). https://doi.org/10.1061/(ASCE)UP.1943-5444.0000466

Judice, A., Gordon, J., Abrams, J., & Irwin, K. (2021). Community Perceptions of Tree Risk and Management. *Land*, (10), 1096.

Kanniah, K. D. (2017). *Quantifying Green Cover Change for Sustainable Urban Planning: A Case of Kuala Lumpur, Malaysia*.

Kirkpatrick, J. B., Davison, A., & Daniels, G. D. (2013). Sinners, scapegoats or fashion victims? Understanding the deaths of trees in the green city. *Geoforum*, *48*, 165–176. https://doi.org/10.1016/j.geoforum.2013.04.018

Klobucar, B., Ostberg, J., Wistrom, B., & Jansson, M. (2021). Residential urban trees – socio-ecological factors affecting tree and shrub abundance in the city of Malm¨o, Sweden. *Urban Forestry & Urban Greening*, *62*. https://doi.org/10.1016/j.ufug.2021.127118

Koeser, A., Hauer, R., Norris, K., & Krouse, R. (2013). Factors influencing long-term street tree survival in Milwaukee, WI, USA. *Urban Forestry & Urban Greening*, *12*(4), 562–568. https://doi.org/10.1016/j.ufug.2013.05.006

Kronenberg, J. (2014). Why not to green a city? Institutional barriers to preserving urban ecosystem services. *Ecosystem Services*, 1–10. https://doi.org/10.1016/j.ecoser.2014.07.002

Lavy, B. L., & Hagelman, R. R. (2017). Spatial and Temporal Patterns Associated with Permitted Tree Removal in Austin, Texas, 2002-2011. *The Professional Geographer*, *0124*(July), 2002–2011. https://doi.org/10.1080/00330124.2016.1266953

Lavy, B. L., & Hagelman, R. R. (2019). Protecting the urban forest: Variations in standards and sustainability dimensions of municipal tree preservation ordinances. *Urban Forestry & Urban Greening*, *44*(July), 126394. https://doi.org/10.1016/j.ufug.2019.126394

Morgenroth, J., Neil-dunne, J. O., & Apiolaza, L. A. (2017). Redevelopment and the urban forest: A study of tree removal and retention during demolition activities. *Applied Geography*, *82*, 1–10. https://doi.org/10.1016/j.apgeog.2017.02.011

Nor Hanisah, M. H., & Hitchmough, J. D. (2015). The comparisons of perceptions among landscape professionals' on tree retention and legislation. *International Academic Research Journal of Social Science*, *1*(2), 164–176.

Nowak, D. J., & Greenfield, E. J. (2018). Declining urban and community tree cover in the United States. *Urban Forestry & Urban Greening*, *32*(November 2017), 32–55. https://doi.org/10.1016/j.ufug.2018.03.006

Nowak, D. J., & Greenfield, E. J. (2020). The increase of impervious cover and decrease of tree cover within urban areas globally (2012 – 2017). *Urban Forestry & Urban Greening*, *49*(January). https://doi.org/10.1016/j.ufug.2020.126638

Pike, K., Herrin, K. O., Klimas, C., & Vogt, J. (2021). Tree preservation during construction : An evaluation of a comprehensive municipal tree ordinance. *Urban Forestry & Urban Greening*, *57*(August 2020), 126914. https://doi.org/10.1016/j.ufug.2020.126914

Profous, G. V., & Loeb, R. E. (1990). The legal protection of Urban trees: A comparative world survey. *Journal of Environmental Law*, *2*(2), 179–193. https://doi.org/10.1093/jel/2.2.179

Roman, L. A., Conway, T. M., Eisenman, T. S., Locke, D. H., Koeser, A. K., Ordo, C., … Johan, O. (2020). Beyond 'trees are good": Disservices, management costs, and tradeoffs in urban forestry. *Ambio*. https://doi.org/10.1007/s13280-020-01396-8

Roman, L. A., Fristensky, J. P., Lundgren, R. E., Cerwinka, C. E., & Lubar, J. E. (2022). Construction and Proactive Management Led to Tree Removals on an Urban College Campus. *Forests*, (13), 871.

Skoff, J. B. T., & Cavender, N. (2019). The benefits of trees for livable and sustainable communities. *Plants, People, Planet*, (1), 323–335. https://doi.org/10.1002/ppp3.39

Susskind, L., Chun, J., Goldberg, S., Gordon, J. A., Smith, G., & Zaerpoor, Y. (2020). Breaking Out of Carbon Lock-In : Malaysia's Path to Decarbonization. *Front. Built Environ.*, *6*(March). https://doi.org/10.3389/fbuil.2020.00021

Tan, X., & Shibata, S. (2022). Factors influencing street tree health in constrained planting spaces: Evidence from Kyoto City, Japan. *Urban Forestry & Urban Greening*, *67*(March 2020), 127416. https://doi.org/10.1016/j.ufug.2021.127416

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