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# Application of ecological attributes in the contemporary landscape assessment research

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**Abstract:** Ecological attributes are most commonly associated to nature-based landscape assessment. But their applications are less discussed in the non-nature based landscape assessment. This paper reviews a collection of 31 journal articles, which were published between 1974 and 2015. The results show that ecological attributes such as water, vegetation and landform, have increasingly featured in various studies on non-nature based landscape assessment studies. This suggests that ecological attributes can support and enhance the assessment of both nature- and non-nature-based landscapes significantly. To this end, this paper also proposes a preliminary ecological model for landscape assessment research.

**Key words**: Ecological attributes; Scenic beauty; Landscape assessment

## 1. Introduction

Ecological attributes are more commonly applied to nature-based landscape assessment but less on non-nature-based landscape assessment. Previous work by scholars such as Daniel (2001); Palmer (2008); Jamilah, (2011) and etc., which have focused heavily on the application of ecological attributes in the nature-based landscape may have, in part, give credence to this prevalent misconception. Ecology is always closely linked to landscape quality and landscape assessment. High concern and interest in scenic landscapes with ecological issues can be found in the studies of Jogensen (2011); Kovacs, LeRoy, Fischer, Lubarsky and Burke (2006); Parsons and Daniel (2002) and Daniel (2001). This suggests that application of ecological attributes in landscape assessment should be more widespread and, should not limited to nature-based landscape assessment only. This paper reviews a collection of journal articles to identify the common ecological attributes that have been used in both nature- and non-nature-based landscape assessment studies.

The aim is to show that ecological attributes are importantly relevant in both types of landscape assessment. It is hoped that the findings from this study would provide the impetus for further researches and developments on landscape assessment methods, especially where ecological attributes play a greater role in the non-nature-based landscape assessment.

## 2. Landscape assessment

Scenic beauty is among the landscape values, which is assessed using expert, public experiential, cognitive and psychophysical methods (Zube et al., 1982). Sometimes researcher uses Scenic Beauty Assessment (SBA) to determine healthy environment that would be the basis to landscape integrity, which involves visual interpretation of the landscapes perceived. This involves scenic preferences for different types of landscape (Unwin, 1975). The method describes the manner, where peoples of various backgrounds interpret and judge a landscape. The results of the assessment should be easily understood and applied for better landscape management practices, landscape design and planning decisions. The method was clearly stated in the work of Zube et al. (1982).

In the design-based research, quantifying scenic quality should be the consequence of a management action (Buhyoff et al., 1994). Importantly, many ecological attributes of a landscape are important indicators of the health of an environment. Scenic value might be the primary indicator to an intrinsic landscape, since it triggers positive responses in people (Anderson and Schroeder, 1983). The value would also be the indicator to guide and plan for better management of public landscapes with ecological value (Jamilah et al., 2011).

## 3. Ecological attributes

Some ecological values should be restored or screened as early as the planning stage for balance ecosystems and sustainable environment (Beer and Higgins, 1990). Scenic landscapes can be associated with valuable ecology and healthy environment. There are some ecological attributes that have strongly influenced the scenic beauty of a natural

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landscape. For instance, these are the landform, vegetation, wildlife and water elements (e.g. lake, river, stream, or waterfall). The followings describe the ecological attributes of water, landform and water that are commonly used to evaluate scenic landscapes.

### 3.1. Water

The abundance of water might lead to positive terrestrial habitats of forest, grassland, wetland, shoreline and beach. To some extent, the amount of water within an environment may support a habitat with certain species (Sani, 1998). Water is an independence component that supports the important landscape features such as vegetation. However, most water sources have potential to get polluted by unsustainable developments. It is clear that water is essential to sustain the living environment of various species. As a natural resource, it also promotes high visual quality. Ecological design and planning that integrate water features in response to human needs may be appreciated for their scenic landscapes. The approach restores the biodiversity as well as protecting further loss of scenic value. The idea of self-regulating and self-maintaining of some ecological attributes helps sustaining scenic beauty and fostering lively and healthy environments. For instance, waterway management planning is assumed to be a workable management plan for protecting scenic value of a river corridor (Oregon Parks and Recreation Department, 2015).

### 3.2. Landform

Form, altitude and soil physical are among the controlling factors that characterise types of landform of an environment. Additionally, the elements determine the types of development, vegetation availability, microclimatic temperature, humidity, and etc. Interestingly, fertile land is mostly found in the humid subtropical climate. For instance, the situation can be evidenced in the highland ecosystem such as Cameron Highlands, Malaysia (Barrow et al., 2009). Here, fresh and cool climates with the elevation between 1070 to 1830 meters above sea level would establish successful agricultural activity. It is evidenced that landform can influence types of land use of an area. Unsurprisingly, elevation and slope are often associating with outstanding scenic views. Perhaps, such ambiences are still evidenced at the Frasers Hill, Cameron Highland, Penang Hill and Genting Highland of Malaysia.

### 3.3. Vegetation

Vegetation is a system with large spontaneously growing plants. Maarel (2005) provides comprehensive description on the ecology of vegetation and claims that not all greens are vegetation, unless they have the ability to grow naturally. Usually, forest lands have been cleared up or modified for agricultural and development activities. Developments are necessary, yet excessive vegetation clearing would alter the physical form of a landscape and depleting some natural resources. Review shows that physical changes due to new development activity may cause visual impact on the scenic landscape (Amir and Gidalizon, 1990). Since vegetation is among the natural components having associated with visual quality, thus, sustainable development should consider scenic reserve through detailed design, planning and management.

## 4. Methodology

The study reviewed the application of three ecological attributes in the landscape assessment research. The review analysed the contents of 31 English articles from the perspectives of American, Spanish, British, Netherlands, Turkish, Italian and Malaysian. The articles were peer-reviewed social science journals and categorised under the disciplines of landscape architecture, geography, forestry, and environmental science. Some of the journals are ISI (Institute for Scientific Information), and Scopus indexed. The issues were published between 1974 and 2015 with 41 years old of an establishment. The identification of the articles was randomly selected under the keywords of ecology or scenic beauty assessment. Some of them were retrieved from electronic journal via online. The paper used content analysis to evaluate the contents of the articles. Seven ecological keywords were identified and categorised into themes namely rural, urban, agriculture, culture, natural, landscape perception and landscape management. The followings are the brief criteria of the selection.

- The contents should have a discussion, description, evaluation or methodologies concerning the issues of ecology and landscape assessment research
- The terms scenic quality, landscape quality, scenic value, aesthetics, visual quality, scenic landscape are accepted having similar definitions
- The contents would specify both the theoretical and practical aspects of the landscape assessment research

## 5. Assessment of nature and non-nature based landscape

The study of landscape assessment research provides information about public's visual expectation on the landscape perceived (Gobster and Westphal, 2004). From here, types and quality environments with diverse landscapes are identified using several landscape physical attributes. The intrinsic quality of the landscape features may determine quality environment. The followings describe the details of the landscape characters.

### 5.1. Rural landscape

Rural landscape can be explained by an area that undergoes a low-density kind of residential subdivision (Johnson and Beale, 1995). Thus, the landscape with low-density development can be classified as having rural characteristics. In contrast, a rural landscape can be recognised as a suburban area that is usually located at urban fringe (Ryan, 2002). So, wilderness and man-made features like buildings would play significant role in determining the visual quality of the rural landscape. Based on the Andalusia experience, Arriaza, Ortega, Madueno and Aviles, (2003) found that, multi-crop lands allocation and the use of natural cover between olive trees would contribute to higher visual quality of the agricultural landscape there. Review shows that a rural landscape is unique, when having mixed with natural and cultural landscape components (Stilgoe, 1989).

### 5.2. Urbanscape

Urbanscape is an area, where variation of materials that covers the landscape such as paving, structure and vegetation is found (Anderson and Schroeder, 1983). It is observed that the study of visual analysis would create early awareness about the importance of establishing public's participation. Some natural landscape components have potential to elevate the landscape values of an urban environment and this includes scenic beauty. In the context of Malaysia, more developers are keen in promoting the natural attributes as one of the main attractions in their development having believed that these may increase the value of properties. Besides that, the attributes would also influence quality of life and environment.

The study of urbanscape assessment identifies the locations of natural value that might expose to an environmental issue. So, the natural resources located should be utilised wisely with an optimum protective measure. Perhaps, a landscape assessment practice is considered essential, when one urbanscape has an ecological influence. Review shows that the combination of landscape features of man-made and natural would enable designers to produce beautiful and practical landscape (Erdonmez and Kaptanoglu, 2007). This study also suggests that proper landscape maintenance and management should be practised to sustain the scenic beauty of the urban environment.

### 5.3. Rural landscape

Cultural Landscape is the continuity of the land-use patterns that being preserved through generations (Lynchh and Gimblett, 1992). Traditionally, the evolution of the patterns only happens between settlement and economic practices. The Malaysians are unique, due to their diversities of races, ethnics, belief, religions, cultures and many more. A cultural landscape should portray the ambience of the community with more valuable norms and behaviors through correct utilization of landscape. These are landscape expressions passed through generations based on land-use patterns. Perhaps, this is where the historical remnants of civilization can be emphasized in the urbanization planning through the concepts of adding value or standing - alone feature. The historical elements of a landscape include fencing patterns, wind breaks, tree alignment, building composition, and cemeteries, which may relate to certain cultural values. This study views the elements of the cultural landscape as common sceneries to represent the usage of space from generations. Parallel to that, a historical landscape would be an indicator of how man has evolved and gradually changed the landscape features, components and characters from time to time.

### 5.4. Agricultural landscape

Agricultural landscape is related to a planned-forest harvesting activity to support the timber need (Cissel, 1999). Based on the study of Brien (2003), excessive lodging activity on the valuable forest timber species can interrupt the integrity of an ecosystem. Thus, landscape management practices associated with clustered lodging, re-plantation of lodged area, small scale lodging at one time and etc. are done to reduce the negative impacts on the forest landscape. Gobster (1999) provides comprehensive studies on the landscape management practices of a forest landscape. The work of Brien (2003) emphasises on public's perceptions of a natural environment with the agreement that the landscape would provide healthy outdoor activity with the mentally pleasurable surrounding. Overall, this concludes that the landscape management practices would be crucial to sustain the ecological resources of a forest landscape, due to change of land use patterns. Among the outcomes of the landscape assessment research is to produce the relevant landscape management plan for sensitive ecosystems of forest.

### 5.5. Natural landscape

Natural landscape is biologically diverse environment with less human intervention (Gobster and Westphal, 2004). The study of landscape assessment research on scenic preferences of natural landscapes has flourished tremendously. It is found that natural settings are relevant to the sustainable management of scenic resources and aesthetics amenities of urban, rural, or cultural environments (Ulrich, 1986). The intimate relationship between ecology and aesthetic is considered complex (Gobster et al., 2007). It is agreed that aesthetic has more implications on quality ecology. Similarly, a landscape aesthetic is agreed to have a critical linkage between human and the ecological processes. The idea is highlighted in the ecological model proposed. Among the public, scenic beauty of the natural landscapes receives good ratings. It is evidenced that natural landscape is

strongly connected to aesthetic or sometimes understood as ecological aesthetic (Thorne and Huang, 1991). Public's landscapes with healthy and diversity ecology environment should be properly managed, protected and maintained.

## 6. Result and discussion

The review of the 31 journal articles provides new insights in the study of landscape assessment research. 14 articles were categorised as landscape perception and landscape management. Table 1 presents the results of the review. It is evidenced that vegetation, water and landform influence the visual quality of a landscape. Based on the results, the study proposes a model to describe the application of the ecological attributes to a broader scope of landscape assessment research (refer to **Fig. 1**).

**Table 1**: Distribution of ecological attributes found in nature and non-nature based research

| Discipline | Review period (years) | Origin | No. of articles |
|---|---|---|---|
| Rural | 1989,1995,2002 | England | ٣ |
| | 2003 | Spain | ١ |
| | 2005 | Italy | ١ |
| Urban | 1983, 2004, 2015 | US | ٣ |
| Agriculture | 2009 | Malaysia | ١ |
| Cultural | 1992 | US | ١ |
| Natural | 1998, 2015 | Malaysia | ٢ |
| | 1986, 2002, 2007 | US | ٣ |
| | 2006 | Turkey | ١ |
| | 2005 | UK | ١ |
| Landscape perception | 1982, 1995, 2001 | US | ٣ |
| | 1975, 1990, 1994 | UK | ٣ |
| | 2007 | Turkey | ١ |
| Landscape management | 1990, 1999, 2000, 2015 | US | ٤ |
| | 1991 | Netherkands | ١ |
| | 2013 | Turkey | ١ |
| | 1974 | UK | ١ |
| Total | | | ٣١ |

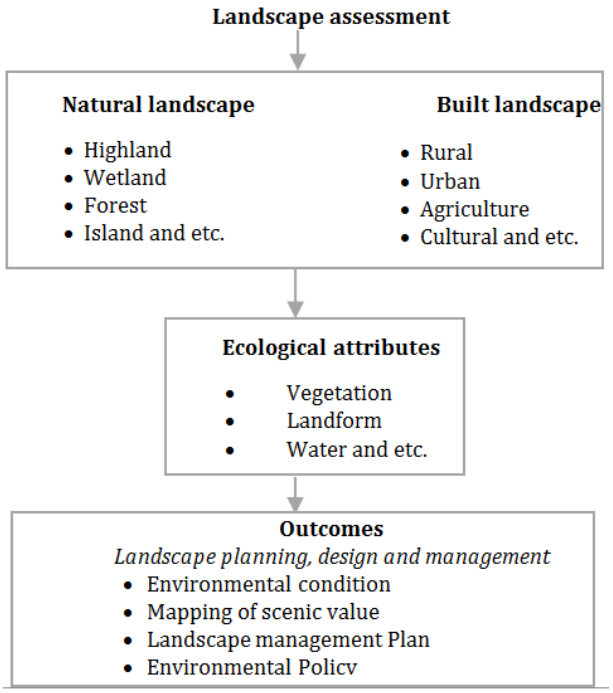


**Fig 1**: Proposed ecological model for landscape assessment research

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