DESIGN FOR COMMUNITY GREENWAY – LOW MAINTENANCE TRAIL FOR RECREATIONAL AND EDUCATIONAL PURPOSES AT THE FACULTY OF SUSTAINABLE AGRICULTURE, UMS SANDAKAN

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ACKNOWLEDGEMENT

This dissertation is dedicated:

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ABSTRACT

This study was conducted from February 2015 to November 2015 (28 weeks) to explore greenway landscape planning at the Faculty of Sustainable Agriculture, Universiti Malaysia Sabah Sandakan Campus (geographical coordinates: 50° 55’ 51.32” N, 118° 00’ 39.92” E), Sandakan. This study aimed to promote a healthy campus life in Faculty of Sustainable Agriculture (FSA) as well as to improve the well-being of its community. The study site was located at the main lake of FSA, which is also the largest lake in FSA. The objectives of this research were to assess FSA’s community’s input on the idea of a multi-functional trail in the campus and their knowledge on sustainable landscape practices, conduct site inventory and analysis at the proposed site and recommend a low-maintenance trail design. This thesis employed a mixed-method approach which were qualitative method (site inventory and site analysis) and quantitative method (questionnaire survey and descriptive statistical analysis). The existing soil was extremely dry and the pH range from 6.2 to 8. Questionnaire were distributed to 50 respondents and the findings collected were analysed and utilized for the design recommendation at the proposed site. Based on the findings, there were 86% respondents who were unsatisfied with the existing site and 72% was not familiar with application of sustainable landscape practices. The proposed site was divided into four different zones: Zone A, Zone B, Zone C and Zone D. The final output of the landscape design recommendation were master plan, several perspectives from each zone and planting palette. To conclude, a low-maintenance landscape, which integrated with greenway concept and sustainable practices, was proposed to be implemented at the lakeside of FSA, which mainly included low-maintenance (concrete-based) trail and low-maintenance plants along the lakeside for recreational and educational purposes.
**REKA BENTUK TAMAN KOMUNITI-LALUAN PENYELENGGARAAN RENDAH UNTUK TUJUAN REKREASI DAN PENDIDIKAN DI FAKULTI PERTANIAN LESTARI, UMS SANDAKAN**

**ABSTRAK**

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LIST OF SYMBOLS, UNITS AND ABBREVIATIONS

% Percentage
'
Minutes
" Seconds
° Degrees
am Ante meridiem
E East
e.g. for example
et al. et alia
etc. et cetera
FPL Fakulti Pertanian Lestari
FSA Faculty of Sustainable Agriculture
i.e. that is
JPP Jabatan Pembangunan dan Penyelenggaraan
lux Illuminance
m Metre
N North
PhD Doctor of Philosophy
pm Post meridiem
PMR Penilaian Menengah Rendah
PT3 Aplikasi Pentaksiran Tingkatan 3
STPM Sijil Tinggi Persekolahan Malaysia
UMS Universiti Malaysia Sabah
UPSR Ujian Pencapaian Sekolah Rendah
CHAPTER 1
INTRODUCTION

1.1 Background

Provision of quality living and learning setting is important for both students and staffs in university campuses (Noraini and Ismail, 2014). Thus, greenway plays a crucial role in campus planning in order to create a healthy and responsive working and learning environment. It plays multiple roles such as for ecological protection, environmental protection, educational and recreational. It is believed to offer more benefits; physically, socially and emotionally (Nurhayati et al., 2015).

Greenway allows movement of campus residents at the surrounding of lake under comfortable and safe conditions. It may also provide route for cyclist and pedestrian to boost health benefits through contact with nature when they utilize the greenway and promotes 'green' transportation mode. Greenway at lakeside may also become a communal space because it provides a chance to congregate and communicate through a simple greeting and smiling (Noraini and Ismail, 2014).

Past studies have confirmed that there is a link between health outcomes and green space, which is affected by the increasing levels of physical activity of individuals living in areas with more green space (Mytton et al., 2012). Thus, this study is proposed to go beyond the creation of an infrastructure for recreation and education by developing a relaxing and learning platform for campus community.

The design of greenway includes the entire areas alongside of the lake in FSA, offering a chance for campus residents to carry out their daily activities such as biking,
jogging, walking, experiencing nature, displaying artworks, watching people, meeting friends and so on. A low maintenance trail, which is also considered as lakeside promenade, becomes an infrastructure for recreational and educational purposes.

It might be one such environmental influence promoting physical activity by offering a safe, accessible and attractive place for exercise, such as walking, jogging, running or cycling (Figure 1.1). It is hypothesized that those who have access to more green space including greenway in their surrounding environment might be expected to achieve higher levels of physical activity (Mytton et al., 2012). In addition, the creation of such a greenway, where sustainable practices are involved, will help to improve environmental and visual quality in the campus.

Figure 1.1 A greenway design that runs alongside the lake in Aix les Bains, France

According to Noraini and Ismail (2014), greenery that would provide a wide range of benefits to campus community, especially students. In this sense, they agreed that
students might prefer a campus with a large green area as comfortable places for study. Thus, campus greening at lakeside FSA is one of the approaches taken to achieve environmentally good campus by maintaining and improving all the landscape elements that exist alongside the lake as well as other recreational facilities. On the other hand, greenway at lakeside FSA may also give an opportunity to conserve the remnant green spaces, which nearly disappear from a campus scene due to continuously development pressure.

In short, this study is conducted to explore greenway landscape planning at the lakeside for recreational and educational purposes to promote a healthy campus life in FSA as well as to improve the well-being of its community.

1.2 Justification of Study

Furthermore, the existing landscape in FSA is considered as lacking aesthetically and functionally. FSA’s landscape should be a testing grounds for innovative landscape practices and even acts as a demonstration area for the public. Referring to Figure 1.2, it can be clearly seen that there is only one type of groundcover and only a few trees planted on the surrounding of the lake. Currently, the area is used for only one type of recreation activity, which kayaking. The lack of landscape facilities has also discouraged the community from using the site for other outdoor activities. Obviously, it is not attractive enough for staff or students to do other recreational activities such as cycling and jogging. The lake has the potential to serve as focal point to attract users. This study will explore the ideas of multifunctional greenway planning for recreational and educational purposes such as group discussion, photographing, walking, kayaking, wildlife observation, fishing and jogging. The importance of aesthetic features in a landscape design is important is to integrate the trail into the landscape context. Besides, the landscape design planning will respond to the needs of a low-maintenance trail through the integration of sustainable landscape practices.
1.3 Objectives

The objectives of this research are:
I. To assess Faculty of Sustainable Agriculture (FSA)'s community's input on the idea of a multi-functional trail in the campus and their knowledge on sustainable landscape practices.
II. To conduct site inventory and analysis at the proposed site.
III. To recommend a low-maintenance trail design for recreational activities and educational purposes.
CHAPTER 2
LITERATURE REVIEW

2.1 Greenway

2.1.1 Greenway Concepts

According to Shafer et al. (2000), greenway is generally defined as a linear open space corridor that includes a natural or human-made feature either for travel or recreational activities. On the other hand, Ahern (2003) identified greenway as networks of land that are planned, managed and utilized for multiple purposes including cultural, recreational, ecological, aesthetic, or other congruous with sustainable land use concept.

Furthermore, Greenways Incorporated (2011) suggested that greenways are utilized as land corridors that are able to connect both places and people together. In this case, greenways can be considered as vegetated buffers to improve water quality, protect natural habitats, and reduce flooding impacts in areas of floodplain (Figure 2.1). Greenways mostly contain trails, which improve existing recreational opportunities, enhance the overall life quality, and provide routes for alternative transportation in that particular area (City of Boulder Greenways System, 2011).

Besides, greenways nowadays have been implemented to control flooding and enhance water quality (Figure 2.1). Shafer et al. (2000) found that greenway is able to protect floodplain areas from encroachment and thus indirectly benefit residents by keeping them out of harm’s way. Therefore, greenways are usually designated along natural features such as streams and rivers for better storm-water management. They also mentioned that greenway corridors also help to purify water because it recharges aquifers or other sources for instance reservoir.
To protect and restore riparian, floodplain, and wetland habitat.

To enhance water quality.

To facilitate storm drainage and mitigate floods.

To provide alternative transportation routes or trails for pedestrians and bicyclists.

To provide recreation opportunities.

To protect cultural resources.

Figure 2.1 Objectives of greenway program
Source: City of Boulder Greenways System, 2011

Ribeiro and Barao (2005) stated that the widely use of greenway concept can be related to its effectiveness in achieving its aims to foster landscape conservation, protect heritage and provide opportunities for public recreation. In addition, they suggested that landscape conservation should be done as a group of methods aimed at safeguard cultural and natural resources. Mytton et al. (2012) realized that greenway is one of the environment influences promoting physical activity by offering an attractive safe, accessible and place for relaxing, exercise, and playing games.

According to Ahern (1995), the greenway movement builds on scientific theories such as the meta-population and island bio-geographic theories of ecology, which shows the need for ecological connectivity. He also mentioned that greenways are not only for the protection of nature, but also for other human uses of the landscape which are recognized and legitimized, so that there is a balance between resource use and protection. Sustainability should be regarded as a special globally accepted goal and paradigm for the future.

There are five ideas listed by Ahern (2003) regarding greenway concepts. He suggested that the spatial configuration of greenways is primarily linear. Linkage is a key greenway characteristic that defines the greenway and relates it to the larger landscape context, generally at multiple scale levels. For example, greenway is integrated systems
bid to realize a synergy based on the benefits of linkages across spatial scales. At times, it may be gain the synergistic properties of a network.

Furthermore, based on an assumed or negotiated spatial and functional compatibility of special uses, greenways are considered multifunctional. These trade-offs have important spatial and functional consequences, thus they are particularly important in greenway planning (Ahern, 2003). The decisions made on greenway goals like environmental protection should reflect cultural and social perceptions and values. Besides, he also mentioned that greenways strategy is consistent with the concept of sustainable development based on an assumed complementarity between nature protection and economic development. In addition, greenways indicate a distinct spatial strategy depending on the particular characteristics and advantages of integrated linear. He suggested that greenways should be considered as a complement to comprehensive landscape and physical planning but not a replacement. Efforts should be done in order to protect other important landscapes that are not linear and for those elements that may not benefit from linkage or multiple use.

Ahern (2003) also stated that focusing on linear greenway elements should not be causing less concern for other non-linear areas with equally important landscape planning issues. This can be just as a strategy or a plan, due to its much intrinsic merit. The definition and the five key ideas described above provide an overview of greenways as a complex and variable strategic approach to landscape planning.

### 2.1.2 Greenway Purposes

Trail development effect normally on the special qualities of a place is outweighed by the need to prevent wear and tear and to control the access to an area by visitors/users. Consideration should be given to the particular theme that it will be used to explore the objectives of its provision. Themes may be one or a combination such as relaxation and general exercise by anyone, with an emphasis on multi-accessibility; wildlife viewing; scenic viewing leading to a viewpoint; visiting archaeological sites or other cultural features; educational visits to explore geology, geography, natural or cultural history; physically demanding routes for exercise (Bell, 2008).
Greenways provide benefits that ultimately influence the sustainability of a region's environmental, economic, and social health. The process of establishing goals in greenway planning is critically important, since all the goals cannot be optimized, trade-offs and compromises must be done to reflect the cultural, ecological, aesthetic and social goals associated with greenways (Ahern, 2003). For example, the needs of recreation and wildlife habitat protection often conflict, and may require spatial segregation, elimination of one of the uses or specific management if compatibility cannot be achieved.

Tourism and recreation-related revenues from trails and greenways can be several forms. Trails and greenways create opportunities in construction and maintenance, recreation rentals (such as bicycles and kayaks), recreation services (such as shuttle buses and guided tours), historic preservation, restaurants and lodging (United State Forest Service, 2008).

2.1.3 Landscape as a Setting for Recreation and Education

According to Bell (2008), a landscape enfolding wildlife, habitats, cultural heritage and different land uses may have the potential to offer the opportunities to fulfill some or all of the demands, by way of the type of recreation, by its carrying capacity or land use (Figure 2.2).

![Diagram](image.png)

**Figure 2.2** Combination principles when making trail planning  
**Source:** Kines, 2015

There are some concepts related to greenway trail planning, design and management. Firstly, understanding the impact is very important. Greenways trails have
specific zones of influence, which need to be planned with nature and intensity of trail use, awareness of the timing, and with the natural of landscape through which the trail passes. Next, understand the trail users which are diverse and heterogeneous group, each of them with unique and important characteristics (Bell, 2008). The growing success of the greenway concept can be related to its effectiveness in achieving its aims to foster landscape conservation and supply opportunities for public recreation.

Since greenway planning has been linked to the identification and assessment of areas with special resources, thus most of the time the methods used are based on parametric approaches to landscape analysis and assessment. The methods of landscape assessment are often evolved from the work of pioneers in landscape planning. All of these methods include phase of site inventory, site analysis, planning proposals such as conceptual diagrams, schematic design, and evaluation (Lin, 1993).

Landscape analysis includes natural and cultural factors such as natural drainage network, geomorphology, physiography and historic sites (Ribeiro and Barao, 2005). The natural resources were assessed in terms of soil conservation, biodiversity, ecological functional, water conservation, and natural history potential for interpretation and research. Design of every trail requires consideration of four main goals: safety, connectivity, response to location, and diversity of users (Portland Park and Recreation Trail Guidelines Coordination Team, 2009). Safety is the top concern. Ideally, cars and trucks alongside or crossing a trail should be minimized. Visibility is particularly important at intersections with roads and in natural areas, but design principles for prevention of crime should be considered to all projects. Different trail users also travel at differing speeds, which can cause conflicts and accidents.

Then, connectivity is also important because trail length makes longer trips perhaps, increasing effectiveness for communicating and exercise. Trails also connect gaps in the on-street pedestrian network. Trails should be built to have multiple access points from the surrounding system of sidewalks, other trails, and bikeways to make short trips and loops perhaps (Portland Park and Recreation Trail Guidelines Coordination Team, 2009). Nevertheless, these access points will be less frequent than in a typical street network to minimize interruptions to the flow of users along the trail.
Next, response to location means that trail design responds to constraints, opportunities, and character of the surroundings (Portland Park and Recreation Trail Guidelines Coordination Team, 2009). For example, supplying periodic views of water may prevent from damaging user-made trails to reach the water. Trail width, slope, and material of trails may also need to be changed to fit neighboring development, drainage needs, vegetation, vehicle circulation patterns, and so on (Baughman and Serres, 2006). Impacts to private property should be avoided or minimized. Trails may be less consistent over their length, but the adaptations enliven the overall trail experience and fit wide range of neighborhoods and settings. Lastly, diversity of users refers to activity, ability, and age (Portland Park and Recreation Trail Guidelines Coordination Team, 2009). Although the overall recreational trail system includes challenging segments for the most fit and expert, the common aim is to provide challenge levels suitable for all abilities and ages.

2.1.4 Recreation Purposes Greenway

According to Bell (2008), ‘recreation’ is the term used mainly to refer to activities that are carried out not far from home and within the normal daily routines and a key function of greenway for people. On the other hand, recreation greenways involve trails and other means of access for human use, such as canoe / kayak launches. Normally these corridors are constructed for low-impact and non-motorized recreation activities such as hiking, horseback riding, nature watching, cycling and kayaking. This is depending on different location and size of the greenway (Portland Park and Recreation Trail Guidelines Coordination Team, 2009). As Bell emphasized in his book (2008), recreation corridors can include single use trails, such as those that allow only hiking, or multiple use trails, which accommodate a wide range of non-motorized uses.

Recreational trails enable users to get closer with the natural surroundings, to soothe their psyches and to challenge their bodies. Shafer et al. (2000) found that approximately 75% of greenway based trail use was exclusively for recreation purposes. They stated that people usually use greenway trail to walk, run, cycle, and skate for exercise, to interact with other people, and to experience nature. Besides, ‘recreational trails’ are defined in the Irish Trails Strategy as being ‘a corridor, pathway or route, generally water or land based, primarily intended for recreational purposes, including
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