

Ecological Footprint for Campus Sustainability in Malaysia

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ABSTRACT *Ecological footprint (EF) is applied in universities to reduce the environmental impact and resource consumption from its main activities; teaching-learning, research and operations. The campus also functions in providing a physical environment covered by land area, building and infrastructure to support the living environment. In this case, the campus environment represents a small city level of EF sustainability assessment. The unique roles of EF can contribute to campus sustainability in developing own version of EF which measures the level of campus sustainability. With this approach, unsustainable elements can be determined and actions can be taken to mitigate the negative impact to the environment. In more specific, EF translates to individual levels that have an impact towards a campus by converting levels of consumption into the amount of land needed. This preliminary paper discusses the rationale and needs of EF as one of sustainability assessment for Malaysian universities in the context of campus sustainability.*

KEYWORDS campus sustainability, ecological footprint, universities, sustainability

1.0 Introduction

University consumes resources in order to fulfill its core functions of teaching-learning, research and operation. A sustainable university should be able to address, involve and promote the minimization of the negative environmental, economic, social and health effects from the three core functions and help society make the transition to sustainable lifestyles (Velazquez, Munguia, Platt, & Taddei, 2006). As worldwide universities are increasingly focused on promoting campus sustainability, there is a need to develop methodologies to measure a campus level of sustainability in which EF is one of the potential approaches (Conway, Dalton, Loo, & Benakoun, 2008; Samsudin, Said, Ashikin, & Razali, 2010). The rationale is to improve university sustainability by decreasing their EF (Jauch, Ogden, Betzen, Stumpff, & Bigley, 2009).

EF is applied in various level, from global, regional, nation to city level. Many researches have been developed for EF at national level (Monfreda, Wackernagel, & Deumling, 2004; Wackernagel, Monfreda, & Deumling, 2002), regional and city level (Hopton & White, 2012; Wackernagel, Kitzes, Moran, Goldfinger, & Thomas, 2006) and university or campus level (Conway et al., 2008; Dawe, Vetter, & Martin, 2004; Flint, 2001; G. J. Li et al., 2008; Venetoulis, 2001). Other EF studies developed include industry or product level such as wines (Niccolucci et al., 2008), ethanol (Marcelo, Vaughan, & Rykiel, 2005), mobile phones (Frey, Harrison, & Billett, 2006), tourism (Peeters & Schouten, 2006), international trade (H. Li, Pei Dong, Chunyu, & Wang, 2007) and others. EF also can be used

to compare the impacts of different lifestyles (Flint, 2001). There is a need to measure how much is consumed by community in Malaysian universities. The EF field is still in its infancy stage and currently widespread debate over the methodology for calculating an organizational EF (Aporo et al., 2007). There is no commonly accepted method for EF calculation therefore it poses a challenge (Begum & Pereira, 2012).

To date, EF is mainly used for raising awareness of environmental impacts, education tool, resource management tool, policy tool, sustainability development measurement and scenario development. However, this paper would discuss about the rationale and needs of EF for universities in Malaysia.

2.0 Overview of Ecological Footprint

Individual activity has an impact on the Earth to a whole city or country (Wackernagel & Rees, 1996). The urgency to protect the Earth is getting crucial due to the accelerating global economy and population continuity to grow yet the Earth still remains the same size. Human consumption rate increase faster than the Earth to regenerate and sustain (Galli et al., 2012). This fact provides important justification of specific assessment to determine our milestone and capacity in the context of sustainability. This has encouraged a number of sustainability indicators to arise including EF.

In general, EF is an indicator of human impact on nature. It is often referred as eco-footprint or environmental footprint. EF was developed in the early of 1990s by Professor William Rees and Dr. Mathis Wackernagel at the School for Community and Regional Planning, University of British Columbia in Vancouver, Canada (Begum & Pereira, 2012; Rees, 1992). EF is defined as the area of biologically productive land and water ecosystems required to produce the resources that the population consumes and assimilate the wastes that the population produces, wherever on Earth the land and water is located (Wackernagel & Rees, 1996).

In other words, EF evaluates the impact of an individual, groups or nations lifestyle on the planet by converting levels of consumption into the amount of land needed to sustain necessary production levels and lifestyle choices. It is measured in a standardized unit [area/individual] called hectare (ha) per capita or global hectare (gha) per capita or global acre (ga) per capita. A hectare is equivalent to 2.5 acres and an acre is approximately the size of a football field. A global hectare is a hectare of biologically productive space with world average productivity of the given year. Most of the EF reports and applications expressed EF in global hectare per capita (Kitzes, Peller, Goldfinger, & Wackernagel, 2007). Another purpose of EF is to inform the individual's unsustainable behavior which further influence the consumers' consumption patterns towards sustainability lifestyle, thus reducing the impact to the environmental (Franz & Papyrakis, 2011).

2.1 The World Ecological Footprint

Conceptually, EF must not exceed the biocapacity of the Earth in order to sustain human society. From the world EF and biocapacity illustrated in Figure 1 for 1961 to 2012, it is clearly shown that humanity only used about two-third of Earth available resources in 1961. When population increased, human demand for resources began outstripping what the

planet could renewably produce during the early 1970s. In 2009, the global EF has reached 2.6 gha per capita but what is available on the Earth is only 1.8 gha per capita (Network, 2013). The result implicated that humanity consumption has exceeded the amount of resources Earth provided by 50%. Furthermore, the Earth needs 1.5 years to regenerate resources that people are using in a single year. It is predicted that two planets will not be enough to support the demand on resources by 2030.

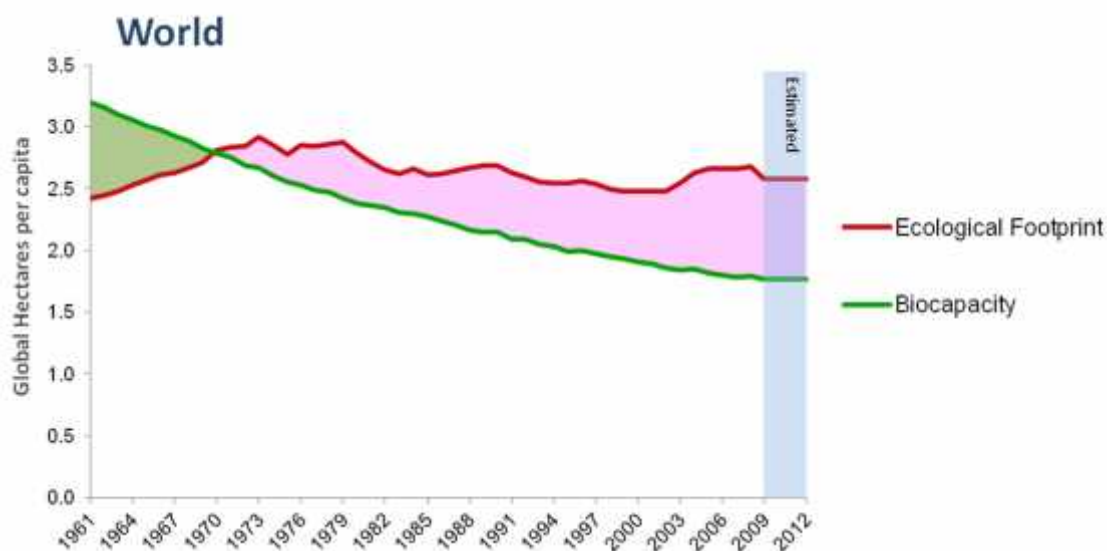


Figure 1: World Ecological Footprint and Biocapacity (1961-2012)

2.2 Malaysia Ecological Footprint

The Malaysia EF is smaller compared to the developed countries such as United States, Canada and United Kingdom. In the region, Malaysia has larger EF than other ASEAN countries such as Thailand, Indonesia and Philippines (Begum & Pereira, 2009; Begum, Pereira, Jaafar, & Al-Amin, 2009; Network, 2013). Currently, the Malaysia EF calculation is provided by Living Planet Report (LPR) and National Footprint Accounts (NFA).

LPR is published every two years by World Wide Fund for Nature (WWF) in cooperation with the United Nations Environmental Programme (UNEP) and Global Footprint Network (GFN). It is the world's leading, science-based analysis on the health of our planet and the impact of human activity. The latest edition of LPR was released in May 2012.

On the other hand, the NFA is released by GFN annually. It provides comprehensive data on human demand on resources as to support their activity. They track how this demand compares across several over 200 countries, territories and regions and how it relates to planet's biocapacity to meet this demand. The NFA 2014 is the most current published edition at the moment where EF and biocapacity observed data results from 1961 to 2010 and estimated data results up to 2014 documented.

The Malaysia EF and biocapacity from 1961 to 2012 is presented in Figure 2. According to the figure, Malaysia EF has exceeded its biocapacity since 1995. The Malaysia EF recorded at 3.0 gha per capita and biocapacity at 2.4 gha per capita in 2009 (Network, 2013). In other words, each Malaysian would require about three hectares of land to sustain their current living standards. Malaysia's ecological deficit reached about 0.5 gha per capita in 2009. Up to now, Malaysia EF has exceeded the global average of 2.6 gha per capita.

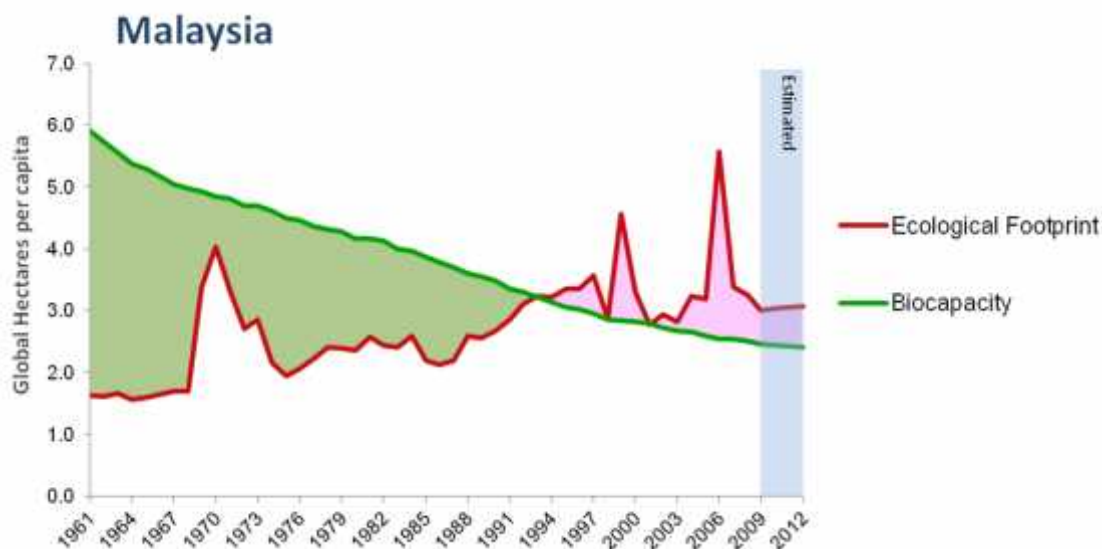


Figure 2: Malaysia Ecological Footprint and Biocapacity (1961-2012)

3.0 Ecological Footprint for University

As university has city characteristic in smaller size, the EF application will consider their size, growing populations, increasing number of traffics and several activities including education and research (Alshuwaikhat & Abubakar, 2008). The physical built environment covers a range of building types such as office, classroom, hostel, laboratory, health care and large assembly hall. It will have an impact to the environment and sustainability through the resources consumption such as energy and water as well as waste generation (Bennett, Hopkinson, & James, 2006). Furthermore, universities are considered as the largest consumers where they use a huge amount of paper, energy and water. In addition, research-intensive university consumes more resources than a conventional university (Baboulet & Lenzen, 2010) as not all research or education activities contribute to a more sustainable university (Lukman, Krajnc, & Glavi, 2010).

The application of EF to university is neither new nor novel. EF calculations have been undertaken in campuses such as University of Redlands, University of Newcastle, University of Toronto at Mississauga, University of Otago and Macquarie University. In Malaysia, studies of EF are limited notably at the national level and absent at the state and city levels. This is partly attributable to data limitation (Begum & Pereira, 2012). Only one EF at university level conducted in the Universiti Pendidikan Sultan Idris (UPSI) by Samsudin et al. (2010). There are only a few published articles (Begum & Pereira, 2009, 2012; Begum et al., 2009; Samsudin et al., 2010) and theses (Chan, 2008; Lee, 2008; Raisdana, 2010) doing on EF in Malaysia context. Begum and Pereira (2009, 2012); Begum

et al. (2009) did their EF research at national level based on input-output (IO) analysis for Malaysia. While, other EF application in Malaysia was conducted in high rise condominium residential area (Chan, 2008) and Malaysian palm oil industry (Lee, 2008).

In conjunction with sustainable development, Malaysian universities such as Universiti Malaya (UM), Universiti Sains Malaysia (USM), Universiti Kebangsaan Malaysia (UKM), Universiti Putra Malaysia (UPM) and Universiti Teknologi Malaysia (UTM) have their own campus sustainability initiatives. However, without measurement of the environmental impact, it would be difficult to manage sustainable development (Wackernagel et al., 2002). Knowing the current level of environmental impact allows the universities to know how far they are from achieving sustainability.

EF is one of the sustainable indicators that could help to assess the environmental impact for universities. There are a number of key benefits of EF as a metric to support sustainability for campus. Firstly, it highlights the current level of environmental impact for the university. Secondly, EF is presented on a single arrogated scale that allows for direct comparison of the impact of different components against one another. Thirdly, the EF assessment could assist sustainable development decision making for the management of university. Calculating EF could be the first step for Malaysian university to become a more sustainable campus.

4.0 Conclusion

EF is a useful sustainability assessment tool to measure current university activities, improving community awareness and assist the university management in decision making. As Malaysian universities are pursuing campus sustainability, the application of EF would contribute and in parallel with the effort. Universities that are interested will find such study is important as the data can be used to help them in developing strategic action plans to improve the level of campus sustainability.

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