THE INFLUENCE OF RECREATION USE ON WATER INFILTRATION RATE AT URBAN PARK: A CASE STUDY AT BUKIT EKSPO, UNIVERSITI PUTRA MALAYSIA

ROS SHUHADA BINTI MOHAMAD YUSOFF

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THE INFLUENCE OF RECREATION USE ON WATER INFILTRATION RATE AT URBAN PARK: A CASE STUDY AT BUKIT EKSPO, UNIVERSITI PUTRA MALAYSIA

By

ROS SHUHADA BINTI MOHAMAD YUSOFF

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ALHAMDULLILAH

DEDICATION

TO MY BELOVED PARENTS,

MOHAMAD YUSOFF BIN EMBONG

ROSMAWATI BINTI ABDULWAHAB

SIBLINGS

ROS SUAIMAH, MOHD SYAFIQ, MOHD SYUAIB,

ROS SHODIJAH, ROS SOLEHAH

MY SUPERVISOR,

DR. RUZANA ADIBAH BINTI MOHD SANUSI

MY CO-SUPERVISOR,

DR. MOHD ROSLAN BIN MOHD KASIM

ALL MY FRIENDS.

Thanks you for your encouragements and supports

Thanks for everything.

ABSTRACT

Urban Park is commonly used for recreation activities. However, recreational activity can influence water infiltration rate of a park. Infiltration is a process of water entering soil and is important as soil acts as a medium for the tree growth, root water uptake and habitat for organisms. Therefore, this research aimed to look at the water infiltration rate at a park and compare the infiltration rate among four sites with different recreational activities. This study was conducted at Bukit Ekspo, Universiti Putra Malaysia located in Serdang Selangor. The research was carried out by using double ring infiltrometer for water infiltration rate measurement at four sites (i.e. football field, an area beside a lake and road as well as a non-activity area), with three sampling points in each site. The result showed that the infiltration rate was greater in roadside area compared to the non-activity area. Therefore, infiltration rate in non-activity area was greater than football and beside lake area due to recreational impact on the soil as these two sites were highly used by user. This shows that recreational activities can affect the soil for example by increasing the soil compaction that will reduced water infiltration rate. This study suggests rehabilitation of the soil surface by planting and managing new trees or grasses regularly because recreational activities can reduce the infiltration rate at Bukit Ekspo Universiti Putra Malaysia. The findings from this research will be beneficial for the management of this park in improving the water infiltration especially at areas with high recreational activities.

ABSTRAK

Kawasan taman bandar biasanya digunakan untuk aktiviti riadah. Walau bagaimanapun, aktiviti rekreasi dapat mempengaruhi kadar penyusupan air ke dalam tanah di kawasan taman bandar. Penyusupan adalah proses air memasuki tanah dan penting kerana tanah berfungsi sebagai medium untuk pertumbuhan pokok, penyerapan akar dan habitat untuk organisma. Oleh itu, kajian ini bertujuan untuk membandingkan kadar penyusupan di antara empat tapak aktiviti riadah yang berlainan. Kajian ini dijalankan di Bukit Ekspo, Universiti Putra Malaysia yang terletak di Serdang Selangor. Kajian ini dilakukan dengan menggunakan infiltrometer untuk pengukur kadar penyusupan air di empat tapak kawasan bola sepak, di kawasan tepi tasik, kawasan bukan aktiviti dan di kawasan tepi jalan dengan tiga titik pensampelan di setiap tapak. Hasilnya menunjukkan bahawa kadar penyusupan di kawasan tepi jalan berbanding lebih tinggi kawasan bukan aktiviti. Bagaimanapun, kadar penyusupan di kawasan bukan aktiviti lebih besar daripada kawasan bola sepak dan di kawasan tepi tasik akibat kesan rekreasi kepada tanah kerana kedua-dua tapak ini sering digunakan oleh pengguna. Ini menunjukkan aktiviti riadah boleh menjejaskan tanah contohnya dengan peningkatan mampatan tanah yang akan mengurangkan kadar penyusupan air. Kajian ini mencadangkan pemulihan permukaan tanah dengan menanam dan menyelenggara pokok baru atau rumput kerana aktiviti reakreasi akan mengurangkan kadar penyusupan di Bukit Ekspo Universiti Putra Malaysia. Hasil kajian ini akan bermanfaat kepada pengurusan taman dan akan meningkatkan kadar penyusupan air dan memberi penambahbaikan pada masa hadapan.

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APPROVAL SHEET

I certify that this research project report entitled “The Influence of Recreation Use on Water Infiltration Rate at Urban Park: A Case Study at Bukit Ekspo, Universiti Putra Malaysia.” By Ros Shuhada Binti Mohamad Yusoff has been examined and approved as a partial fulfillment of the requirements for the degree of Bachelor of Forestry Science in the Faculty of Forestry, Universiti Putra Malaysia.

_____

Dr. Ruzana Adibah Binti Mohd Sanusi
Faculty of Forestry
Universiti Putra Malaysia
(Supervisor)

_____

Prof. Dr. Mohamed Zakaria Bin Hussin
Dean
Faculty of Forestry
Universiti Putra Malaysia

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NRCS	Natural Resources Conservation Services
USDA	United State Department of Agriculture
ANOVA	Analysis of variance
SPSS	Statistical Package for the Social Sciences

CHAPTER 1

INTRODUCTION

1.1 Background

Green space is an important part of complex urban ecosystems and provides essential ecosystem services. At the city level, a green network system of green wedges, parks and green corridors is important in urban development area as it provides environmental, social and economic benefits to the surrounding communities (Wright *et al.,* 2012). This green network also helps to limit the influence from future urban expansion to improve urban environmental quality and human.

One of the examples of green network in urban area is urban park. Parks as an urban landscape feature serve many functions such as passive and active recreations, environmental benefits, and wildlife habitat. Recreation is one of the important ways for human to release their stresses and enjoy their leisure time, however, proper management of the recreational area is needed to protect it from any damages and disturbances (Jim & Chen, 2006).

Therefore, in order to make sure the benefits from urban parks can be achieved, proper management of the park especially on its soil functions is important. Soil condition of the park is very important as it will influence the overall function and services that can be provided (NRCS, 1998). However, recreational activities and

other types of biophysical characteristics such as vegetation covers, slope steepness and rainfall intensity can influence the soil condition of the park especially the water infiltration capacity (Liu *et al.,* 2010).

Water infiltration is generally a process of water entering downwards through all or part of the soil surface. Soil with lower moisture content has ability to allow continuous water entering the soil from the surface to downwards through pores, and with greater rainfall intensity the water infiltration rate into the soil also increases (Huat *et al*., 2006; NRCS, 1998).

Water infiltration rate is important for urban parks because the urban park area is usually highly used for recreational purpose. Greater water infiltration rate will give the influences to urban park area where with greater moisture content can help vegetation and tree growth with adequate water source. Therefore, with healthy trees and vegetation in addition to the good condition of the surrounding area will increase the ecosystem benefits such as biodiversity and climate mitigation of the urban park area (Niemelä *et al*., 2010). Big canopy tree also will shaded the area from direct sunlight and will make the area cooler even being surrounded by urbanization and will have an important human thermal comfort impact on urban residents and increase their live ability (Georgi & Zafiriadis, 2006).

Water infiltration rate is also important for urban park because, low infiltration rate due to soil compaction can affect the environment that can introduces flooding hazard in urban area caused by poor surface water quality (Yang & Zhang, 2011). Moreover, less runoff water excess from rainfall if the area has the greater infiltration rate which can avoid the flooding in urban area where it helps in long term environment protection of the area.

Study proved that total volume of water released during a flood are greater for urban streams than for rural streams and flooding can destroy the surrounding of the urban park area, increase the erosion when higher surface runoff thus will adding the sedimentation in lake and river (Konrad, 2003). Therefore, greater infiltration rate will keep the soil moisture and greater soil ability to absorb high amount of rainfall into the soil reduces the flooding and other environmental hazards.

1.2 Problem Statement

Recreational opportunities and facilities in urban green spaces are important to human. As more people are living in the urban areas, the green spaces can help people to reduce their stress level and enjoy their leisure time by providing recreational opportunities such as jogging, cycling and playing football (Sharp & Miller 2015).

The high usage of green spaces for recreational purpose will influence the soil condition such as increase in soil compaction and lack of vegetation cover at urban park area. According to Liddle, (1997) and Newsome *et al*., (2002), the most obvious recreation activities that have high impact on vegetation was from the activities such as camping, walking, and off-road driving. Although using park for recreational purpose is important, without proper management and consideration of the consequences on the soil condition may lead to many problems in the future such as limiting root penetration due to poor soil condition that can disturb the tree growth (Powlson *et al*., 2011).

Moreover, increase in recreational use increases the compaction level of the soil that leads to the reduction of water infiltration rates thus will have an impact on the soil health. Soil compaction can strongly affect plant performance where it will cause the root damage, and limiting soil expansion due to the compacted soil (Alameda *et al*., 2012). The root growth and distribution will also change and reduced when soil strength reached critical levels due to natural or induced compaction (Unger & Kaspar, 1994).

Water and nutrient also cannot enter and flow efficiently into the root when the soil is compacted and this will cause the trees to not have enough source of water and affect tree growth. When the growth of trees is affected, it can destroy the existing landscape of urban park area and can give negative influence on urban residents as the urban parks can have important positive influence on

people's lives (Georgi & Zafiriadis, 2006). Proper management of the soil can help to increase and maximize water infiltration rate (NRCS, 1998). Good soil condition will have greater amount of vegetation cover to protect soil surface thus also can prevent flooding happen (Konrad, 2003). Therefore, the influence of recreational use on water infiltration rate is needed for efficient soil and water management (Hillel, 2004).

Bukit Ekspo, Universiti Putra Malaysia (UPM) is located within the university area which in highly populated and developed area. Bukit Ekspo is an urban park area that can give environmental, esthetic, and economic benefits to urban communities and also known as recreation area because there are many recreational activities carried out by the university's students and also the public. However, the high usage of Bukit Ekspo especially in terms of recreational activities may influence the soil condition of this park.

Therefore, it is important to investigate the soil infiltration rate at Bukit Ekspo UPM and its relationship to recreational activities carried out in this area. The findings from this research will be beneficial for the management of this park and provide some recommendation for future improvement.

1.3 Objective

Therefore, the objectives for this study were:

I. To evaluate the water infiltration rate of at Bukit Ekspo UPM.

II. To compare the water infiltration rate between four different recreational activities at Bukit Ekspo UPM.

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