USING WEB-BASED REMOTE SENSING TO MEASURE THE SEVERITY OF FOREST FRAGMENTATION IN SOUTHEAST ASIAN SUB REGIONS

INTAN NUR FARISA BINTI MOHD FAUZI

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By

INTAN NUR FARISA BINTI MOHD FAUZI

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DEDICATION

Praise be to Allah,

With a humble heart I would like to dedicate the dissertation to:

My beloved and precious family

My supervisor

And also my friends

Thank you for your encouragements, supports and helps that you have

given.

Thank you for everything. May Allah bless all of us.

ABSTRACT

Forest fragmentation is major threat to biodiversity, yet measuring it is still a challenge. Current techniques for measuring forest fragmentation is exclusively limited to experts of Geographic Information System (GIS) and remote sensing technology. The acquisition of satellite images as well as commercial GIS and remote sensing software is extremely expensive to natural resource managers and scientists from developing countries. Hence, this study provides a simple but reliable new method to measure forest fragmentation using Google Earth Pro which relies on the area and perimeter of an existing forest patch that are benchmarked against those measured for an optimal (i.e. circular) shaped patch. A 120 random forest patches were selected from Southeast Asian sub regions namely, Borneo, Peninsular Malaysia, Sulawesi and Sumatra using Google Earth Pro. The spatial geometry of the forest patches (area and perimeter) of the existing patch and theoretical circular shape were measured, the forest fragmentation effect value was then derived from the data obtained: 1) Forest Fragmentation Effect Value based on Area [FEVba]. 2) Forest Fragmentation Effect Value based on Perimeter [FEVbp]. Based on [FEVba], Sulawesi has the highest mean (0.6313), followed by Borneo, Peninsular Malaysia and Sumatra. Based on [FEVbp], Sumatra has the highest mean (0.2633) followed by Sulawesi, Peninsular Malaysia and Borneo. The result obtained indicates that the method can be universally applied across region to guide conservation stakeholders and help scientists to study biodiversity in fragmented landscapes.

ABSTRAK

Pemecahan hutan adalah ancaman utama kepada kepelbagaian biologi, namun mengukurnya masih menjadi cabaran. Teknik semasa untuk mengukur pemecahan hutan terhad kepada pakar Sistem Informasi Geografi (GIS) dan teknologi penderiaan jarak jauh. Perolehan imej satelit serta perisian GIS dan perisian penderiaan jauh amat mahal untuk pengurus sumber dan saintis asli dari negara-negara membangun. Oleh itu, kajian ini menyediakan kaedah baru yang mudah tetapi boleh dipercayai untuk mengukur pemecahan hutan menggunakan Google Earth Pro yang bergantung kepada kawasan dan perimeter serpihan hutan yang sedia ada yang ditanda aras terhadap yang serpihan hutan berbentuk optimum (iaitu bulat). Sebanyak 120 rintangan hutan rawak dipilih dari rantau Asian Tenggara iaitu Borneo, Semenanjung Malaysia, Sulawesi dan Sumatra menggunakan Google Earth Pro (GEP) Geometri spatial hutan (luas kawasan dan perimeter) daripada serpihan hutan sedia ada dan bentuk teori bulat telah diukur, nilai kesan pemecahan hutan kemudian diperoleh daripada data tersebut: 1) Nilai Kesan Fragmentasi Hutan berdasarkan Kawasan [FEVba]. 2) Nilai Kesan Fragmentasi Hutan berdasarkan Perimeter [FEVbp]. Berdasarkan [FEVba], Sulawesi mempunyai nilai tertinggi (0.6313), diikuti oleh Borneo, Semenanjung Malaysia dan Sumatra. Berdasarkan [FEVbp], Sumatra mempunyai nilai tertinggi (0.2633) diikuti oleh Sulawesi, Semenanjung Malaysia dan Borneo. Hasil yang diperoleh menunjukkan bahawa kaedah ini boleh digunakan secara meluas di seluruh rantau untuk panduan pihak berkepentingan kepada pemuliharaan dan membantu para saintis mengkaji biodiversiti di landskap terpecah.

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APPROVAL SHEET

I certify that this research project report entitled **"**Using Web-Based Remote Sensing to Measure the Severity of Forest Fragmentation in Southeast Asian Sub Regions**"** by Intan Nur Farisa Binti Mohd Fauzi 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. Badrul Azhar Md. Sharif
Faculty of Forestry
Universiti Putra Malaysia
(Supervisor)

_____

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

Date: January 2018

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LIST OF ABBREVIATIONS

[FEVba]	Fragmentation Effect Value Based on Area
[FEVbp]	Fragmentation Effect Value Based on Perimeter
ANOVA	Analysis of Variance
WWF	World Wildlife Fund
GIS	Geographic Information System

CHAPTER 1

INTRODUCTION

1.1   Background

Currently, many of the developing countries which located in the tropical regions are facing rapid forest fragmentation due to the commercial logging, urbanization and agriculture expansion, which inevitably continues over the coming years. Forest fragmentation is a widespread phenomenon and is recognized as one of the major threats to biological diversity. It is a process by which large expanses of forests are converted into smaller tracts of forest surrounded by a matrix of habitats unlike the original in ways that reduce or eliminate the ability of the forest to provide ecological, economic, and social benefits, causing a disruption in continuity of the natural landscape.

Natural and anthropogenic factors can lead to forest fragmentation. The natural causes include storms, fires and aging. Numerous anthropogenic factors can also account for forest fragmentation. Among other things land use, infrastructure construction, urbanization, land tenure and socioeconomic factors can account for forest fragmentation

Forest fragmentation reduces the overall amount of habitat and producing a smaller isolated patches with a decrease of the core area and an increase of the edge. The expand in edge habitat facilitates the proliferation of invasive species of plants and animals as well as predators. Core area is the most-protected area in any forest patch, it is the area that is most distant from outside

disruptions. Basically, an ideal nature forest should obtain a shape of a perfect circle to reduce dispersal distances to avoid detrimental edge effects.

Area and Edge (perimeter) are the simplest measures of a patch. At the class and landscape levels, these can be summarized with basic statistics (e.g., mean, median, max, variance), also included is the patch radius of gyration, which can be considered the average distance an organism can move within a patch before encountering the patch boundary from a random starting point.

Currently, many tools available for instance Fragstats2.0, V-LATE, Landscape Analyst (Lang et al., 2004) to quantify the landscape structure for the study of landscape function and change. However, to make them fully available and operable for scientists and planners is still a challenge.

In this research, I intended to introduce a new method to measure the forest fragmentation using a Web-Based remote sensing which is Google Earth Pro. Google Earth Pro offers a comprehensive choice of landscape metrics as well as the geospatial information. The program is almost completely automated and requires less technical training. In this method, I extend to use both area and perimeter and incorporating one more functional component by using optimal circular shape of reserve design as the benchmarks to measure the forest fragmentation. This method is expected to be universally applied across regions to guide conservation stakeholders and help scientists to study biodiversity in fragmented landscapes.

1.2   Problem Statement

Forest fragmentation in developing countries through many land use changes is affecting the tropical regions**.** However, current techniques for measuring forest fragmentation is exclusively limited to experts of GIS and remote sensing technology. Furthermore, the acquisition of satellite images as well as commercial GIS and remote sensing software is extremely expensive to natural resource managers and scientists from developing countries. Thus, Google Earth Pro is used as a simple but reliable new method to measure forest fragmentation. The method relies on the area and perimeter of an existing patch that are benchmarked against those measured for an optimal circular shaped patch.

1.3   Objectives

The main objective of this study was to identify the forest patches in Southeast Asian sub regions. In addition, this study also measured the severity of forest fragmentation based on the area and perimeter.

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