Analysis of Distribution and Vulnerability of Invasive Alien Flora Species (IAS) in Udawalawe National Park, Sri Lanka

By

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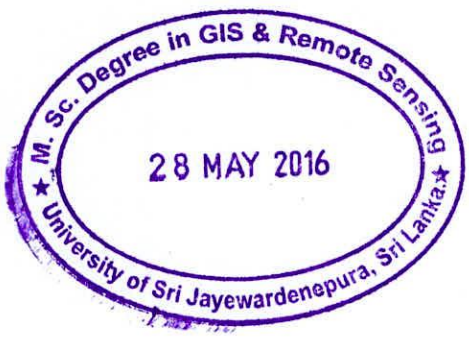

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DECLARATION OF THE CANDIDATE

I do hereby declare that work described in this thesis was carried out by me under the supervision of Dr. Shirantha Heenkenda and Dr. H.M. Ranjith Premasiri, and report on this thesis has not been submitted in whole or in part to any University or any other institution for another Degree/Diploma.

Date 20.03.2016 .... CA Ranasinghe

Madhawa Sandun Ranasinghe
"Madura", Aluthgama, Bandaragama

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List of Abbreviations

AOI - Area of Interest

CBD - Convention on Biological Diversity

CI - Conservation International

DEM - Digital Elevation Model

DWC - Department of Wildlife Conservation

GIS - Geographic Information System

GPS - Global Positioning System

IAS - Invasive Alien Species

IDW - Inverse Distance Weighted

ISMF - Invasive Species Management Framework

ISSG - Invasive Species Specialist Group

IUCN - International Union for Conservation of Nature

NASA - National Aeronautics and Space Administration

NDVI - Normalized Difference Vegetation Index

NPQS - National Plant Quarantine Service

TIN - Triangulated Irregular Network

TIRS - Thermal Infrared Sensor

USGS - United States Geology Survey

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ABSTRACT

The Udawalawa National Park is one of the most valuable biological rich grounds in Sri Lanka. It was declared as a National park in 1972 protecting its diversity values. According to the previous, records 650 to 700 Asian elephants (*Elephas maximus*), endemic flora and fauna were recorded in Udawalawa National Park.In last few decads invasive alien species rapidly spread in large area of Udawalawa National Park. *Lantana camara* is dominant terrestrial invasive plant observed in the park. It is drastically reduced grassing land available for elephants and other wild animals. It mainly affects to change the natural habitats and ecosystems. Due to that it has caused to significant loss of biological diversity of Udawalawa National Park.This study was basically focused to analyse vulnerability of invasive alien species (IAS) in Udawalawa National Park and to identify most suitable controlling method for IAS (flora) in the selected area of Udawalawa National Park. The methodology of this study consist of Remote Sensing and Ground Survey method. Landsat images were provided to four year back picture of *Lantana camara* distribution pattern and area of spreading in 2012 and 2014 is 15.43 % and 18.60 % respectively.This species currently invade 25.61 % out of total area of the park. The zonation method revealed the zonal variation of each of five zones selected in this study. This study facilitated to identify proper management strategy for removal of IAS distribution and establishment of controlling mechanism for IAS in Udawalawa National Park.

Key Words - Invasive Alien Species, Landsat, *Lantana camara*

Chapter One

1. INTRODUCTION

1. 1. Introduction

Because of the long geological and evolutionary history, our planet has very different species of plants, animals and microorganisms on the various continents, and in the various ecosystems (Wallace, 1876).Oceanic islands and other geographically isolated ecosystems often have their own suits of species, many found nowhere else (terms "endemic species"); about 20 percent of the world's flora is made up of insular endemics found on only 3.6 percent of the land surface area. Geographical barriers have ensure that most species remain within their own region, thus resulting in much greater species richness across the planet world have been the case if all land masses were part of a single continent. This historical biogeographical framework provides the basis for defining concepts of native and alien species (Udvardy, 1969).

Alien plant species are defined as taxa in a given area whose presence there is due to intentional or unintentional human involvement, or which have arrived there without the help of people from an area in which they are alien (Pysek *et al.*, 2004).

In plant ecology, the term invasion is generally used for situations where the distribution and abundance of plants changes as a result of human activities. For other situations such as after the retreat of glaciations, the terms migration, spread, range expansion or range extension are used (Pysek *et al.*, 2004).

1.1.1. IAS (Invasive Alien Species)

Many definitions of invaders and invasion have been proposed by various workers during the last few decades. According to Kolar and Lodge (2001) invasive species is "a non-indigenous species that spreads from the point of introduction and becomes abundant". Some definitions include the intervention of man. According to di Castri (1990) "A biological invader is a species of plant, animal or micro-organism which, most usually transported inadvertently or intentionally by man, colonizes and spreads into new territories some distance from its home territory". However, the term 'invasive' includes alien species as well as widespread species that have negative effects on the recipient ecosystem (Davis and Thompson, 2000; Mack *et al.*, 2000).

1.1.2. Species Diversity in Sri Lanka

Sri Lanka's geographic location, varied climatic conditions and topography have given rise to its unique biological diversity. Along with the Western Ghats of India, the country has been identified by Conservation International (CI) as one of the 34 global biodiversity "hotpots" considering not only the high concentration of endemic species, but also the loss of over 75% of the primary vegetation. Sri Lanka has the highest species diversity per unit land area of all Asian countries in terms of flowering plants and all vertebrate groups, excluding birds. In the terrestrial ecosystems of Sri Lanka, the wet zone forests in the southwest are especially important as they sustain 75% of the endemic species of flora and fauna. Based on the diversity of plants distributed in the wild, 15 floristic regions have been designated in the country (IAS project document, 2010).

1.1.3. Impacts of Invasive Alien Species (IAS)

The scale of impacts of alien invasive species is massive. Considered as the second most important agents responsible for biodiversity loss and extinction (Jayasuriya, 2000). Plant invaders reduce richness and abundance of native species by preventing seedling establishment, inhibiting growth and development, modifying plant-pollinator interactions, increasing above and below ground competition and swamping native gene pools *via* interbreeding with native species of the environment (Schei, 1996; Ellstrandia & Schierenbeck, 2000; Vranjic, Wood & Barnard, 2000; Vilà & Weiner 2004; Yurkonis, Meiners & Wachholder, 2005; Bjerknes *et al.*, 2007).

IAS have many negative impacts on human economic interests. Weed reduce crop yields, increase control costs and decrease water supply by degrading catchment areas and freshwater ecosystems. Tourists unwittingly introduce alien plants in to national parks, where they degrade protected ecosystems and drive up management costs. Pests and pathogens of crops, livestock and trees destroy them outright, or reduce yields and increase pest control costs. Invasive plants have wreaked havoc in ecosystems the world over with far – reaching consequences. They are considered to be one of the leading threat to the ecological integrity of native flora and fauna. In fact, invasive alien species are the second leading cause of global biodiversity loss, after habitat fragmentation (Drake *et al.*, 1989).

1.1.4. IAS Context in Sri Lanka

A few researchers have previously attempted to compile lists of invasive alien flora in Sri Lanka (Wijesundara, 1999; Bambaradeniya, 2002; Marambe *et al.,* 2003a). The main drawback of these attempts is the lack of proper criteria to determine the invasive nature of the listed species. Others have either documented the spread of several invasive alien plants in a specific locality (Ratnayake, 2008), or the spread of a single invasive alien plant species in different localities (Marambe *et al.,* 2000a, 2000b; Hitinayake *et al.,* 2000; Jayasuriya, 2001; Pushpakumara & Hitinayake, 2001; Medawatte *et al.,* 2008). Sri Lanka is blessed with a wide array of vegetation types distributed in diverse climatic zones. Some IAS are specific to certain ecosystems or climatic zones while others are widely distributed.

The spread of IAS is a significant and growing threat to the country, According to the IUCN Invasive Species Specialist Group's (ISSG) Global Invasive Species Database, 82 potentially invasive species are present on the island. More than 60 of these species are known to have become invasive (comprising nearly 40 species of invasive alien flora and 20 fauna. The major impacts of these IAS in Sri Lanka include direct exploitation or destruction of native species, superior competitors for resources, hybridization with native species, agricultural and other pests, increase fire hazards in natural areas, interference with ecosystem services and facilitation of the spread of other alien species (IAS project document, 2010).

1.1.5. Geospatial tools use for identifying and managing invasive plants

The land managers of all kinds have the challenge of identifying the species and locations at the most risk of environmental and ecological damage and concentrating their scarce resource accordingly. Unfortunately, managers rarely have the field staff or resource to systematically search for new occurrences. As a result, it is important to both deploy the best available indirect evidence of occurrence and identify locations especially suitable to new invasions, to increase the probability that new infestation will be detection and controlled when they are small (Stohlgren & Schanase, 2006).

There are three major approaches have been effective in a number of settings: (1) Statistical modelling of species distributions, (2) detection of remote sensing, and (3) enabling citizen scientist to better locate high priority species and sites. All can be made