

A pilot study of *Lantana camara* and its impact on elephants in Mudumalai Wildlife Sanctuary and National Park, South India

ACKNOWLEDGEMENTS

This project was funded by Rufford Small Grants for nature Conservation, U.K. I am thankful to Rufford for providing me this support. I am also very thankful to Mr. Ajay A. Desai and Mr. N. Mohanraj for their help and suggestions on designing this project. I thank Dr. Wayne Linklater for his comments as well.

INTRODUCTION AND BACKGROUND

A pilot study was carried out in Mudumalai Wildlife Sanctuary to initiate a larger study designed to estimate the impact of *Lantana camara*, an invasive weed, on the native vegetation to evaluate the extent of its spread and the various methods of removal to clear the area of lantana.

Introduced weed, such as *lantana camara*, can be defined as one that has been intentionally or accidentally introduced by humans into an area outside of its known distribution. To be classified as 'invasive' the introduced species must be capable of establishing self-sustaining and spreading populations within the reserve (Macdonald et al., 1989). Weed invasion can be deleterious by changing and altering the species richness and diversity.

One of the major impacts of invasive species is that they prevent forest tree recruitment and this alters the functioning and structure of the forest ecosystem. Primarily, invasive species inhibit regeneration and growth of smaller forest trees and herbaceous species eventually killing them through physical smothering and shading. There is also a visible reduction of grass cover. Apart from affecting the floral community, lantana may also alter the feeding behavior of the fauna. Herbivore species such as Gaur (*Bos gaurus*), Sambar deer (*Cervis unicolor*), Chital (*Axis axis*), and the elephant (*Elephas maximus*), face a major threat to their diets due to a reduction in grass species that constitute their main food.

Where there is more than one invasive species, then priority needs to be given to understanding and controlling the most damaging weed. In Mudumalai Wildlife Sanctuary, three invasive species *Lantana camara*, *Chromolina odorata* and *Parthenium sp.* pose a threat, *Lantana camara* being the worst.

Lantana camara is an alien invasive species that is widespread in the Indian dry forests. Introduced as an ornamental plant during the nineteenth and early twentieth century, lantana, originally a native of central and South America has now rapidly invaded large areas of forested tracts at the cost of the native flora and has well established and spread in its introduced range. *Lantana camara* is considered as amongst the world's 100 most invasive species (Lowe et al. 2004) by IUCN World Conservation Union.

Lantana is known to suppress regeneration (Ganesan and Bawa, unpublished) affecting the biodiversity. Due to its good nutrient uptake and adaptability to colonize, it is able to grow well even on highly impoverished soils (Bhatt et al. 1994; Rawat et al. 1994). Moreover, studies in other parts of the world such as in the tropics confirm that lantana may be favored by disturbances such as fire and grazing (Duggin and Gentle 1998; Gentle and Duggin 1998). Having advantageous characteristics of other fire-enabled or fire-adapted invasive species, readily re-sprouting on being burnt (Pereira 1919) and with copious quantities of flowers and fruits throughout the year, *Lantana camara* has well established itself. Frugivorous birds readily disperse seeds and contribute to its spread.

Lantana is also known to produce secondary compounds that are toxic to ungulates (Sharma et al. 1981). The reduction of forage due to lantana invasion for the wild herbivores has not been quantified. For these reasons, lantana is the greatest weed problem in Mudumalai Wildlife Sanctuary.

In Mudumalai Wildlife Sanctuary, some areas that were highly infested with *Lantana camara* were cleared. In order to evaluate the effectiveness of the methods used, long term monitoring needs to be undertaken. It is important to understand the implications of removal by different methods and also the relative efficiency of the different methods and their costs. Removal will result in the creation of openings in the under-story that are exposed to colonization by native plant species and also to re-invasion by lantana either from root stock or from seeds. Excavators used to mechanically remove lantana in some areas, results in disturbance of the ground cover and top soil leaving bare earth patches that will create a different micro-climate for regeneration. A significant amount of root stock will also be left behind and this could facilitate rapid regeneration. Cutting would not create a different soil level micro-climate as it would leave the soil and the leaf litter largely undisturbed but it would leave behind root stock that is likely to regenerate quickly.

OBJECTIVES

Spread of lantana

Evaluating the extent of spread - mapping the spread of lantana within the major vegetation (Dry deciduous Forests) type in Mudumalai

Removal of Lantana

Evaluating the removal of lantana using two different methods [mechanical means using an excavator to uproot the plant and cutting the stems manually.]

Evaluating these removal methods on the other plant species (especially – grasses, woody shrubs and seedlings of tree species)

Evaluating regeneration of lantana and native species in the cleared patches

STUDY AREA

Location:

Mudumalai Wildlife Sanctuary located at the foot hills of the Nilgiris district of Tamil Nadu ($11^{\circ} 32'$ and $11^{\circ} 42'$ N and $76^{\circ} 20'$ and $76^{\circ} 45'$ E) forms part of the Nilgiri Biosphere Reserve one of the 12 Biodiversity hotspots of the world (Meyers, 1988). Mudumalai itself covers an area of 321 sq km. It is bounded on the North by Bandipur Tiger Reserve in Karnataka and to the West and Northwest by Wynaad Wildlife Sanctuary in Kerala. Singara and Sigur Reserve Forests form the southern boundary.

Physiographic features:

The altitude varies from 485 m to 1226 m above sea level with an average of about 900 m. The terrain is highly undulating. The Moyar river which is perennial flows along the eastern boundary and drains the area.

Vegetation:

The study area has three major vegetation types namely Tropical Moist Deciduous, Tropical Dry Deciduous and Southern Tropical Thorn Forest (Champion and Seth, 1968). Vegetation varies from southern tropical thorn forest in the East to southern tropical moist deciduous forest in the west. This corresponds to the rainfall variation. Dry deciduous forests lie between these two ends.

Fauna:

Mudumalai has a wide diversity of fauna. Some of the commonly seen large herbivores are elephant (*Elephas maximus*), Gaur (*Bos gaurus*), Sambar (*Cervis unicolor*), Chital (*Axis axis*). Two species of antelope, the Black buck (*Antelope cervicapra*), and the four-horned antelope (*Tetracerus quadricornis*) are found here. Carnivores such as the Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), and Wild dog (*Cuon alpinus*) are present. The Common langur (*Trachypithecus entellus*), Bonnet macaque (*Macaca radiate*), Slender loris (*Loris tardigradus*) are the primates found in this part. Apart from the above mentioned species, other species such as the Sloth bear (*Melursus ursinus*), Wild boar (*Sus scrofa*), Porcupine (*Hystrix indica*), civets, mongoose and black-naped hare are also found here.

METHODS

Mapping of Lantana

A thematic map of the lantana infested areas to know the distribution of lantana was first created. 40 sq km of the 321 sq km of the National Park was selected. Using a GPS, a waypoint in each of the grids was made and the lantana intensity was visually estimated on a scale of 0 to 4 with 0 being no lantana and 4 being highly infested with Lantana. The values 1, 2 and 3 were in between with varying gradations. All the grids within the 40 sq km were covered initially on elephant back and later on foot. The data was entered into Mapinfo professional 7.8 and a thematic map was created.

Map 1: Showing the area selected for the study: The green indicates the boundary of Mudumalai Wildlife Sanctuary. 40 sq km of the study area was selected with each grid measuring 500 sq m. The colours represent the infestation of lantana with orange as high infestation and blue as Lantana free areas. The highly infested areas could possibly be due to disturbance and proximity to human settlement and collection of fire wood. 40 sq km was covered within a short time and it should be possible to collect data throughout the rest of the park.

Forty plots within two different types of clearings (cut and mechanical) in Mudumalai have been marked and data from each of these plots were gathered between June and August 2007. Data such on tree species (GBH, Height and canopy cover) was recorded in each plot. 5 x 5 m plots were used to enumerate the regeneration of tree species including lantana. 1 x 1 m plots were used to record herbs grass cover. Data on lantana infestation in 40 sq km of the park was collected. 2630 rows of data has been entered in an excel sheet with the above data. At this stage of the project, it is too early to show any results. This project will continue in September 2008.

Below is the list of some expenses incurred:

Month	Expense	Amount (Indian Rupee)	British Pound
June-07	Rent for field station	2000	25
	Initial Expenses for Field Station	1200	15
	Gas and cooking	3200	40
	Travel and transport	12,000	150
	Stationery	2000	25
	Communication	2000	25
	Field Assistant	3600	45
July-07	Rent for field station	1200	15
	Gas and cooking	2000	25
	Travel and transport	4000	50
	Stationery	800	10
	Communication	2000	25
	Field Assistant	3600	45
	Purchase of Laptop	40000	500
August-07	Rent for field station	1200	15
	Gas and cooking	2000	25
	Travel and transport	4000	50
	Stationery	800	10
	Communication	2000	25
	Field Assistant	3600	45
	TOTAL	93200	1165