MANAGEMENT OF INVASIVE ALIEN PLANTS IN THE MOIST DECIDUOUS FORESTS OF WESTERN GHATS, INDIA

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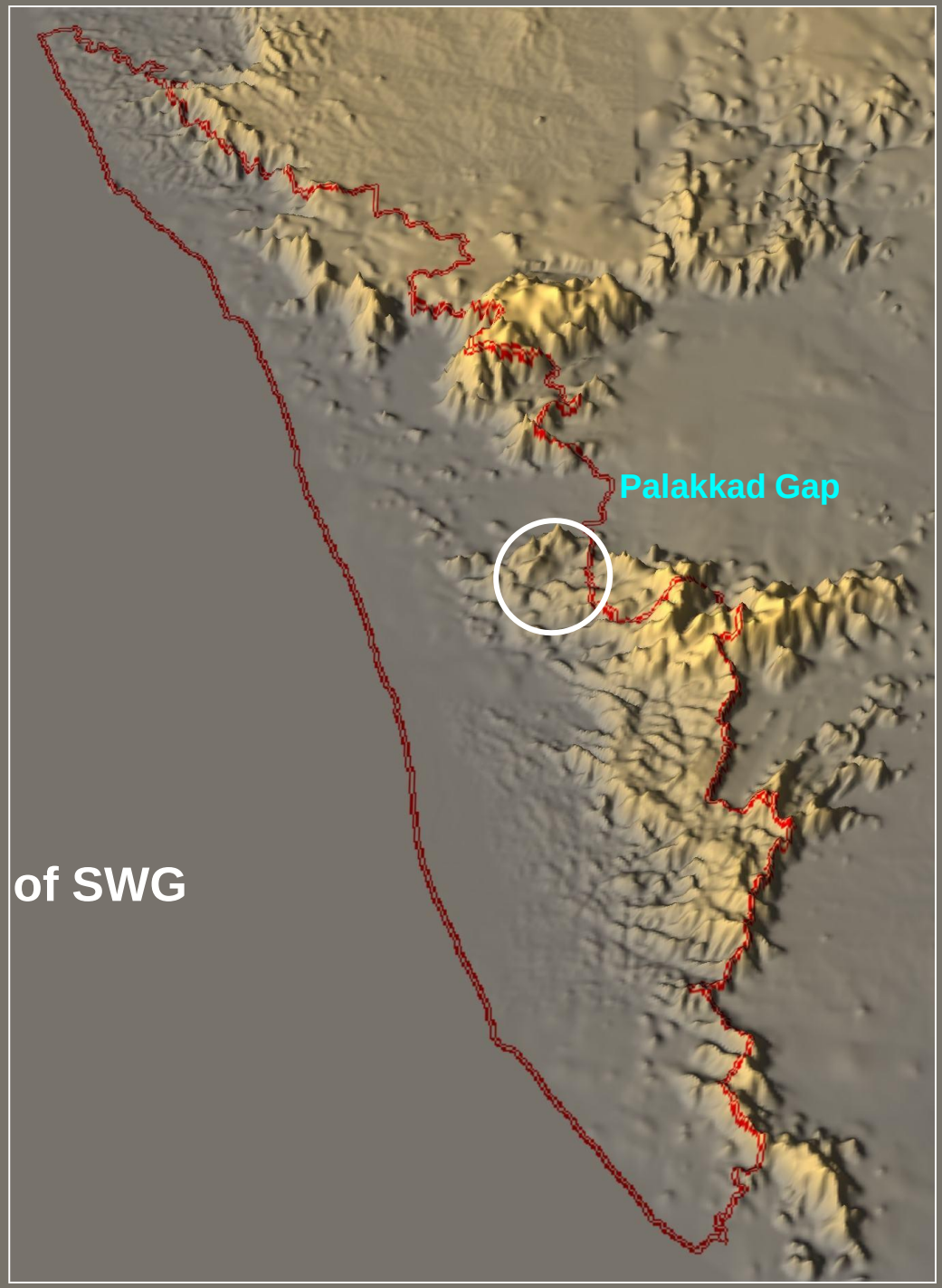
Western Ghats – The lifeline of Peninsular India
Phytogeographical similarities with Sri Lanka
- Northern WG
- Central WG
- Southern WG

Southern Western Ghats

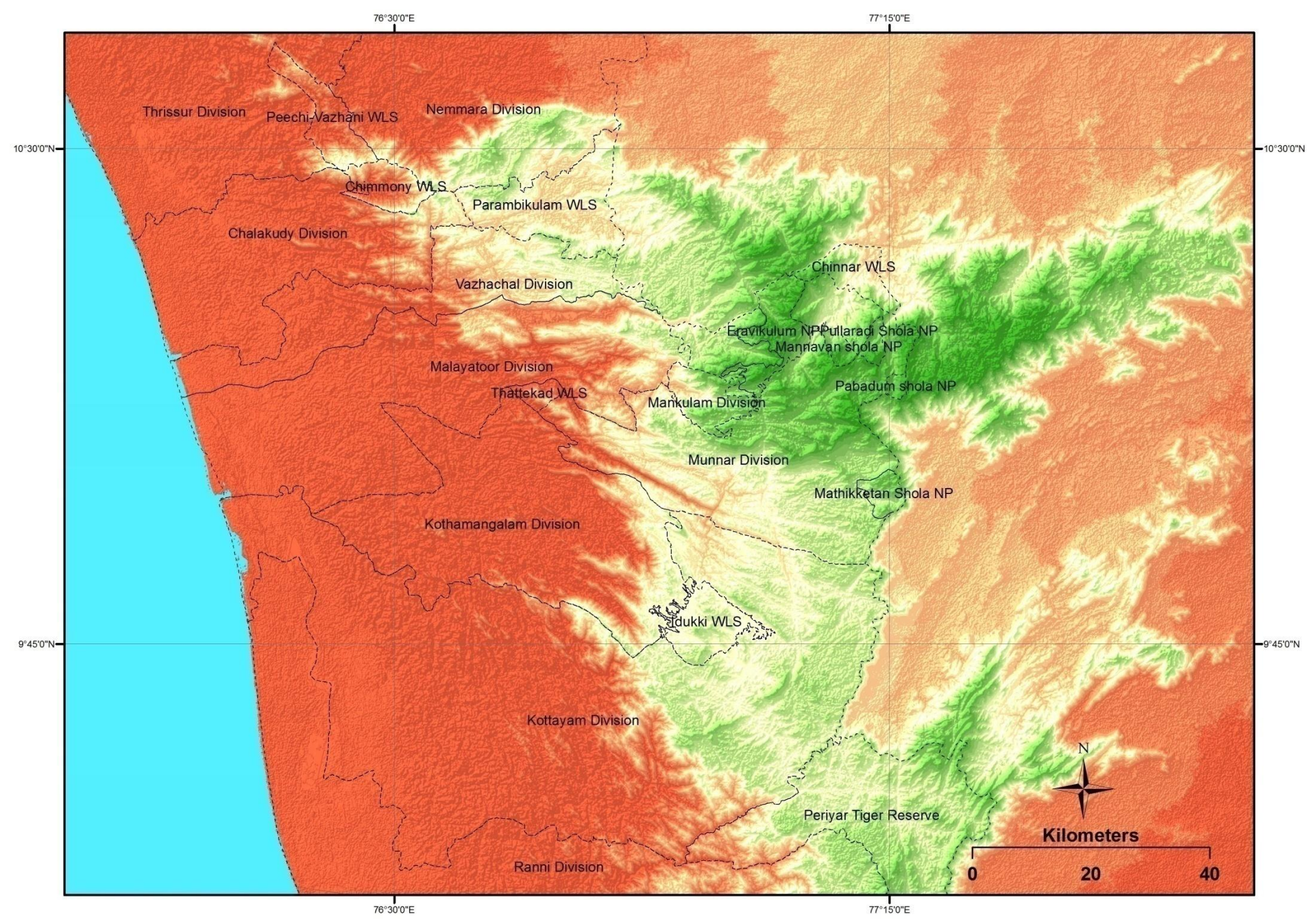


Nilgiri-Wyanad-Kodagu

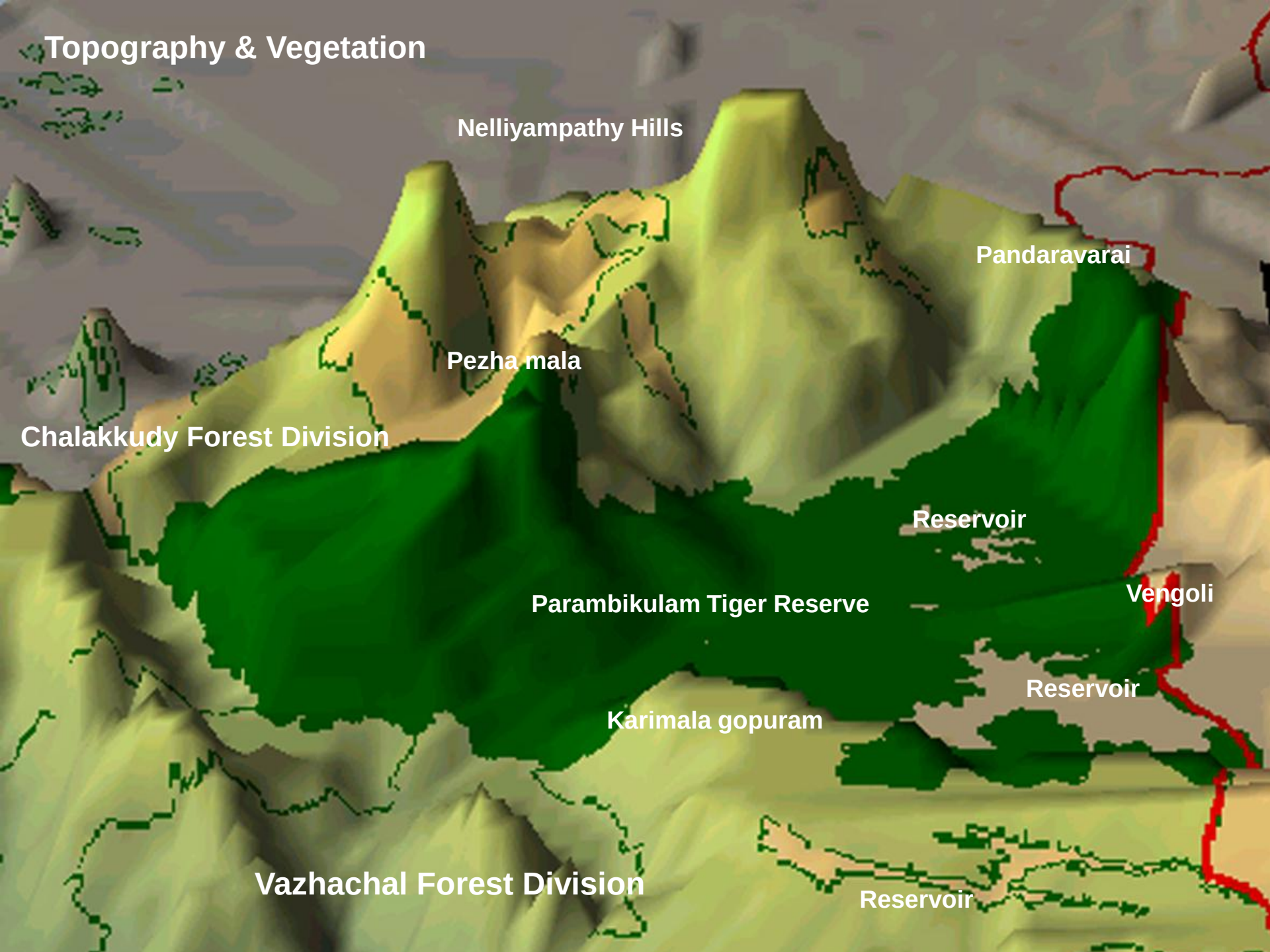
Anamalai Hills – The heart of SWG

Palani Hills

Agasthyamalai Hills



The landscape – DEM Anamalai Phytogeographical region, WG


Topography & Vegetation
Nelliyampathy Hills
Pandaravarai
Pezha mala
Chalakkudy Forest Division
Reservoir
Parambikulam Tiger Reserve
Vengoli
Reservoir
Karimala gopuram
Vazhachal Forest Division
Reservoir

FOREST HEALTH vs INTRODUCTION & SPREAD OF IAS - INVERSELY PROPORTIONAL

- MDF - Major habitat/forest type in the windward region of Western Ghats

- Moist Deciduous Forest – Hot spot of IAS

  Compared to other habitats (evergreen, semi-evergreen and shola forests) highly susceptible to introduction and spread of IAS

  Seasonal variation in the canopy – Leaves sheds during summer, it paved way for the introduction

- Center of major timber yielding trees and commercially important species

- Dense feeding ground of herbivores , thus carnivores - an ideal habitat

- Most of the agricultural landscapes in the lowlands are midlands bordered by MDF – landscape sharing

- Human wildlife conflict is more reported in this type of landscape

- Deterioration in the quality of the ecosystem, directly affects the adjacent agricultural system, increases the human-wildlife conflict, etc.

- Since protection of the reserve forests in the Western Ghats are comparatively better, major threat to the habitat is because of IAS

- General pattern of vegetation in MDF during monsoon

  Centre of timber trees, herbivores, carnivores, etc.

- General pattern of vegetation during summer

Formation of gaps in the canopy, create more chances for invasion, animal movements between and within the habitats and landscapes facilitates the spread

Epicentres of invasion in forest areas

Forest clearings - gaps

Hydroelectric projects and related establishments

Forming linear intrusion into the habitats – forming wounds, from the infestation starts

Power lines – linear intrusion – disturbing the habitat

Help to establish secondary species and IAS

These species gradually intrudes the undisturbed ecosystem and finally destroy it

Reservoirs and monoculture plantations

Banks of the reservoir act as a potential centre of introduction, suitable substratum for establishing IAS

Plantations

- Canopy is partially open
- Dense under storey - completely covered with weeds
- Diversity of weed is similar to that of MDF

Economic loss - Timber volume (teak plantations in the MDF landscape)

Approximate volume of Teak to be obtained as per volume table - different site qualities

Site Quality	Optimum (m^3/ha)	Standard (m^3/ha)
1	240	75
2	175	65
3	125	50
4	90	40

1971 Teak plantation - Vazhachal Forest Division, Kerala

Approximate timber volume calculated based on site quality & comparative study

Same aged plantations in nearby area with more or less uniform topography, soil, etc – but differ in the aspects of weeds

Vazhachal forest Division – Site quality 1

Age group	Timber Volume (m^3/ha) as per the data - 2015	Actual – as per the volume table & comparative study
44	39.093 m^3/ha (40 m^3/ha)	75 – 240 m^3/ha)

General pattern of Invasion – Moist Deciduous Forest

-Impenetrable thickets due to gregarious growth

-Immediately after the first rain – when the indigenous flora in a quiescent stage

-High regeneration potential of IAS

Regeneration in gaps/open areas in forests

***Mikania & Chromolaena* over medicinal herbs, palatable species of herbivores, etc**

Ischaemum spp., Oplismenus spp., Digitaria spp., Eragrostis spp., Axonopus, etc.,

Emilia sonchifolia, Vernonia cinerea, Evolvulus alsinoides, Rubia cordifolia, etc

Major species – in shady as well as in open areas

Lantana camara, Chromolaena odorata, Mikania micrantha

Hyptis capitata, Caesalpinia mimosoides, Mimosa diplotricha

Variation in density with respect to open and closed canopy

Invasive plants in MDF of SWG

34 species

High risk	- 8
Medium risk	- 12
Low risk	- 14

ESTABLISHMENT

- physiological tolerance,
- small seed mass
- prolific seed production
- vigorous vegetative propagation
- lack of natural enemies

SPREAD

- better competitive resource capture
- better utilisation ability
- allelopathy

Common in both shade as well as in open areas - gregarious in open areas

Most gregarious Invasive Species in MDF throughout the Western Ghats

Spread - Agricultural landscape to forest and vice versa

Chromolaena odorata (L.) King & Robins.

Shade as well as in open areas – gregarious in open areas

Almost all the forest areas – gregarious species in MDF of Western Ghats

Spread - Forest to agricultural landscape

Shade as well as in open areas – gregarious in open areas

Almost all the forest areas – gregarious in MDF of Western Ghats

Spread - Homesteads or agricultural landscape to Forest area

Light demanding species – common in forest clearings, especially in lower altitudes

Gregarious growth – forming thickets and cover a broad area

Non-gregarious under the canopy of partial shade

Spread - Cover crop - Agricultural land to forest area

Major tree Invasive species in MDF – introduced as an avenue plant

- Light demanding species - high rate of regeneration including coppice growth

- Difficulty in eradication - due to high regeneration capacity and peculiarity of infested habitats

Regeneration in open areas – subterranean rhizome

- fire lines, fire affected areas, rocky areas of mdf, grasslands etc.

Light demanding species - grow well in shades also

Widespread in forest area – establishing phase in agricultural lands

Pueraria phaseoloides (Roxb.) Benth.

- Light demanding species – common in forest clearings, especially in lower altitudes
- Gregarious growth - forming thick ground cover
- Cover crop - Agricultural land to forest area

Light demanding species - common in forest clearings, especially in lower altitudes

Survive in shade also - high rate of regeneration

Gregarious growth - Smother all the vegetation including trees

Cover crop - Agricultural land to forest area

- Light demanding species – common in forest clearings, especially in lower altitudes
- Gregarious growth in wide range of habitats
- Ornamental plant – Homesteads to forest area

RECENT INTRODUCTION – ESTABLISHING PHASE

Hyptis capitata

South India - 1980

Forest of Kerala - 2005

Spigelia anthelmia

South India -1987

Western Ghats, Kerala - 2013

Medium Risk Plants

Ageratina adenophora

Hyptis capitata

Hyptis suaveolens

Leucaena leucocephala

Merremia vitifolia

Parthenium hysterophorus

Passiflora foetida

Pennisetum pedicellatum

Racosperma auriculiforme

Ricinus communis

Senna hirsuta

Senna tora

Low Risk Plants

Ageratum conyzoides

Alternanthera brasiliana

Amaranthus spinosus

Centrosema molle

Mimosa pudica

Senna occidentalis

Senna siamea

Sesbania grandiflora

Stylosanthes fruticosa

Alternanther bettzickiana

Asclepias curassavica

Croton bonplandianus

Syndrella nodiflora

Tridax procumbens

How to prevent new incursions and manage those already invaded

- Check all plant and soil samples transported to the forest areas for seeds, plant parts and other propagules of IAS.
- Restrict movement of soil and plant parts from infested areas to un-infested areas
- Tourist destinations inside the forests should be under constant surveillance to avoid unintentional transportation of IAS through baggage, vehicles, etc.

- **Plantation activities within the forest areas should be thoroughly monitored – From the time of felling to planting operations upto the maintenance period of minimum 10 years**
- **Adopt restoration policies by planting fast growing native species in the infested areas and assist natural regeneration**
- **MDF is highly susceptible to forest fire and the fire pave way for IAS - Effective measures should be taken to control forest fire**
- **Avoid burning of litter along the fire-line and grassy patches within MDF**

- Control IAS in infested areas before flowering and fruiting
- New introductions of plants should be done with caution
- Gaps in the forests should be under frequent surveillance to detect and eradicate any new introductions
- Enrich the soil seed bank of native species, especially in infested areas
- Since the microhabitats within the MDF vary from location to location, Implement Site specific habitat management plan

Experiments in teak plantations within the MDF habitat

Control plot

2014

Chromolaena odorata	66	412.5
Mikania micrantha	1574	9837.5
Total number of species encountered in the sample plot		60

2015

Chromolaena odorata	55	287.5
Mikania micrantha	1398	8687.5
Total number of species encountered in the sample plot		58

Uprooting and planting of native species – Seeds of native species were sown

Chromolaena odorata	199	1243.75
Mikania micrantha	2671	10443.75
Total number of species encountered in the sample plot		54

Chromolaena odorata	13	62.5
Mikania micrantha	24	150
Total number of species encountered in the sample plot		65

80 - 90 % decrease in density of invasive plants during the first year

Native herbs used: *Sida, Pseudarthria, Desmodium, Cyathula, etc.*

Uprooting two times: 2014 - before the flowering season

2015 - just after the onset of monsoon


Thank you