



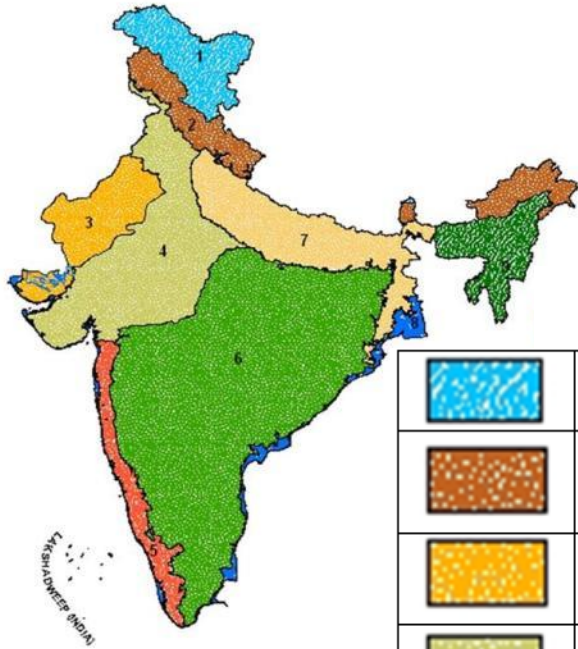
Ecology Invasive Animals and Forest Types













भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Dr. K. Sivakumar
Wildlife Institute of India
Dehradun
ksivakumar@wii.gov.in

Threats to Biodiversity



	1: Trans-Himalaya	Livestock pressure, Tourism, Exotic plantations, Medicinal plants & NTFP extraction, Poaching, Human-animal conflict, Border strife, Climate change.
	2: Himalaya	Climate change, Deforestation, Invasive species, Medicinal plants & NTFP extraction, Fire, Land use change, Development & urbanisation, Mining, Hydropower development, Tourism, Pollution & eutrophication.
	3: Desert	Invasive species, Land use change, Livestock pressure, Human population pressure, Mining, Border strife.
	4: Semi-Arid	Land use change, Mining, Livestock pressure, Poaching.
	5: Western Ghats	Deforestation, Invasive species, Exotic plantations, Encroachment, Mining, Medicinal plants & NTFP extraction, Livestock pressure, Poaching, Fire, Pathogen load & disease transmission, Climate change.
	6: Deccan Peninsula	Deforestation, Invasive species, Development & urbanisation, Mining, Conflict (insurgency), Pathogen load & disease transmission.
	7: Gangetic Plain	Deforestation, Invasive species, Development & urbanisation, Mining, Land use change, Pollution & eutrophication, Livestock pressure, Human population pressure.
	8: Coasts	Climate change, Pollution, Development & urbanisation, Mining, Tourism, Aquaculture, Invasive species.
	9: North East	Deforestation, Agriculture (shifting cultivation), Mining, Hydropower development, Hunting, Conflict (Border strife and insurgency), Climate change.
	10: Islands	Climate change, Invasive species, Development & urbanisation.

Chital in Andamans









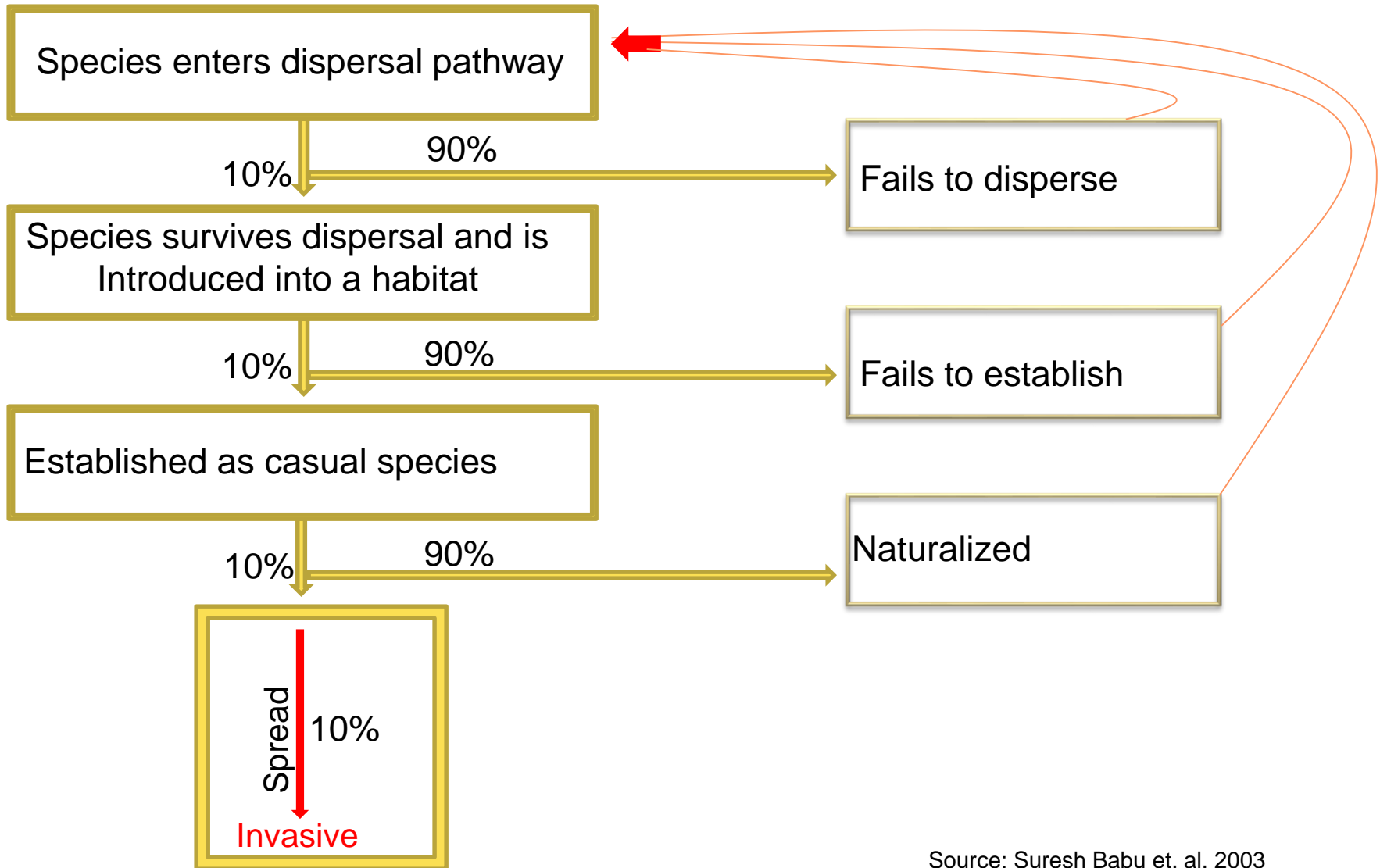
Invasive species



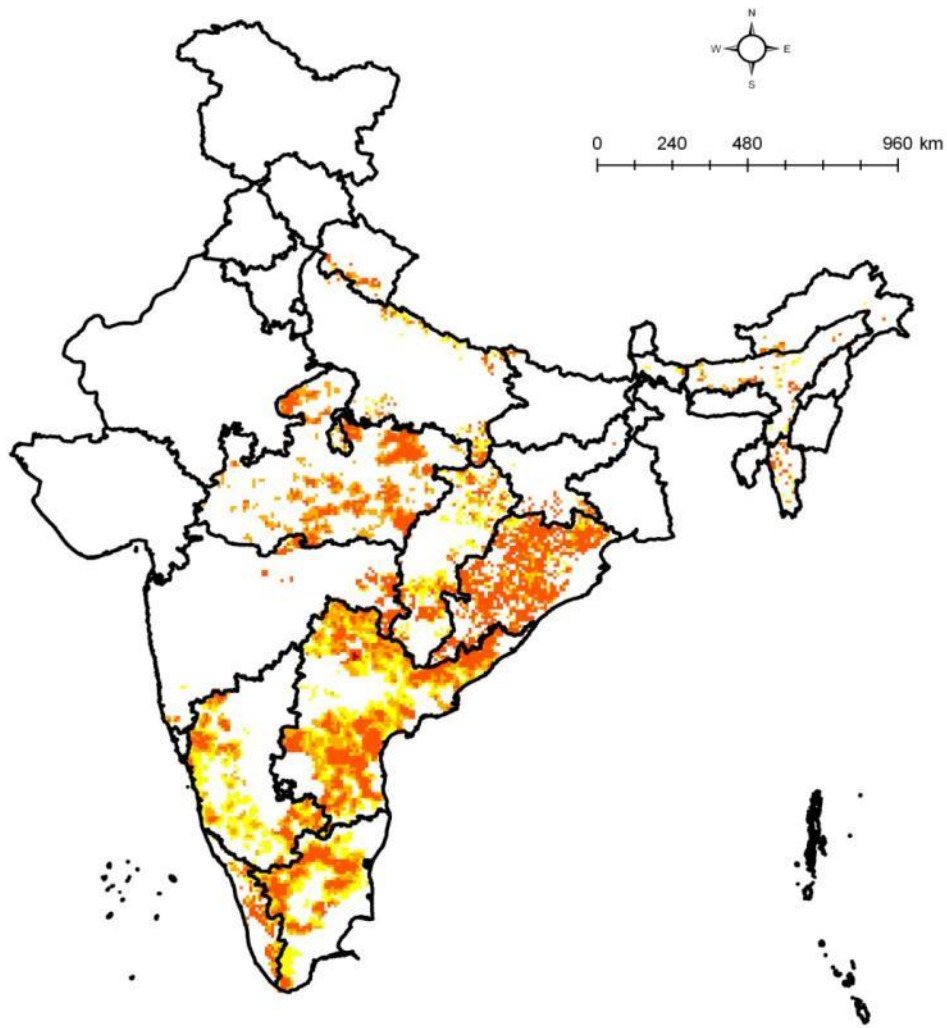
IAS are also commonly referred to as invasive, aliens, exotics or non indigenous species. IAS are species, native to one area or region, that have been introduced into an area outside their normal distribution, either by accident or on purpose, and which have colonized or invaded their new home, threatening biological diversity,



Are all Alien Species Invasive?

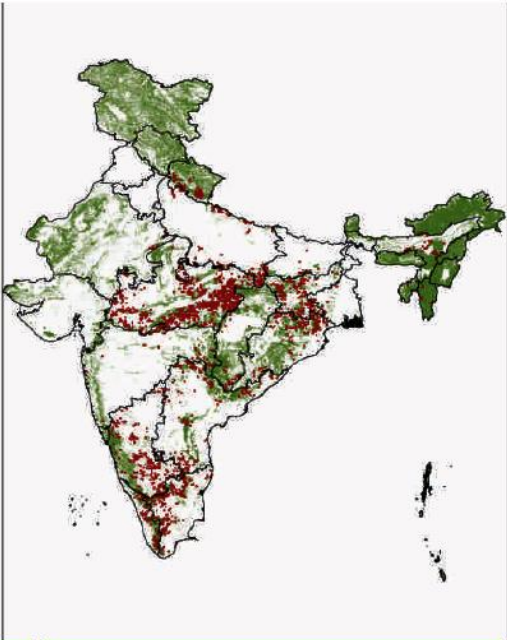


Distribution & Relative Abundance of Weeds in Tiger Occupied States

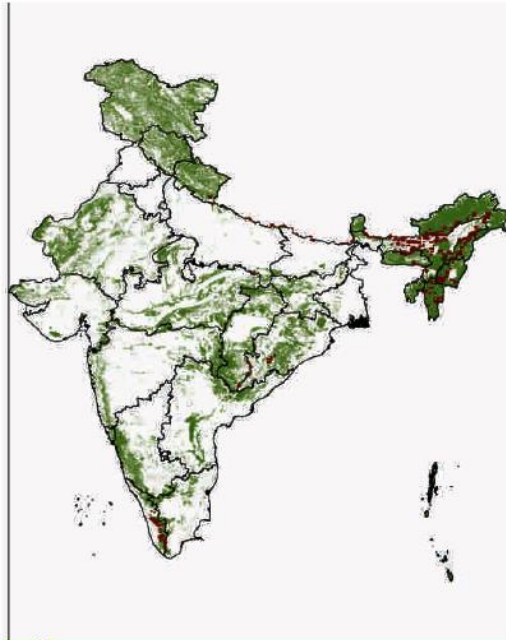


Legend

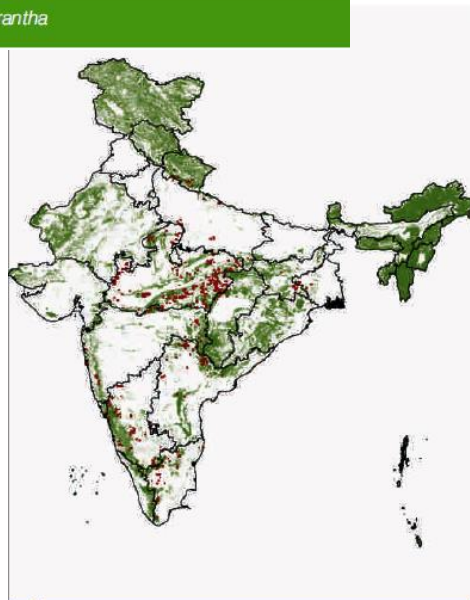




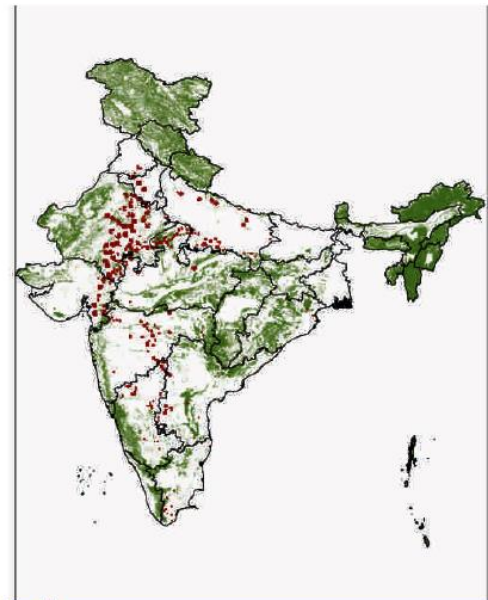
a *Lantana camara*



b *Mikania micrantha*



c *Parthenium hysterophorus*



d *Prosopis juliflora*



Chemical control

- Impractical to cover vast tracts infested with *Lantana* and also not cost-effective, potential hazard to the native biota and environment.

Biological control

- Limited foraging ability of the insects; variety-specific behaviour of the biocontrol agent, performance of the biocontrol agent is affected by climate, biocontrol agents may also affect native species.

Biological control Experiments

36 insect spp. released in 33 countries to control *Lantana camara*

Cactus moth (*Cactoblastis cactovorum*) introduced from South America into Queensland in 1920s to control prickly pear cactus (*Opuntia* spp.)

Septoria spp. from Ecuador into Hawaii in 1997 to control *Lantana camara*

Puccinia spegazzinii (isolate W 1761) of Trinidad origin imported into

New management strategy On the basis of critical assessment of the biological and ecological attributes of lantana

- **(i) its removal by cut rootstock method,**
- **(ii) weeding of saplings from beneath the trees used for perching by generalist birds that disperse the seeds throughout their home range and from surface drainage channels originating from the area covered by such trees and**
- **(iii) ecological restoration of weed-free landscapes, preferably to the grassland, or forest communities according to the needs of stakeholders to prevent**



a



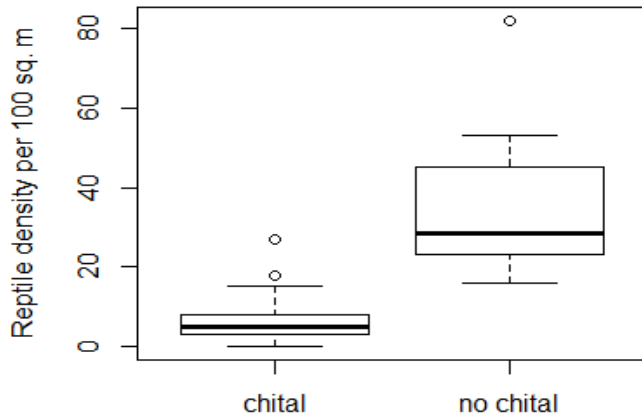
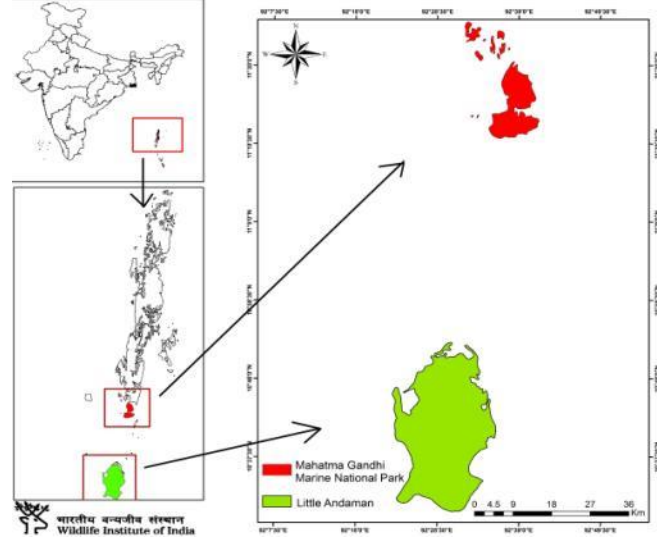
b

*a, coppicing zone at the transition between stem base and root.
b, Lantana removed by cutting the rootstock below the coppicing zone.*

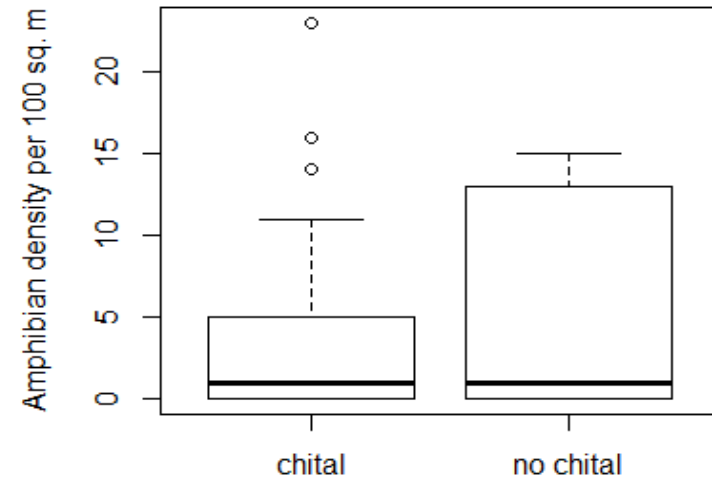








A box plot illustrating the difference in reptile density per bound plot between islands with and without chital ($F = 40.75$, $p < 0.001$ (significant), Effect size (η^2) = 0.58) in Andaman Islands. Island without chital showed higher reptile density per bound plot



A box plot illustrating amphibian density per bound plot in islands with and without chital in Andaman Islands. No difference between these two categories of islands was observed ($F = 0.35$, $p = 0.559$, Effect size (η^2) = 0.01).

Lantana eradication in Sukhna Wildlife Sanctuary, U.T. Chandigarh

Restoration & Biodiversity

More than 50% of the forest area in Sukhna Wildlife Sanctuary was highly infested with lantana weed. Lantana camara is one of the most common and worst weed which is perhaps the most obnoxious in the Shivalik hills and the forests around Chandigarh city. It was posing a serious threat to the 'Biodiversity' of our forests. It is a very hardy weed and grows fast in comparison to the indigenous plant species in wildlife sanctuary and other forest area. Wild growth of lantana had choked all natural regeneration in the forests and thus had adverse impact on the biodiversity of wildlife sanctuary. Lantana eliminates all kind of undergrowth and damages the trees also.



Considering the adverse impact of 'Lantana' on the ecology of Sukhna Wildlife Sanctuary and other forest area, Forest Department of Chandigarh Administration had chalked out a 7 year's schedule in March, 2001 to make sanctuary & other forests of U.T. Chandigarh free from 'Lantana'. By 2008-09, the entire Wildlife Sanctuary and other forest area have already been freed from lantana. This is a unique example of the eradication of Lantana from forests. The department has ensured that lantana does not appear again on the site already cleared of it. This has been a very successful project and good results are visible on the ground. The regeneration of indigenous species like Bansa, Ratti, Karipatta, Giloe, Karaunda and other tree species is appreciable. For the last

four years, there has been good flowering and fruiting in trees like Ber, Dhak (Palas), Karaunda etc. Good grazing grounds for wildlife have also been developed after removal of lantana and thus, there is overall improvement in the wildlife habitat of the sanctuary. Lantana removal has thus proved to be a great boon to the restoration of floral and faunal biodiversity of Sukhna Wildlife Sanctuary. 'Forest fire' threat to the forests has also been reduced due to removal of lantana.



Eradication and monitoring of invasive fishes

Invasive African cat fish *Clarias gariepinus* were posing threat to birds and other wildlife especially aquatics of the Park.

Park Management successfully initiated eradication of this species from the Park but it needs to be continued for longer period.



Eradication and monitoring of invasive plants

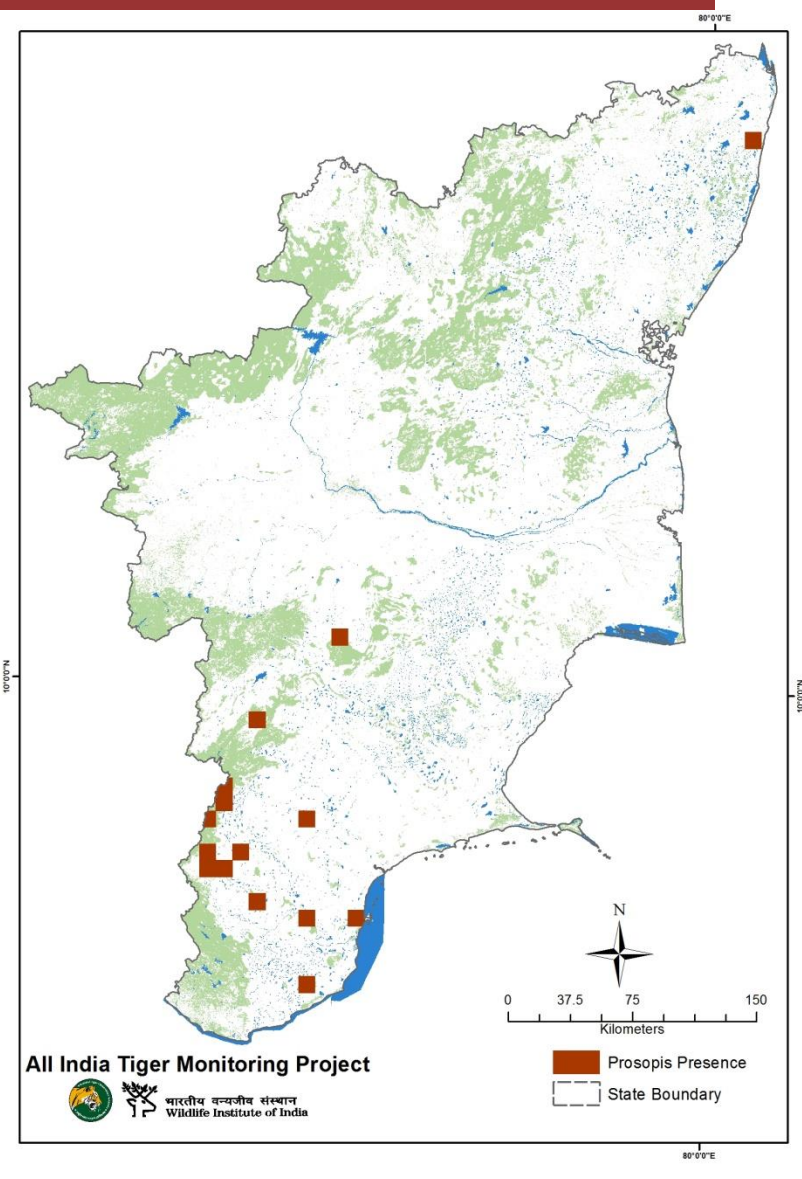
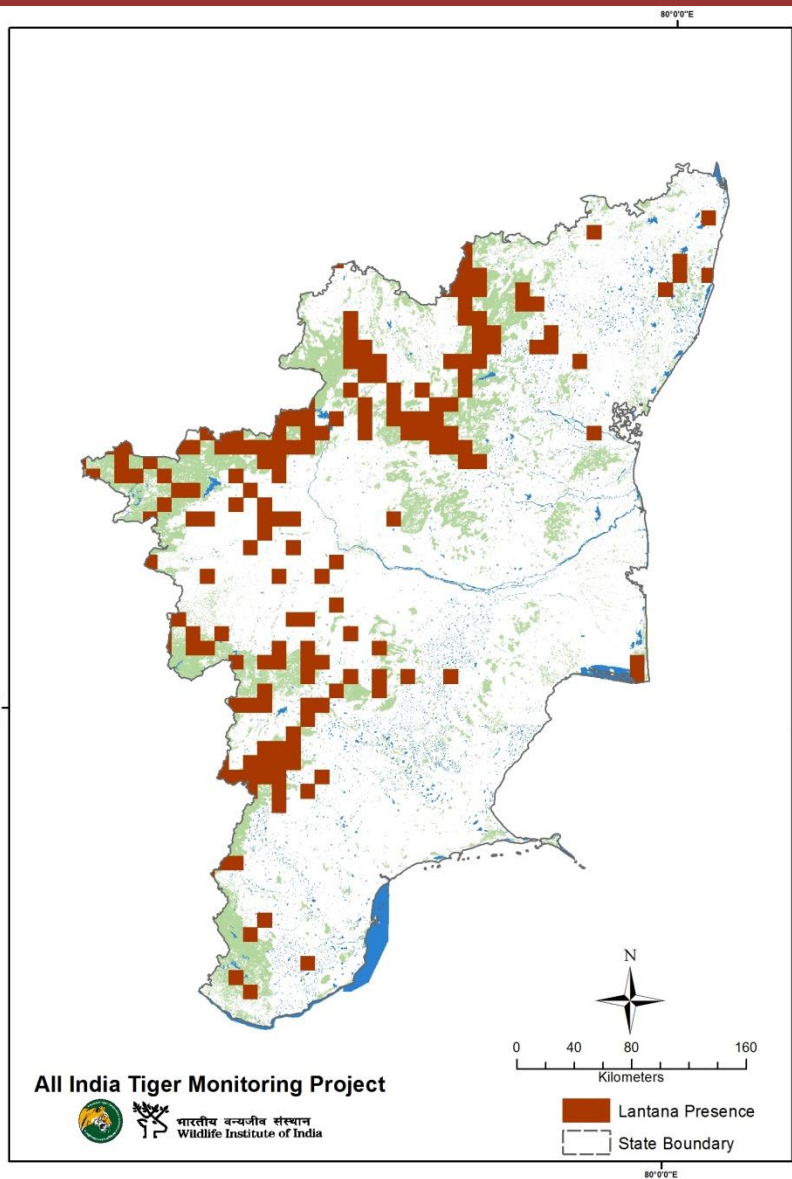




Study on Ecological & Socio-economic impact of invasive species, *Prosopis juliflora* and *Lantana camara*, and their removal from forest, common and fallow land of Tamil Nadu



Presence of Lantana and Prosopis recorded during All India Tiger Monitoring Programme in Tamil Nadu



Driest environment settings of southern zone favored more P. juliflora than other agro-climatic zones that are comparatively wet.

The impact of Prosopis in the forested landscapes of Tamil Nadu, especially in Sathyamangalam Tiger Reserve seemed to be adversely affecting the distribution of native biodiversity.

Dry zone of Tamil Nadu where the groundwater level-soil moisture conditions, humidity and temperature under the canopy cover were better in the habitats dominated by P. juliflora but in the forested landscapes these environmental factors were comparatively lesser

P. juliflora was observed to be allelopathic that discouraging other plants from growing around them and seems to be toxic to other biotas in ways that allow the invasives to monopolize the space, sunlight, and nutrients at the exclusion of other species.



- *Although, alien invasive species such as P. juliflora and L. camara are adversely affecting the native biodiversity especially in the Western Zone and Cauvery Delta but it has livelihood values in the Southern Zone especially Ramanathpuram and adjoining districts of Tamil Nadu.*
- *Economic analyses also revealed that the benefits of the P. juliflora invasion in the southern zone are higher than the costs. However, some aspects such as increased risk of water table and long-term ecological changes were not examined, thus making the total economic valuation incomplete.*
- *The study concludes that complete eradication of P. juliflora and L. camara is inevitable in the forested landscapes and Protected Areas of Tamil Nadu. However, the study recommends that sustainable management and control of P. juliflora may be a better solution than eradication in the Southern Zone*

Kappaphycus alvarezii



78°07' 11.82" E

79°32' 45.49" E

9°18' 58.47" N

9°19' 27.24" N



8°39' 40.39" N

8°41' 28.89" N

78°07' 07.38" E

79°32' 26.83" E

Gulf of Mannar Reef Areas

- 21 Islands of Gulf of Mannar**
- | | |
|-----------------------|----------------------------|
| 1. Shingle Island | 12. Poovarasampatti Island |
| 2. Krusadai Island | 13. Valimunai Island |
| 3. Pullivasal Island | 14. Anaipar Island |
| 4. Poomarichan Island | 15. Nallathanni Island |
| 5. Manoliputti Island | 16. Puluvinichalli Island |
| 6. Manoli Island | 17. Upputhanni Island |
| 7. Hare Island | 18. Kariyachalli Island |
| 8. Mulli Island | 19. Vilanguchalli Island |
| 9. Valai Island | 20. Koswari Island |
| 10. Thalaiyari Island | 21. Vaan Island |
| 11. Appa Island | |







The exotic seaweed, *Kappaphycus alvarezii* invaded in the reef areas in Gulf of Mannar



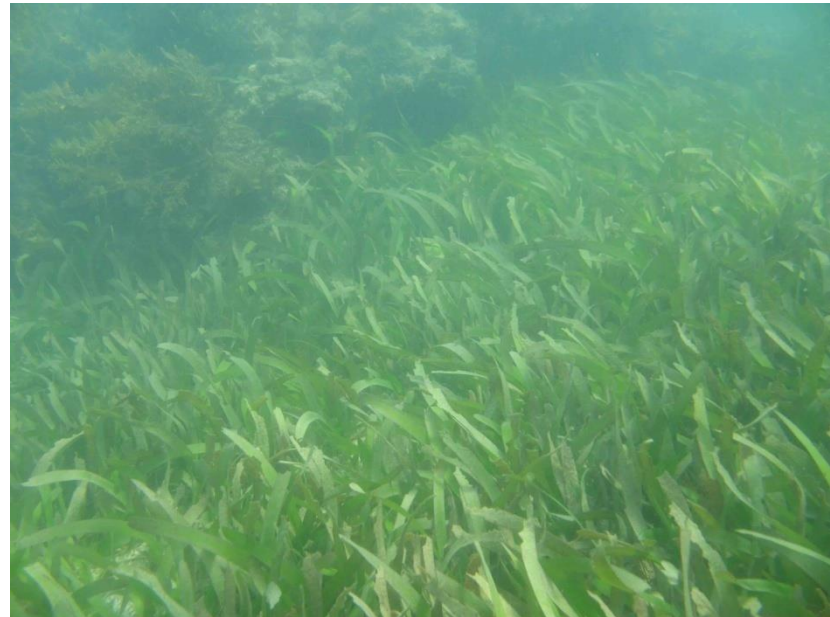
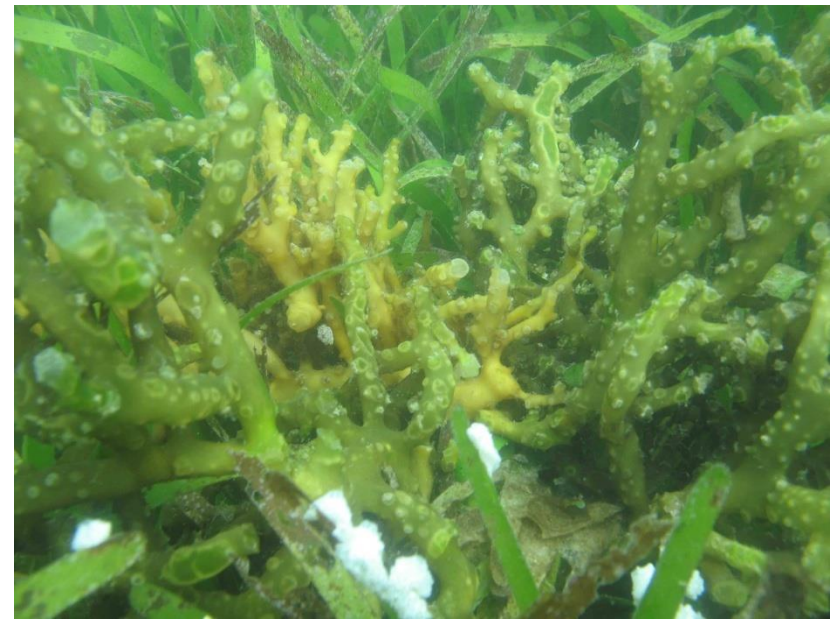
Smothering effect on coral colonies, that leads to mortality of entire colony





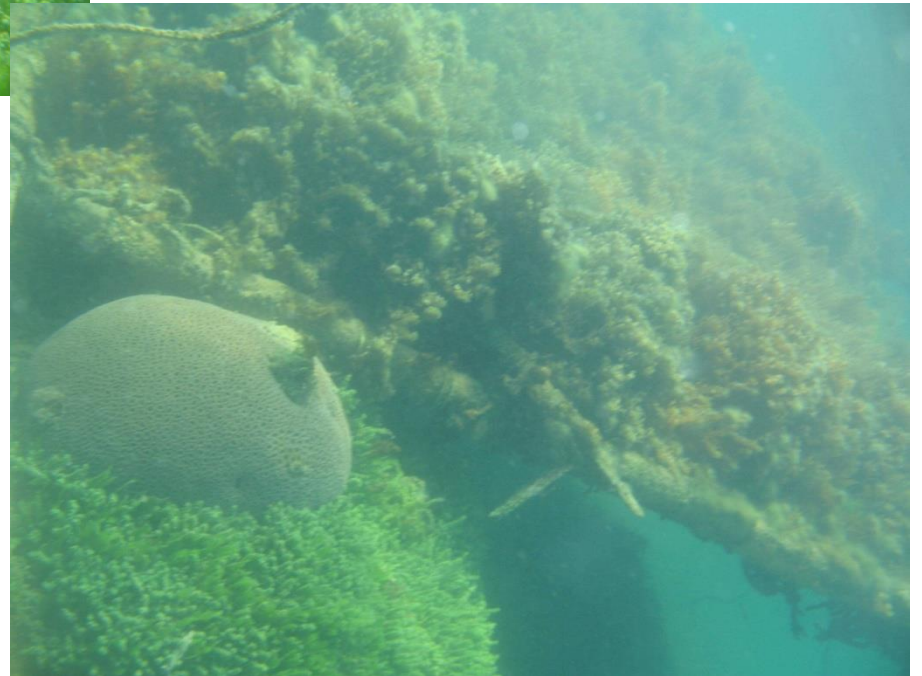
***Kappaphycus* cultivation in Palk Bay reduces light penetration which is highly essential to seagrass growth & health**

In addition, Kappaphycus cultivation in Palk Bay reduces health of the environment and so loss of native fauna and flora





In Palk Bay, where seagrass beds are abundant along with corals, *Kappaphycus* cultivation leads to ecological imbalance



Successful invaders

- **Large native range**
- **Abundant in native range (but not always)**
- **Broad diet (generalist, omnivore)**
- **prolific breeder**
- **associated with man**
- **successfully adaptable in a wide range of environmental conditions**



Impacts

- Next to the deforestation (habitat destruction), introduced species are the major threat to the preservation of biodiversity.
- It can profoundly alter ecosystem structure and function.
- E.g. in Western Ghats, Shola grasslands have been modified by with the invasion of aggressive black wattle (*Acacia mearnsii*, introduced here for tannin industry).
- Acceleration of soil erosion rate: Himalayan tahr in South Africa
- Alteration of hydrological cycles: Invasive fungus *Phytophthora cinnamomi* killing Eucalyptus in



Impact

- Large number of species extinct from Islands due to Invasive. In Islands, Amphibians, reptiles and birds are more vulnerable than mammals.
- Predation: e.g. Trout, Cat, Dog, brown tree snake etc.,
- Browsing and grazing: e.g. Goat, Spotted deer, elephant.,
- Hybridization (Genetic contamination): Turtle dove, Egret, pigs, carps,
- Food competition: exotic carp and native carp, sparrows, bulbuls.,
- Nest site competition: Parrot nest site encroached by introduced honeybee
- Introduction of disease: Avian



Predation - Crown-of-Thorn Starfish

Acanthaster planci



Management

- **Mechanical control**
- **Chemical control**
- **Biological control**
- **Prevention**



Nature Nurtures... Conserve Nature

Together we can build a frame work that
nourishes and not depletes our natural assets...

Thank You !
