

Invasive alien species



Alien species

- Non-native or exotic organisms that occur outside their natural adapted ranges and dispersal potential.
- Some alien species become invasive when introduced outside their natural habitats.
- Express the capability to establish, invade and outcompete native species.

- ❖ Alien Invasive Species as an alien species which becomes established in natural or semi natural ecosystem, an agent of change and threatens native biological diversity.
- ❖ Widely distributed in all kinds of ecosystems through out the world.
- ❖ Include all categories of living organisms.

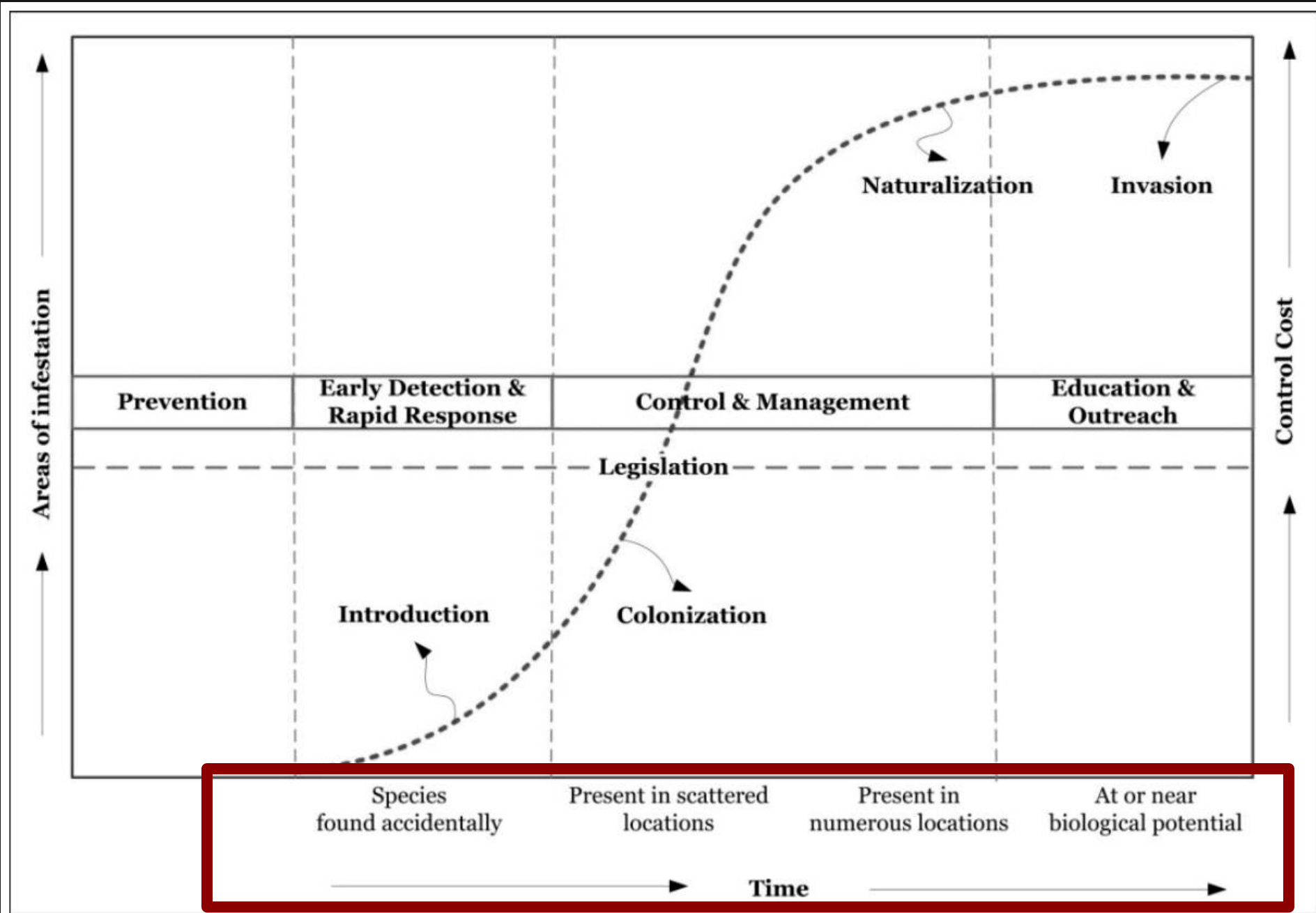


Fig. 1 Management strategies to curtail invasive at different stages of invasion process.

- ❖ Threat to biodiversity.
- ❖ Species extinctions.
- ❖ Changes in hydrology.
- ❖ Ecosystem functions.
- ❖ Change in soil structure, its profile, decomposition, nutrient content of soil, moisture availability, etc.

Forest invasive species

The FIS are categorized as

- Floral (weeds and plants having national and regional distribution)
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- Entomological (insects) and
- Pathogenic (fungi).

- Approximately, 111 FIS have been identified.
- No systematic studies to inventoried the FIS.
- Many invasive species have naturalized in India and being used for various purposes furniture, composting etc.
- Appropriate strategies need to be devised for their control, eradication and management.

WEEDS

- “A plant out of place”
- “A plant that grows so luxuriantly or plentifully that it chokes out all other plants that possess more valuable properties”
- “Spontaneous growth appearing without being sown or cultivated”.
- “Weed is simply a plant, which, in a particular place at a particular time, arouses human dislike and attempts are made at its eradication or control, locally because it competes with more desirable plants, sometimes because it serves as a host to their pests and

Weeds classified into three categories.

Category I:

- ❖ Comprises of the species, which are thoroughly naturalized and appear to behave as wild plants.
- ❖ Members of *Asteraceae, Amaranthaceae*

Category II: -

- ❖ Includes the plants of cultivated origin that have become naturalized or run wild.
- ❖ Members of families such as *Solanaceae*, *Cucurbitaceae*, *Asteraceae*, *Apiaceae*, *Brassicaceae*, *Fabaceae*, *Lamiaceae*, *Convolvulaceae*, etc.

Category III: -

- ❖ Species falling under this category are exclusively cultivated, and also met with as escapes.
- ❖ Include members of *Acanthaceae*, *Caryophyllaceae*, *Malvaceae*, *Asteraceae*, *Poaceae*, *Amaryllidaceae*, etc.

Weeds can also be classified as

❖ ***Annuals*** :

- ❖ Completes its life cycle from seed in < one year.
- ❖ Abundance of seed and fast growth
- ❖ Annuals are very persistent.
- ❖ Cost more to control than perennial weeds.
- ❖ Most common field weeds are annuals.

❖ ***Biennials*** :

- ❖ A biennial plant lives for > one year but not over two years.
- ❖ Only a few troublesome weeds fall in this group.
- ❖ Wild carrot and wild parsnip are examples.

❖ ***Perennials*** :

- ❖ Perennials live for more than two years and may live almost indefinitely.
- ❖ Creeping perennials are probably the most difficult group to control.
- ❖ *Lantana camara*

Impacts of FIS:

Lantana camara

- ❖ One of the most obnoxious weeds that has encroached most of the areas under community and reserve forestlands, especially the outer fragile Himalayas.
- ❖ Causes shade as well as allelopathy impacts on the regeneration of important forestry species.
- ❖ Yields of crops and pastures get reduced.
- ❖ Harvesting costs increase manifolds.
- ❖
- ❖ Heavy expenditure is incurred for afforestation of lands infested with this weed which requires frequent weeding so as to avoid suppression of young seedlings of planted species.
- ❖ Afforestation cost is also increased due to loss of stand and slower growth rate due to weed competition.



Parthenium

- Carrot weed (parthenium), a member of the family Asteraceae, is one of the world's worst weeds.
- It is native to North and South America. Parthenium is currently distributed in many countries
- Parthenium is an annual herb, erect and up to 2 m in height. The stem is branched and covered with trichomes.
- Difficult to control as it seeds prolifically.
- A menace to agriculture because it has allopathic effect and competes with pastures and reduces their carrying capacity.
- Affects human and animal health by causing respiratory problems, severe dermatitis and tainted milk.



Parthenium in cultivated fields





***Parthenium
hysterophorus***



Eupatorium glandulosum

- Is found in the temperate regions.
- Spreads fast and checks the regeneration of other species particularly in Western Ghats and has replaced the valued flora at places.
- It comes in disturbed soils. In most of the goat-travelled paths, it comes up well; that is why it is locally known as '*goat weed*'.
- Since it has no local or commercial use, it has widely spread in denuded and forestlands.



Ulex europaeus

- An invasive shrub deemed as one of the most invasive species in the world.
- Widely distributed in the south-central area of Chile,
- It is one of the most severe pests for agriculture and forestry and has negative effects on the biodiversity of natural ecosystems.
- Represents a fire hazard in the Western Ghats.
- Invades watersheds, which supply a substantial amount of drinking water.
- Threatening agricultural and grazing lands.
- Forms impenetrable thickets with persistent spiny litter.



Acacia mearnsii

- Introduced in Western Ghats particularly in the Nilgiris to provide fuelwood to the rural people to save the shola forests, which were degraded by human activities.
- Also planted in the tea gardens to provide shade
- But now it has covered most of the shola forests and has become a menace in the Nilgiri Hills.
- Regeneration of shola forests is affected due to profuse regeneration and invasive nature of this species.



Mikania micrantha

- It originates from tropical Central and South America and has become a major pest of crops and forests across Asia and Africa.
- A perennial fast growing weed
- A major menace to the natural forests, plantations and agricultural systems in North-east and South-west India.
- Spreads very fast in areas where canopy is open.



Euphorbia royleana

- In the Himalayan zones comes up profusely and has covered thousands of hectares of land. This plant represents a desert environment.
- Being cactus in habit, it has no use in conserving or making of soil.



Other Weeds

- *Artemisia vulgaris*,
- *Carrisa carandas*
- *Dodonea viscosa*
- *Cannabis sativa*
- *Ageratum conizoides*,
- *Cassia tora*,
- *Clerodendron viscosum* etc.

India report of FIS - <https://apfisin.net/wp-content/uploads/2018/07/India.pdf>

<https://www.researchgate.net/publication/269988726> Invasive Plant Species in Indian Protected Areas Conserving Biodiversity in Cultural Landscapes

Current methods /techniques for prevention /control of weeds

Mechanical:

- ❖ Involves hoes, cultivators, harrows, rotary weeders, discs, ploughs, mowers and manual uprooting.
- ❖ Weeds are physically lifted from the soil, cut off or buried.
- ❖ In most of the forestry operations the FIS such as *Lantana*, *Eupatorium*, *Mikania*, *Mimosa*, etc. are uprooted manually and either burnt or buried.
- ❖ In some places, these are being used for making compost.

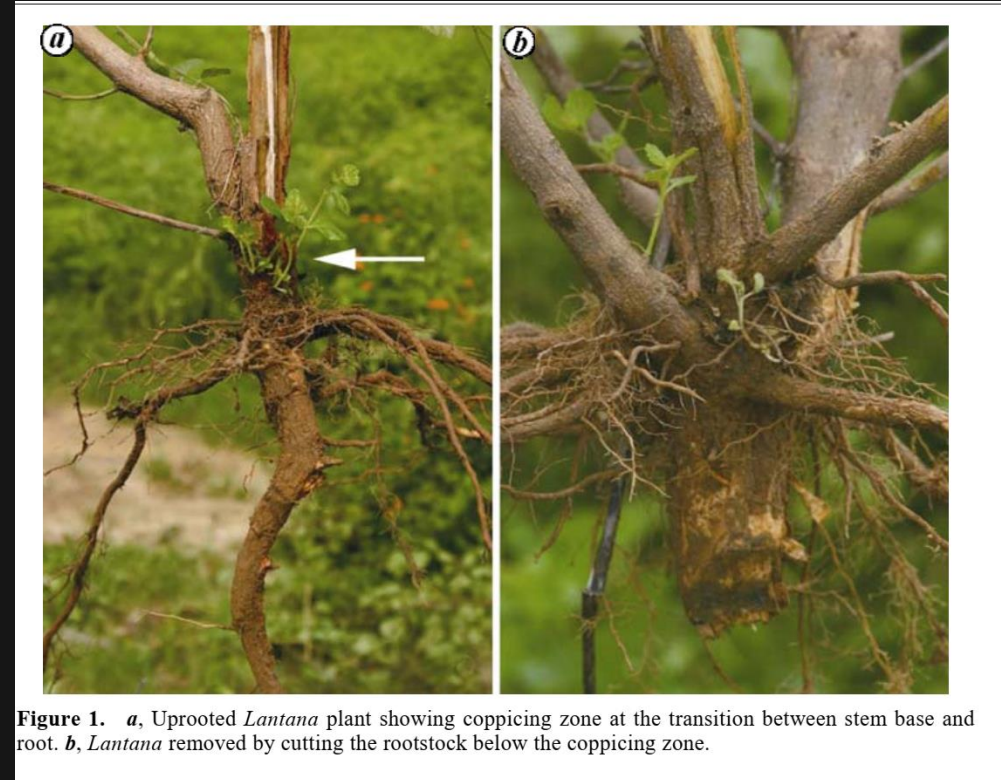


Figure 1. *a*, Uprooted *Lantana* plant showing coppicing zone at the transition between stem base and root. *b*, *Lantana* removed by cutting the rootstock below the coppicing zone.

Chemical:

- ❖ One of the methods employed for control of FIS.
- ❖ Use is not always desirable due to environmental degradation and pollution and effects on other useful species.
- ❖ Use of herbicides like 0.5% 2,4-D amine, 0.2% trichlorpyr plus 0.05% picloram, 0.05% imazapyr all in water at cut stumps help to control lantana.
- ❖ Spray of chemicals like 2,4-D 1.0- 1.5 kg per ha., Fomasafen 0.25 Kg per ha. And oxadiazon 0.25- 0.38 kg per ha. etc. checks parthenium.

Tillage:

- ❖ Helps in the burial of most small annual weeds.
- ❖ If all growing points are buried, most annual weeds will be killed.
- ❖ Also disturbs the rooting system of most of the perennial weeds.
- ❖ The root system is cut to enough depth so that the plant dies from desiccation before it can re-establish its roots.
- ❖ In moist soils or if it rains soon after tillage, the roots may quickly re-establish themselves.
- ❖ Tall annual weeds are mowed or scythed to reduce competition with crop plants and to prevent seed production.

Crop competition:

- ❖ One of the cheapest and most useful methods farmers can use.
- ❖ Often it means using the best crop production methods so favorable to the crop that weeds are crowded out.
- ❖ Weeds compete with crop plants for light, soil moisture, nutrients and carbon dioxide.
- ❖ Early weed competition usually reduces crop yields far more than late season weedy growth.
- ❖ In planning a control programme, it is important to know the weed's life cycle. If it is possible to interrupt the cycle it becomes very effective control.

Crop rotation:

- ❖ Certain weeds are more common in some crops than in others. Besides the annual weeds, for the parasitic weeds, such as *Striga* in sorghum and *Orobanche* in tobacco, the hosts are the crop species grown.
- ❖ Rotation of crops is an efficient way to reduce weed growth.
- ❖ A good rotation for weed control usually includes strong competitive crops grown in each part of the rotation.

Biological control:

- ❖ A 'natural enemy' of the plant is used which is harmless to desired plants.
- ❖
- ❖ Insects or disease organisms are the usual natural enemies.
- ❖ Also parasitic plants, selective grazing by livestock and highly competitive replacement plants are other forms of biological control.
- ❖ Outstanding example of biological weed control is the one on Cactus (*Opuntia spp.*) with a moth borer *Cactoblastic cactorum* and or *Lantana camara* with several kinds of caterpillars and a fly, which damages the berries.
- ❖ Numerous biological agents tested against Parthenium weed, including a gall forming moth, leaf, weevil, beetles and a rust fungus.

Fire:

- ❖ In ditch banks, roadsides and other waste areas, undesirable weed species are burnt during summer.
- ❖ Burning must be repeated at frequent intervals if it to control most perennial weeds.
- ❖ Burning dried vegetation seldom kills the weed seeds; the practice has little value for this purpose.

Table 1. Methods practised for the control of *Lantana* in forest ecosystems in India and their limitations

Control method	Limitations
Slashing/chopping	Stimulates the shoot buds from most of the nodes below the chopped portions of <i>Lantana</i> clumps leading to proliferation of many branches which get interwoven into each other leading to formation of impenetrable thickets.
Burning	Stimulates the sub-terranean meristem (coppicing zone; see Figure 1 <i>a</i> and section on biological and ecological basis for effectiveness of the management strategy developed) which produces profuse shoot buds that develop into shoots. The growth rate of new shoots is also enhanced due to burning ¹⁸ ; it also leads to increase in germination of <i>Lantana</i> seeds from soil seed bank ¹⁸ ; burning eliminates competition from native plant species as the native species are not fire-resistant. The alteration of habitat due to burning can promote invasion of <i>Lantana</i> ¹⁶ or secondary invasion of other weeds if not managed properly.
Manual/mechanical grubbing	<p>Manual grubbing, as practised in India, involves both slashing of branches of <i>Lantana</i> clumps to be removed and extensive digging of root system of the slashed <i>Lantana</i> clumps. There are two major disadvantages of this method: (i) due to extensive digging below the <i>Lantana</i> clump, the soil is extensively disturbed leading to exposure of buried <i>Lantana</i> seeds to light which leads to gregarious germination and establishment of seedlings, (ii) regeneration and recoppicing from slashed branches that are fallen on the ground and from the base of uprooted clump; regeneration also takes place from the rooted prostrate branches that might have been severed from the clump while grubbing.</p> <p>Mechanical grubbing results in extensive loosening of soil leading to enhanced soil erosion and also large scale germination of <i>Lantana</i> seeds; it also disturbs the native plant species established between clumps.</p>
Chemical control	Impractical to cover vast tracts infested with <i>Lantana</i> and also not cost-effective ¹³ ; 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 ¹⁷ ; biocontrol agents may also affect native species.

Actions to prevent introduction of FIS

- ❖ Limit soil disturbances
- ❖ Immediate re-vegetation of disturbed sites
- ❖ Use certified "Weed Free" Seeds for re-vegetation of disturbed sites
- ❖ Clean equipment and materials
- ❖ Early detection and eradication / Pre-activity invasive plant survey
- ❖ Limit seed introductions/ Incorporate invasive plant management in planning phase
- ❖ Education and awareness

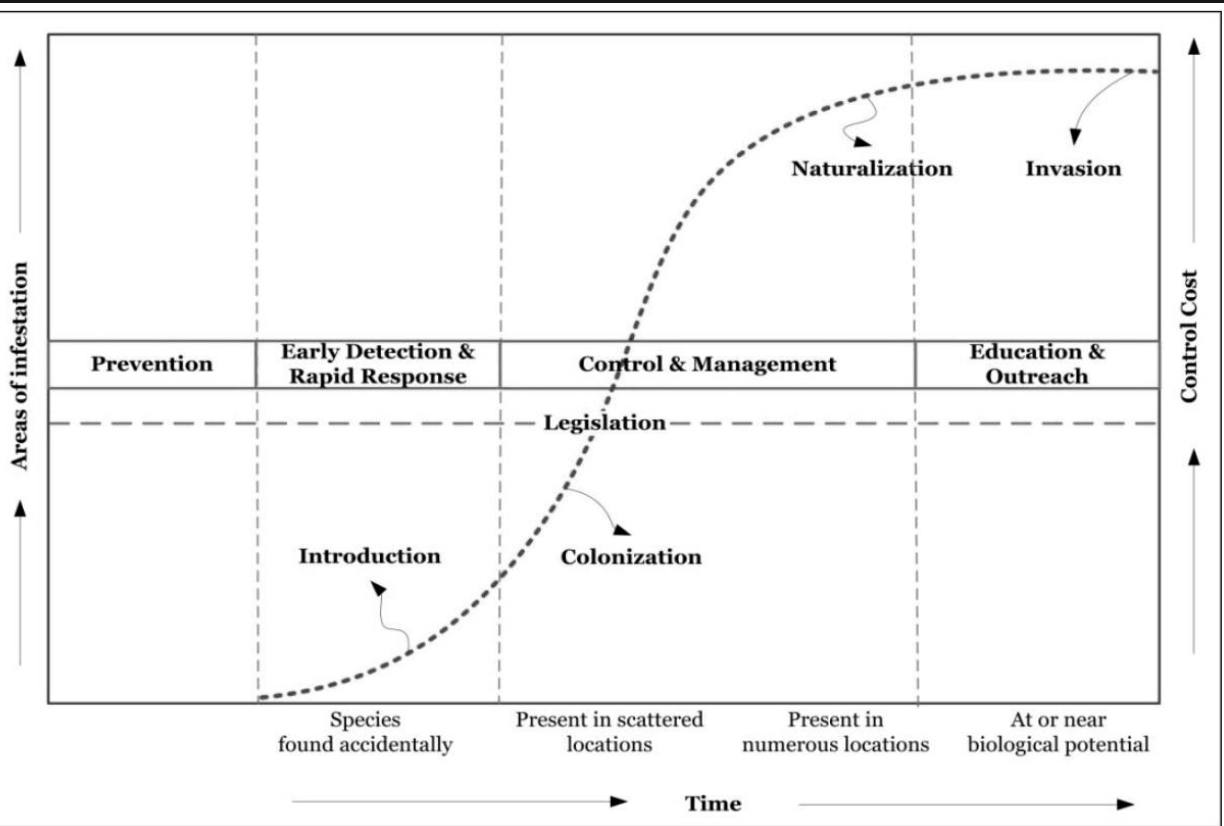
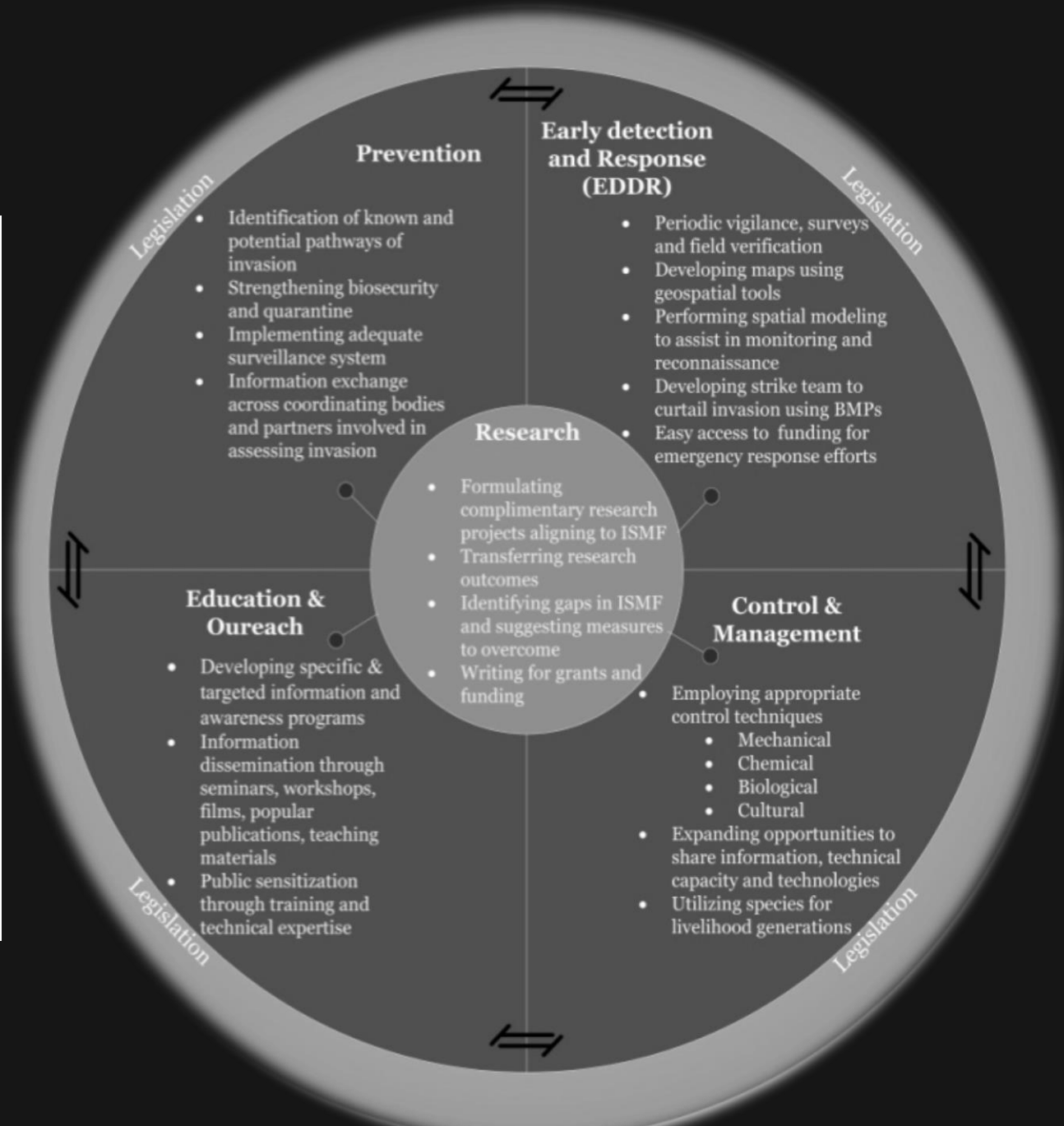


Fig. 1 Management strategies to curtail invasive at different stages of invasion process.



Positive impacts of introduced species on forests and forestry

- sources of products such as **timber, fibre and fuelwood, non-wood forest products**
- **livelihoods & employment.**
- Alien tree species planted in forest plantations and other areas help provide many vital **ecosystem services** such as:
 - combating desertification;
 - protecting soil and water;
 - rehabilitating lands exhausted from other land uses;
 - diversifying the rural landscape;
 - enhancing carbon sequestration;
 - amenity and shade.

Thank you