



Lantana camara Ecology and Management in Forested Landscapes

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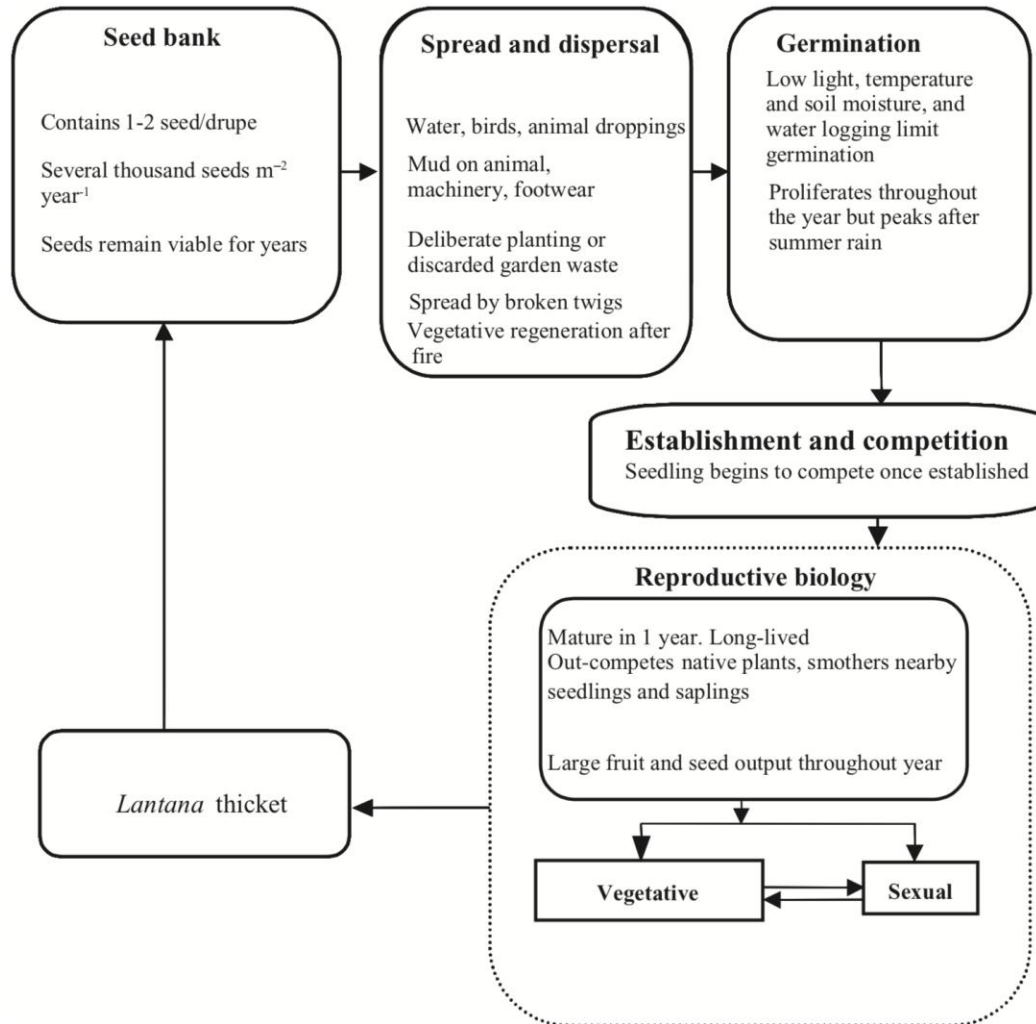
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Lantana camara L.

- Distributed and established in over 12 bioregions and more than 60 countries globally (Richardson and Rejmanek 2011)
 - Australia-4 m ha
 - India-13 m ha
 - South Africa-2 m ha
- Further range expansion forecasted due to climate change (Taylor, *et al.* 2012)

Invasive Traits



Impact

- In Australia, approximately 1200 plants, 100 animals and 57 ecological communities negatively affected by Lantana
 - Loss of biodiversity
 - Disappearance of bottom and middle storey vegetation
 - Lower food availability for wild animals
 - Lower recruitment of tree seedlings
 - Altered soil processes

Control Methods for Lantana

- Manual control methods
 - hand grubbing
 - hand pulling
 - hand cutting
- Mechanical control methods
 - slashing
 - pushing or stick raking
 - mechanical grubbing
 - chain pulling
 - ploughing
- Use of fire
- Chemical control methods
 - foliar spraying
 - low-volume herbicide applications
- Biological control
- Control through utilisation

Manual/Mechanical Control Limitations

- Slashing of branches of Lantana clumps and extensive digging of root system
 - regeneration from fallen branches
 - re-coppicing from base of uprooted clump
- Extensive loosening of soil
 - Soil disturbance and erosion
 - Gregarious germination of Lantana seeds due to exposure of sub-soil Lantana seeds to sunlight / breaking of dormancy
- Destruction of native seedlings / vegetation
- Opening up of forest floor to other invasives



Single Lantana branch developing multiple shoots and roots when cut and left on the ground

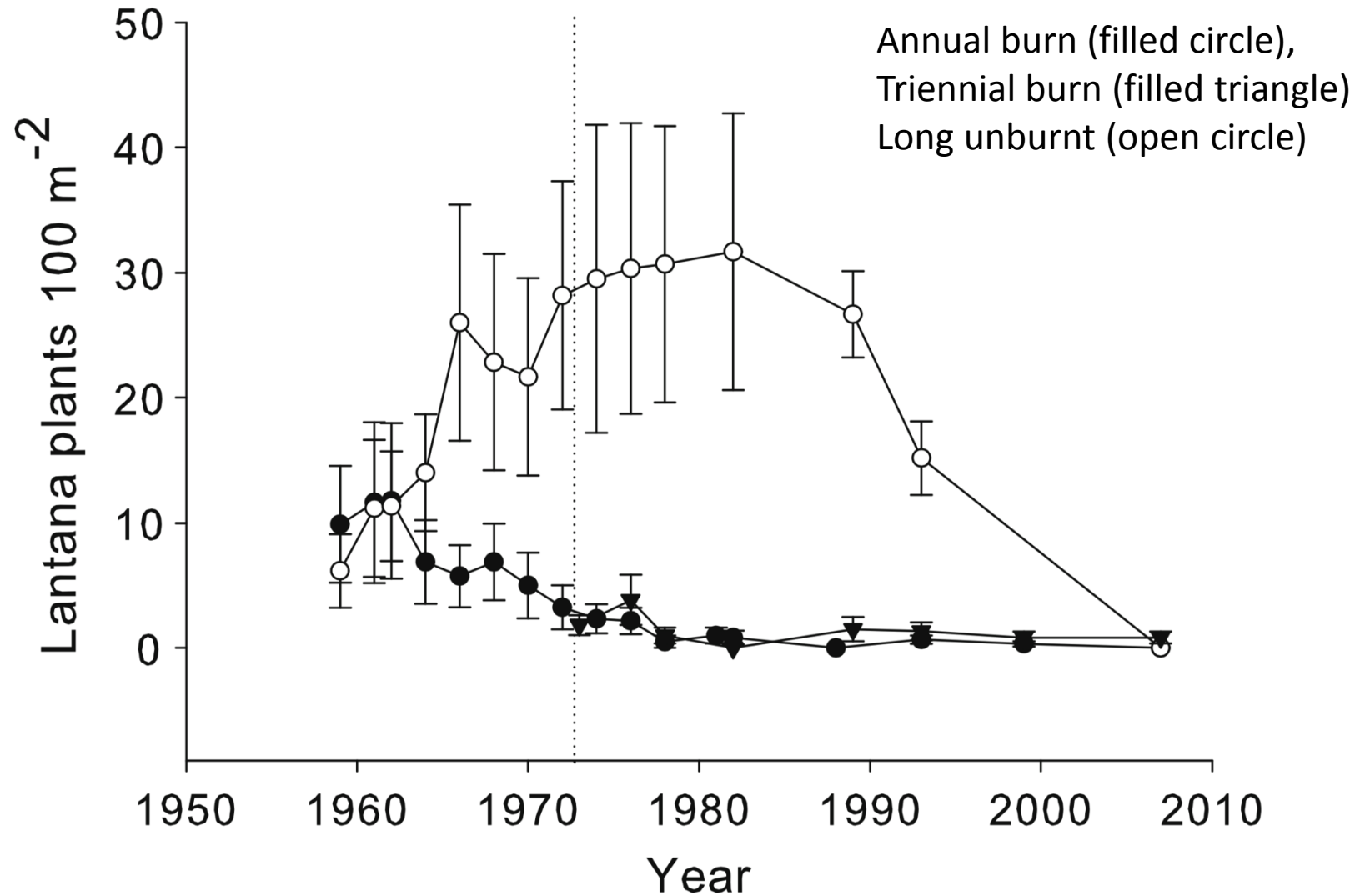
Fire

- One of the cheapest and most commonly used method for controlling *Lantana* in grazing areas (Love *et al.* 2009)
- Mature *Lantana* fire tolerant, re-growth from seeds and basal shoots is common (Hiremath and Sundaram 2005)

Fire-Negative Effects

- Stimulates the subterranean meristem which produces profuse shoot buds.
 - The growth rate of new shoots enhanced
- Leads to increase in Lantana seed germination
- Eliminates competition from native plant species
- Promotes invasion of Lantana or secondary invasion of other weeds if not managed properly

Long-term repeated burning reduces *Lantana camara* regeneration in Australian Dry Eucalypt Forest



(Debus & Lewis 2014)

Chemical Control

- **Glyphosate** -marginally effective as a foliar spray and regrowth is common.
- **Fluroxypyr+Aminopyralid** mix- when applied twice within 6 months is effective, but costly
- **Fluroxypyr** applied as a basal application is consistently effective
- **Glyphosate+Metsulfuron methyl** mix

Chemical Control

- Foliar spraying
 - only effective when plants are actively growing
 - not cost effective for extensive infestations
 - best as follow up after fire or mechanical control
- Hose and handgun/ knapsack sprayers
 - for thickets up to 2m high
- Cut stump application
 - poisoning of the root system
- Basal Bark application
 - for bushes of <5cm basal dia.
- Aerial spraying
 - from helicopter for harder to reach areas
 - will require follow up control treatments

Chemical Control

- For dense infestations (50% density +) over more than 2 ha, it is best to remove the biomass first before spraying with herbicides.
- This will reduce the amount of herbicide required (and therefore cost) as well as the volume of chemical introduced to the local environment.

Chemical Control Limitations

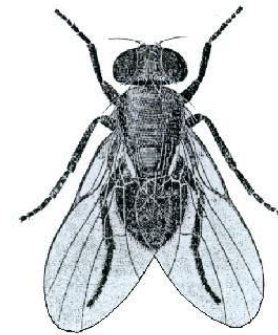
- Impractical to cover vast tracts infested with Lantana
- Cost-ineffective
- Potential hazard to the native biota and environment
- Water pollution

Biological Control

- Most cost-effective, sustainable, and safe
- Biocontrol Agents
 - Limited foraging ability
 - variety-specific behaviour
 - Performance affected by climate
 - May also affect native species

Biological Control

- Availability of effective agents limited on an operational scale till date due to high genetic diversity of the *L. camara* complex
- If present and effective, can only reduce vigour and competitiveness of lantana
 - Effect is seasonal
 - Partial kill, requires integration with other control methods
- Needs follow-up action:
 - Mechanical removal
 - Manual removal
 - Low-volume herbicide
 - Fire, if fuel is adequate



Ophiomyia lantanae

Biological Control

Australian Experience Since 1914

- Introduced: 31
 - Insects : 30
 - Rust: 1 (*Prospodium tuberculatum*)
- Established: 17
- Effective: 4
 - Leaf-mining beetles (*Uroplata girardi*, *Octotoma scabripennis*)
 - Leaf sap sucking bug (*Teleonemia scrupulosa*)
 - Lantana seed fly (*Ophiomyia lantanae*)
 - reducing the vigour and competitiveness of lantana in certain areas



Aceria lantanae -flower-galling mite



- Most recent attempt (South Africa, 2007–2012)
- More than 90% decline in Inflorescence and seed production (Mukwevho et al. 2017)



Control through Utilisation

- Wide spectrum of reported chemicals useful as:
 - Antimicrobial
 - Insecticidal
 - Insect repellent
 - Herbicidal
 - Antioxidant
- Natural dye
- Herbal medicine
- Polymer composite board
- Pulp
- Fuel stock/Charcoal
- Vermicompost/Mulch
- Biochar
- Craft & Furniture
- Thatching & fencing material
-



Control through Utilisation

A case study from MM Hills Reserve Forest, India

- Lantana as a resource as a substitute for scarce bamboo and rattans (Kannan et al., 2009, 2014, 2016)
- Communities earn more than 60 % of their cash income from using Lantana (Kannan et al., 2009; Shaanker et al., 2010)
- Promoted by HESCO (Dehradun) and ATREE (Bangalore)
- Can be viewed as one strategy towards managing the species (Kannan, et al. 2016)

Control through Utilisation

Advantages



- Inexpensive
- Can be sustained over years
- Involves the local communities
- Empowers and enhances the livelihoods of local communities



(Kannan, et al. 2016)

Cut Root-Stock (CRS) Method

A success story from India

Babu, S. *et al.* (2009); Love *et al.* (2009)

FIELD MANUAL FOR CUT ROOT-STOCK METHOD OF *Lantana Camara* MANAGEMENT

(version 2 dated 12.10.2015)

This Field Manual has been prepared by Junglescapes Charitable Trust for the use of the Forest Department staff of Bandipur Tiger Reserve. The manual is based on questions frequently raised during training sessions held by CEMDE, Delhi and Junglescapes at Bandipur Tiger Reserve on 15, 16 and 17 April 2014.



Junglescapes
Towards Sustainable Wildlife Protection



CRS Approach

- Inside –out operation
 - From maximum to minimum density of Lantana
 - First on slopes, top to bottom, valley
- Best season for eradication
 - Plains-Winter
 - minimal flowers
 - no or a few mature fruits
 - Hills-after the first summer rain showers
 - soil softer and easier to cut the root–stock

The Basis

- The transition zone between stem base and rootstock that lies 2–3 inches below the soil is the reproductive part of the Lantana plant
- Cutting the root exactly below the transition zone eliminates the reproductive ability of the plant
- Lantana does not come up from the horizontal roots, so it is safe to cut these roots while uprooting the plant

Cut Root-Stock (CRS) Method



- The involves making a small cut below the soil level, with minimum disturbance of the soil.
- The scar left at the point of removal is 9 - 12 inches in diameter. Therefore there is very little disturbance of dormant Lantana seeds lying in the soil.

CRS Steps

- Chop the main tap root just 3 – 5 cm below the ground surface by standing close to the clump, with a few hits using a narrow tongued implement with a long handle.
- Lift the clump and place it upside down for drying
- Burn the dried clumps of Lantana.
- Uproot seedlings of Lantana if any, by hand, after removing the clump.
- Locate perching trees and remove the saplings under the canopy of perching trees and along the surface run off originating from the perching trees.



Extent of CRS Success

- In India, more than 8000 hectares of Lantana invaded areas have been restored into healthy grassland habitats in the last 8–10 years.
 - Corbett NP
 - Rajaji NP
 - Mudumalai Tiger Reserve
 - Bandipur Tiger Reserve

CRS Advantages

- Minimal soil disturbance
- Easy disposal of Lantana
- Easy workability during winters when the bush is almost leafless and 'cutting point' is easily locatable
- If correctly done 85% lantana is removed in first cut
- Cost effective-Involves 50–60% less manual effort compared to cutting or slashing
- The average time needed for clearing one acre is 60 man days which amounts to earnings for the local community members of Rs. 12,000
- Natural recovery of the cleared areas by native species

Operation Cost

7.5 SCHEDULE OF RATES FOR HABITAT IMPROVEMENT/ PASTURE LAND DEVELOPMENT

S. No.	Item of Work	Units	Zone A		Zone B		Zone C	
			Mandays	Rates (Rs.)	Mandays	Rates (Rs.)	Mandays	Rates (Rs.)
A.	<i>Lantana</i> eradication							
1.	Areas covered by <i>Lantana</i> up to 50%							
a)	1st year	ha	41.10	3000	41.10	3000	-	-
b)	2nd year	ha	8.22	600	8.22	600	-	-
c)	3rd year	ha	4.11	300	4.11	300	-	-
d)	4th year	ha	2.05	150	2.05	150	-	-
e)	5th year	ha	2.05	150	2.05	150	-	-
2.	Areas covered more than 50% by <i>Lantana</i>							
a)	1st year	ha	68.49	5000	68.49	5000	-	-
b)	2nd year	ha	13.70	1000	13.70	1000	-	-
c)	3rd year	ha	6.85	500	6.85	500	-	-
d)	4th year	ha	3.42	250	3.42	250	-	-
e)	5th year	ha	3.42	250	3.42	250	-	-
B.	Cutting, collecting in heaps and burning of bushes							
1.	<i>Lantana</i> infected areas	ha	11.64	850	8.22	600	-	-
2.	Other areas	ha	5.32	388	2.40	175	2.74	200
C.	Digging of grass for planting and cartage to the planting site	100 bunch	0.34	25	0.34	25	0.34	25
D.	Planting of grass	100 bunch	0.22	16	0.27	20	0.27	20
E.	Watcher (area per month, Rs. 800/- minimum)	Month	10.96	800 (5ha)	10.96	800 (3 ha)	10.96	800 (3 ha)

Forest Works Manual, Uttarakhand, MNREGA, Ministry of Rural Development, Govt. of India (2008)

FORESTS DEPARTMENT

NOTIFICATION

Shimla-171002, the 20th April, 2017

No. FFE-B-F (5)-6/2009.—The Governor of Himachal Pradesh is pleased to notify the Policy for Managing Lantana (*Lantana camara*) in Himachal Pradesh enclosed as **Annexure-X** (8-pages) approved by the State Cabinet *vide* Memorandum under Item No. 11 on dated 10-04-2017.

By order,
(TARUN KAPOOR),
Additional Chief Secretary (Forests).

Annexure-X

Policy Document

for

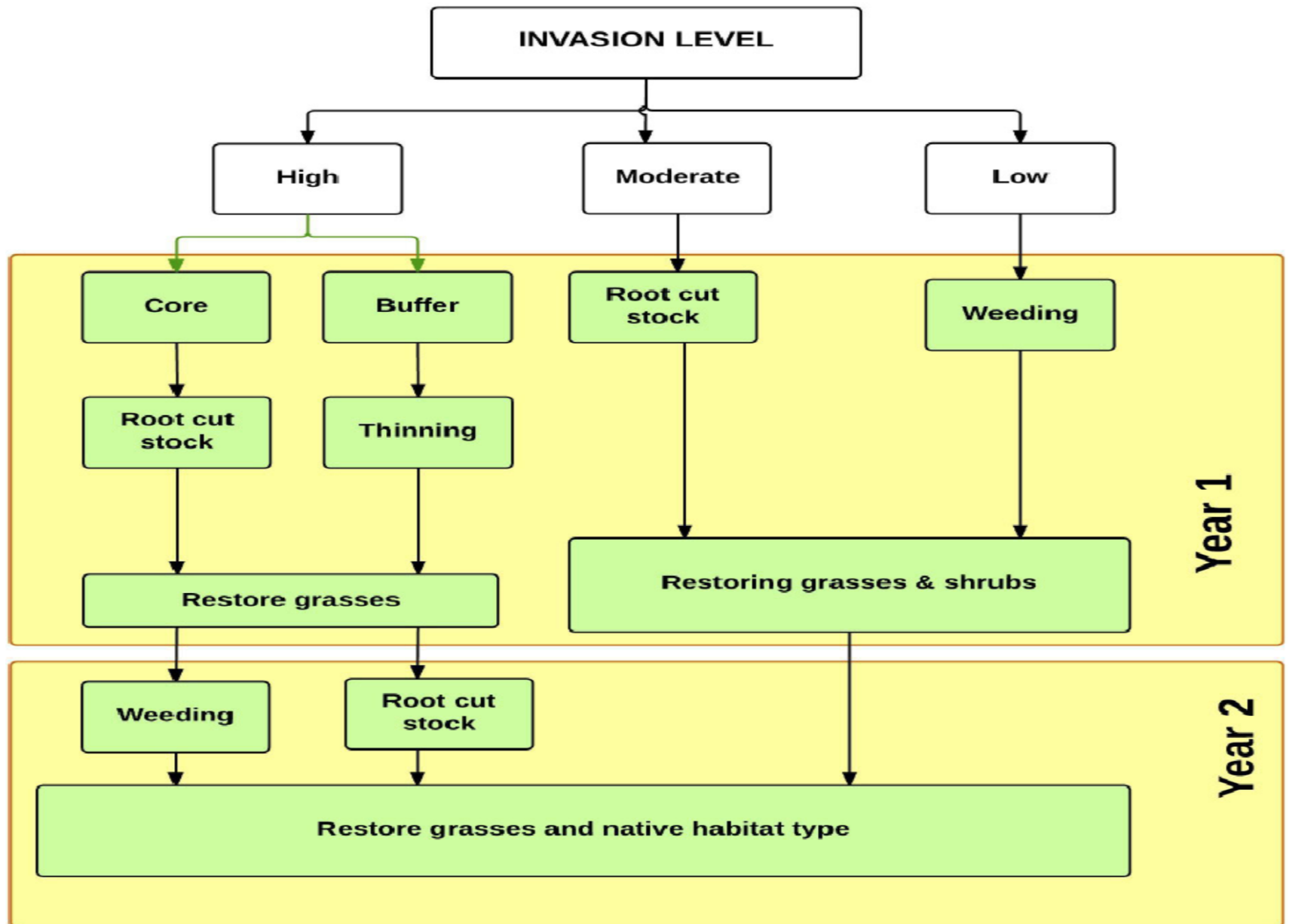
Managing Lantana (*Lantana camara*) in

Himachal Pradesh

**HIMACHAL PRADESH FOREST DEPARTMENT
GOVERNMENT OF HIMACHAL PRADESH**

1. Background

Lantana camara (hereafter Lantana) is a pan-tropical weed. It occurs in diverse habitats and on a variety of soil types. It is a low erect vigorous shrub with stout recurved prickles and grows to



Integrated Approach is Essential

- Integrated Lantana control combines two or more methods
- Targeting vulnerable aspects of the weed and different points in its life cycle or its environment in order to achieve more effective control.
- In most situations, Lantana can only be controlled successfully through integrated control together with sustained follow-up and revegetation.

Integrated Approach is Essential

- Mechanical control needs to be followed up by herbicide control of seedlings and replacing the lantana with pasture or other vegetation cover.
- Foliar spray herbicides with **Fluroxypyr** as major active ingredient provide a good kill for lantana stressed by biological control agents.

Management Strategy

- Developing best practice policy guidelines based on integrated approach
- Prioritizing critical habitats that require management of invasive species
- Long-term monitoring and management scaled to timeframes of ecological processes
- Phased enlargement of managed sites
- Isolation of high-priority habitats from dispersal originating from surrounding lantana source populations

(Based on Ramaswami, *et al.* 2014)

Thank You



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