

Government of Tamil Nadu State Planning Commission



Tamil Nadu State Land Use Research Board

REPORT

2023 - 2024

The Effective Management of Prosopis juliflora in the Southern Districts of Tamil Nadu

Effective Management of *Prosopis juliflora* in Southern Districts of Tamil Nadu



Tamil Nadu State Land Use Research Board, State Planning Commission

MARCH 2024

Published by

Tamil Nadu State Land Use Research Board, State Planning Commission

March 2024

Contributors

Tmt. Sudha S IFS, Member Secretary, State Planning Commission

Prof. Narasimman (Retd), Madras Christian College

Tamil Nadu Agricultural University & Research Institute, Madurai

Thiru. S. Govindaraju, Planning Officer, Land Use Division, SPC

Tmt. Durgadevi J, Technical Assistant

Tmt. Radha.R, Technical Assistant

Tmt. Vasumathi, Planning Assistant

Tmt. Benita Tresa, Research Associate

Selvi.Nishalini V, Research Associate

Reviewed by

Prof. M. Vijayabaskar, Additional Full Time Member, SPC

Prof. Sultan Ahmed Ismail, Member, SPC

Thiru. Deenabandhu IAS (Retd), Member, SPC







STATE PLANNING COMMISSION, "EZHILAGAM" CHEPAUKKAM, CHENNAI-600 005.

Foreword

Endowed with a rich biological diversity, Tamil Nadu is home to numerous species of endemic flora and fauna. Introduction of exotic species poses an impending threat to the native and indigenous flora of our geographical region. Eucalyptus, Prosopis, and Acacias are some of the popular non-native trees, distributed widely to meet human requirements, while continuing to spread extensively into the native habitats. Over time, some of these species have established themselves extensively, displacing local species and thereby affecting the distribution and abundance of native vegetation.

Prosopis invasion has several negative impacts on social, ecological, and economic systems, altering the ecosystem services such as water supply, hydrological functioning, herbivore grazing potential, and soil quality.

With invasive plants spreading widely in both public and private lands across the state, the use of land for other productive purposes continues to be limited for the future generations. This also leads to destruction of various ecological heritage of wetlands, forests, lakes, and rivers. Delaying action to mitigate this growth will result in higher costs for their control in the near future.

In this context, the Tamil Nadu State Planning Commission has come out with strategies for effective management of Prosopis in southern districts of Tamil Nadu. The objective of the exercise was to explore the effective management strategies for Invasive Alien Species by optimizing the use of Prosopis, providing livelihood opportunities, achieving sustainability, protecting biodiversity and framing policies. A workshop was conducted on this theme which discussed at length, the positive and negative implications of Prosopis juliflora on the environment, health, livelihood, ecosystem services, and socio-economic development.

This report compiles the recommendations provided by experts and stakeholders for the sustainable management of Prosopis juliflora in Tamil Nadu. In addition, the report also brings out certain case studies from our state where local solutions has yielded positive results in effectively managing this species.

Vice Chairman, State Planning Commission

Acknowledgement

Our sincere gratitude to Dr.J.Jeyaranjan, Vice-chairman, Prof.M. Vijayabaskar, Additional Full Time Member and Prof.Sultan Ahmed Ismail, Member, State Planning Commission for the support and guidance.

We are thankful to the Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai for coordinating to conduct the workshop and stakeholders for their support. Also we thank Thiru. K. Deenabandu, IAS (Retd.) Member, State Planning Commission for reviewing the report. We also thank the Tamilnadu Forest Department for giving valuable insights for the report.

Prosopis has invaded most parts of India, currently occupying 40% of the country's geographical area. Dense, bushy, thorny, impenetrable thickets have become a common sight in pastures, rangelands, agricultural lands, irrigation channels, water bodies, wastelands, government, and private lands. Prosopis juliflora is believed to be one of the worst invaders affecting natural and man-made ecosystems and local biodiversity in Tamil Nadu. Therefore, complete eradication of P. juliflora is deemed necessary across the state.

With this perspective, the State Planning Commission organized a workshop in March 2023, inviting various stakeholders, subject experts, and related institutions to discuss the possible management of Prosopis juliflora and gain insight into best practices adopted in other states. The thematic areas of the workshop included

- Prosopis juliflora: Current status and its implications
- Ecological impact of *Prosopis juliflora*
- Livelihood opportunity associated with Prosopis juliflora
- Demand and supply of *Prosopis juliflora* to industries
- Civic societies' perspectives on Prosopis juliflora
- Way forward Effective management of *Prosopis juliflora* in TamilNadu

The report on Prosopis juliflora serves as a comprehensive and specialized resource, focusing on all aspects of this significant member of the Prosopis genus. The report aims to consolidate and present in-depth knowledge, research findings, and practical experiences related to its positive and negative impacts, the need for eradication, measures currently taken by the State, details of the discussions held during the workshop, and the way forward based on the outcomes of the workshop. Its objective is to enhance understanding, promote sustainable management, and facilitate evidence-based decision-making concerning this plant species and its impact on ecosystems, societies, and economies.

Contents

Chapter No.	Chapter title	Page
1.	Introduction	1
2.	Invasive Alien Plant Species (IAPS)	2
2.1	Transformations of plants to invasive species	3
2.2	Habitations of invasive plants	3
2.3	How can invasive plants thrive in alien environments?	4
2.4	Projected impacts of invasive plants	4
3.	Introduction of <i>Prosopis</i> Juliflora	5
3.1	Features	6
3.2	Stems and leaves	6
3.3	Flowers	7
3.4	Pods and seeds	7
4.	Distribution of <i>Prosopis Juliflora -</i> Scenario in India and Tamil Nadu.	8
5.	Impacts of Prosopis Juliflora	10
5.1	Nutrient dynamics and allelopathic effects of <i>Prosopis</i> juliflora	10
5.2	Negative Impacts of <i>Prosopis</i>	11
5.3	Ecology of <i>Prosopis</i> Juliflora	12
6.	Utilization of Prosopis Juliflora	13
6.1	Wood as direct fuel	14
6.2	Wood as charcoal	14
6.3	Wood as timber	14
6.4	Prosopis sawmills	15
6.5	Pods as animal feed	15
6.6	Pods as human food	16

6.7	Medicinal Uses	16
6.8	Indirect uses	16
7.	Existing Policy Framework	17
7.1	Tamil Nadu Policy on Invasive Plants and Ecological Restoration (TN PIPER)	17
7.2	Objectives	17
7.3	Invasive Removal and Restoration Planning (IRRP)	18
7.4	Nodal Agency	18
8.	Recommendations	19
8.1	Differential and effective management of <i>Prosopis</i>	19
8.2	Restoration of <i>Prosopis</i> infested lands	21
8.3	Value addition to restrict spread of <i>Prosopis</i> and to promote wealth out of waste	21
8.4	Promoting entrepreneurship for effective management of Prosopis	22
8.5	Research areas to be focused:	22
8.6	Policy Decisions	23
	ANNEXURE	24
	Summary of the Workshop	25
	CASE STUDIES	46

Effective Management of Prosopis *juliflora* in Southern Districts of Tamil Nadu

1. Introduction

Prosopis juliflora, commonly known as mesquite (Seemaikaruvelam in Tamil), is a leguminous tree highly resistant to drought and salinity. It grows at altitudes ranging from sea level to 1500 meters ASL and is recognized as one of the world's 100 most dominant invasive species (IUCN, 2004). In Rajasthan, it was declared a 'Royal plant' and is also referred to as 'wooden anthracite' due to its multi-purpose uses as excellent fuelwood.

Prosopis plays a vital role in mitigating desertification caused by salinity. In dry lands, it improves soil fertility, controls soil erosion, and stabilizes sand dunes (Dave and Bhandari, 2013; Patnaik et al., 2017). It also aids in bioremediation by accumulating various metals and non-metals such as Fe, Mn, Cu, Zn, Cr, Ni, Cd and grows well on gypsum mine soil, coal mine overburden, and fly ash landfills (Pandey et al., 2015).

Historically, Prosopis pods have been a source of food for both humans and livestock, earning it the title of an 'unfailing crop.' Value-added products like instant juli coffee, juli syrup, cussar powder, doughnuts, biscuits, and ladoos have been standardized (NAIP report, 2014). Medicinal properties such as anticarcinogenic effects (Tiwari et al., 2013), anti-Alzheimer properties of the alkaloid juliflorine (Choudhary et al., 2005), and antioxidant potential (Sirma et al., 2011) have been reported. For livestock, technologies like pod-based concentrate mixture, multi-nutrient feed block, and complete feed block processes have been developed. Green energy has also been harnessed from Prosopis wood, contributing to sustainable practices.

A public-private participatory model developed by the Central Arid Zone Research Institute, Jodhpur, Rajasthan, generates electricity and offers a scope for Prosopis management while providing livelihood opportunities. Prosopis has significantly benefited farmers and resourcepoor laborers by offering various livelihood support options, including food, fuel, fodder, and employment.

On the flip side, Prosopis is a phreatophyte, a deep-rooted plant that absorbs water from the phreatic zone below the water table, exacerbating hydrological drought and leading to the demise of other species. Its allelopathic nature inhibits the germination of seeds from many plant species and reduces native plant diversity, posing a serious threat to phytodiversity. Furthermore, Prosopis presents a significant risk to the survival of wetland birds. In Tamil Nadu, several seasonal wetlands that once hosted native Acacia species have been replaced by Prosopis (Rawat et al., 2018). Prosopis has colonized five out of twelve bird sanctuaries in Tamil Nadu, and the remaining sanctuaries are also at risk of Prosopis invasion, which could have serious consequences (Chandrasekaran et al., 2014).

In South Asia, India and Pakistan are two countries where farmers, ecologists, forest managers, NGOs, and policy planners have been alarmed by the invasion of P. juliflora in vast areas of land over the last four to five decades. They have exerted pressure on the government, which, in turn, has instructed related state departments to stop planting the species and has even initiated eradication programs (Tewari and Harsh, 2009).

Growing public concern over Prosopis can be observed in the increasing number of public interest writ petitions filed in the Madras High Court. Judicial interventions in the removal of Prosopis highlight the significant damage it poses to ecology and biodiversity. However, the livelihood opportunities it provides to resource-poor people cannot be overlooked. The discussions on whether Prosopis is a boon or a bane, a weed or a wonder crop are ongoing. In the meantime, to draw conclusions, provide livelihood opportunities, achieve sustainability, protect biodiversity, and frame policies, a workshop comprising brainstorming sessions and panel discussions was organized by the State Planning Commission.

2. Invasive Alien Plant Species (IAPS)

Invasive alien species are now globally recognized as causing serious economic and environmental damage, affecting ecosystem and human health, and threatening the conservation of biological diversity. Invasive species are considered one of the most significant threats to the conservation of biodiversity due to their impact on native species in ecosystems around the world.

IAPS tend to reduce global agricultural productivity by acting as weeds, thereby hampering forest diversity. Interestingly, the Sustainable Development Goals (SDGs), which address sustainable agriculture, water sanitation, food safety/security, poverty, human well-being/health, etc., are adversely affected by the concerted impact of current environmental disturbances linked with invasion biology.

Table 1: Estimated Area under some major invasive alien plant species in
Tamil Nadu (TN Forest Department estimate)
(Source : TNPIPER Policy)

S.No	Species	Area in ha.
1	Acacia wattles	22,400
2	Chromolaena odorata	11,532
3	Eucalyptus	6,780
4	Lantana camara	1,85,000
5	Parthenium hysterophorus	12,150
6	Prosopis juliflora	56,000
7	Senna spectabilis	2,400
8	Opuntia sp.	2,300
9	Pinus sp.	2,700
	Total	2,68,100

2.1 Transformations of plants to invasive species

Plants that do not occur naturally in a region but proliferate in the area they have been introduced into, and cause several negative impacts (such as affecting native biodiversity, causing economic losses, and harming human health) in these new habitats, are called invasive plants.

However, not all introduced plants are invasive; many alien plants cannot establish in new environments, and some that do establish are not harmful, unlike invasives.

2.2 Habitations of invasive plants

In many cases, aliens or exotics that were deliberately introduced for ornamental, floricultural or agricultural uses have turned invasive. The tropical American shrub lantana (*Lantana camara*) for instance was introduced in India in the early 19th century as an ornamental plant; it now invades diverse terrestrial habitats including scrublands and forests.

Invasive plants now occur on every continent on Earth, including the remote and hostile ecosystems of Antarctica.

Characteristics of Invasive Alien Species:

- Non-indigenous
- Originating from a similar climate
- Abundant in natural range, history of invasiveness outside that range
- No natural enemies
- Adaptability and wide distribution in different habitats
- Invasive, competitive, sometimes allelopathic or parasitic
- Rapid reproduction, seed dormancy
- Fast growth and early maturity
- High and efficient dispersal ability

2.3 How can invasive plants thrive in alien environments?

Invasive species display several traits that give them an edge over native flora. They tend to grow faster (r & k ecological strategy). They have shorter life cycles, invest heavily in reproduction, produce more seeds, display better dispersal, and even germinate faster.

Similar climates or environmental conditions between the native and invaded habitats of invasives could put some areas at higher risk of invasions. This could be the reason why almost half of India's geographical area could be at risk of being occupied by invasives. Areas with fewer species also tend to be more vulnerable to invasion.

Many invasives show 'phenotypic plasticity': the ability to adapt to new physical conditions in the habitats that they have invaded. Often, human-caused disturbances – including roads and livestock grazing – in its new environment also aid the establishment and spread of alien invasives.

2.4 Projected impacts of invasive plants

Once established, invasives can outcompete native flora in several ways. They can occupy the habitats of native plants, successfully crowding these original inhabitants out. Some can suppress the growth of native tree seedlings with their allelopathic properties (production of bio-chemicals to prevent germination and growth of other species in the soil nearby) and by disrupting underground mutualisms with fungi. Certain invasives also increase the risk of wild fires and soil erosion. Some invasives affect animal assemblages. A study in southern Karnataka's reserve forests shows that areas with high Lantana densities showed decreased bird species diversity, species richness, and abundance. Others invasives, such as Parthenium in India, are toxic to livestock. The weed also affects human health by exacerbating breathing and skin diseases. Invasives also cause huge economic losses by invading agricultural and pastoral lands.

3. Introduction of Prosopis juliflora

The history of the first introduction of *Prosopis juliflora* into India is about 130 years old. Introduction of the species was first seriously attempted in 1870. Owing to its fast growth and drought hardiness, the species has since been introduced in many other parts of India from the north-west to extreme southern parts. The species proved its potential as a versatile plantation forestry species from the very first introduction and has been grown in highly saline areas, alkaline soils, coastal areas, sand dunes of the Thar desert, in ravines of many north, central and south Indian rivers, and in dry and degraded grasslands.

P. juliflora has become an acclimatised exotic in large parts of arid and semi-arid tropical India. It is found especially in areas with 150-750 mm mean annual rainfall and maximum shade temperatures of 40-45°C. From north-west to south, the species is distributed from the States of Punjab to Tamil Nadu, and in an east- west direction, it is found from Kutchh region of Gujarat State to drier parts of Orissa. The States where it mainly occurs are: Andhra Pradesh, Telangana, Delhi, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh. The domain of the species in arid and semi-arid tropical regions is mostly in plains and valleys but in many places it grows at altitudes of up to 1200 m above mean sea level.



Figure 2

P. juliflora can grow in a wide variety of soils and situations. It is, however, generally not found in frost prone areas, the Himalayan region or in warm humid tracts such as the north eastern region, West Bengal and Kerala. However, in Kerala, and in Bihar and Orissa, farmers use the species as a live fence around fields and farms.

3.1 Features

In areas where it is widespread, P. juliflora commonly takes the form of a spreading shrub. This is because people cut the plant for fuel wood as soon as it reaches 1-1.5 m high and new coppice shoots emerge in the subsequent growing season. However, the tree form is also common.



Figure 3

The species seeds prolifically and has tremendous regeneration capacity, and can withstand droughts even at seedling stage. Where most other species fail to withstand drought and environmental harshness, P. juliflora can successfully establish and colonise wastelands and other similar habitats.

3.2 Stems and leaves

In India, the shrubby thicket form with spreading branches is common. The stem height of these shrubs varies but generally ranges between 1 and 3 m. The tree form varies from 4-12 m or sometimes even more (especially in valleys, areas with more moisture and in well protected areas). The clear bole length of tree forms ranges from 1-3.5 m. The tree bark is 2-3 cm thick, grey or dark purple with a blackish tinge, splitting off in long strips. Branches have thorns which are usually paired, straight and up to 5cm long. The branchlets are zig-zag, cylindrical, green, and spiny with persistent, green foliage. These are typical features of shrubby thicket forms. The dark purple wood is very hard.



Figure 4

Leaves cluster on short shoots along the branches. They are bipinnate, with 13-25 pairs of obliquely oblong, dark green leaflets per pinna. The leaflets are generally 5-24 mm long, 1.5-5.2mm wide and spaced along the rachis usually at a greater distance apart than their width.

3.3 Flowers

Inflorescence is an axillary spike, 8-10 cm long and bearing greenish- white flowers that turn light yellow when mature. Plants start flowering at three or four years of age. The calyx is five-toothed, campamelate, one mm long. The corolla is pentamerous free, tomentose, on the inner surface towards apex. There are five stamens which are 3-6 mm long. The plant flowers three times a year, in August-September, November-December and February-March.



Figure 5

Trees usually start flowering earlier in the south than in the north. The fruits or pods from August-September flowering mature by early November and those from November-December flowering ripen by late February to early March. The pods from February-March flowering mature by early May. Thus, the plant appears to be flowering almost any time of the year except from hot summer (May) to mid rainy season (August).

3.4 Pods and seeds

The pods are usually flattened and straight, but incurved at the apex. Some pods may be sickle shaped. In general, pods are 6-30 cm long, 5-16 mm wide and 4-9 mm thick. With age, the pods swell and become pulpy and yellowish brown in colour.

The prominent outline of seeds in immature green pods is no longer discernible in mature pods. The endocarp may have up to 29 rounded, rectangular segments, each carrying a seed. The seeds are hard, flattened, 7 x 4 mm in size and ovoid, and have shiny yellowish-brown colour.



Figure 6

4. Distribution of *Prosopis juliflora -* Scenario in India and Tamil Nadu

In India, *Prosopis* juliflora is one among the woody plants introduced for fuel wood, fodder, shade, livestock hedges, stabilizing sand dunes and soil reclamation (Sawal *et al.* 2014). *Prosopis juliflora* is considered one of the poor man's fuel woods, because of its fast-growing nature, fuel wood capable of growing in wide range of soils (Basavaraja *et al.* 2007). It is Phreatophyte (A Phreatophyte is a deep-rooted plant that obtains a significant portion of the water that it needs from the Phreatic zone), evergreen fast growing, drought resistant widely distributed not only in India, but also in other arid and semi-arid tropical countries and sub-tropical regions of the world. *Prosopis* is a thorny, deciduous, large crowned and deep-rooted bush or tree which grows up to 10 m height or more, depending on the variety and climatic conditions. *P. juliflora* has survived where other tree species have failed and, in many cases, become a major nuisance. *P.juliflora* continues to invade millions of hectares of rangeland in South Africa, East Africa, Australia, and coastal Asia (Pasiecznik *et. al.* 2001). In 2004 it was rated one of the world's top 100 least wanted species (IUCN, 2004).

Prosopis juliflora was introduced into India (then Andra Pradesh) from Tropical America during 1877. Since then, *Prosopis* has invaded most of the parts of India and currently it occupies 40% of the geographical area of India. Dense bushy thorny impenetrable thickets have become a common scenario in pastures, rangelands, agricultural lands, irrigation channels, water bodies, waste lands, government, and private lands. Invasive nature of *Prosopis* is due to its biological attributes *viz.*, rapid reproduction, fast growth, ecological adaptability, viable soil seed bank, high dispersal ability and production of allelochemicals. *Prosopis,* well known for its phenotypic and genotypic adaptation, grows in varied types of soil, diverse climatic conditions, altitudes from sea level to 1500 m ASL and pH range of 312 and is highly resistant to drought and salinity.

In Tamil Nadu, *Prosopis juliflora* was introduced in 1959, to overcome the fuel shortage (Sakthivadivel, 2016) and it had other uses like shade, timber, forage, food, and medicine (Hunde and Thulin, 1989). As this plant species was introduced, *P. juliflora* was called as *Seemai Karuvalum* in Tamil where "Seemai" means "foreign land" in Tamil. Naturally regenerated *P.juliflora* has caused severe threats to the fertile landscape and agricultural lands and watersheds (Kathiresan, 2006), and it is predominately distributed in the entire southern dry districts of Tamil Nadu and it gradually started invading cultivable fertile lands and irrigation tanks in early 1960's. During continuous drought period in the southern districts of Tamil Nadu, *P.juliflora* invasion became very severe and established strongly. The *P.juliflora* wood has high calorific value of 4200-4800 kcal kg-1 (Wright, 2010). It is described as wooden anthracite due to its slow and even burning capacity without smoke

(Duke, 1983). The local people use the wood for cooking even when it is fresh. In general, from one kg biomass of *P. julifora* 2.5 m³ gases could be generated which can provide 3000 kcal of thermal energy (Rao and Vasanthi, 1986).



Figure 7- Distribution of Prosopis juliflora in India

Presently, it has invaded most of the districts of Tamil Nadu. Spatial mapping of *P. juliflora* invasion using satellite images in twenty-five Districts of Tamil Nadu has been done by Institute of Forests Genetics and Tree Breeding, Coimbatore. About 6.82 Lakhs ha area (About 5% of Tamil Nadu) has been invaded by *P. juliflora* in these districts.



Figure 8 - Distribution of Prosopis juliflora in Tamil Nadu

A study reported high infestation of *Prosopis in* Southern districts *viz.*, Virudhunagar (56285 ha), Sivagangai (59700 ha), Thoothukudi (73403 ha) and Ramanathapuram (115434 ha). The major reasons for highest infestation of *Prosopis in* Ramanathapuram district include absentee landlordism, stray cattle population, abandoning agriculture, and poorly managed waterbodies.

5. Impacts of Prosopis juliflora

5.1 Nutrient dynamics and allelopathic effects of Prosopis juliflora

Nutrient dynamic studies are essential to understand the ecological status and functioning of an invade ecosystems of *Prosopis juliflora*. Nutrient cycling or turnover is mainly regulated by arboreal vegetation in an ecosystem. Invasive tree species bring series of changes in ecological and soil physico-chemical characters in invaded region. The nature of changes brought by them depends on their type, rooting pattern, and quantity of litter fall. The studies conducted by Nair (1987) in different parts of the world showed that the effect of trees on soil properties varies from region to region and the magnitudes of beneficial and adverse effects mediated by them depend on site specific features.

5.2 Negative Impacts of Prosopis

Prosopis invasion has several negative impacts on social, ecological, and economic aspects (Shackleton *et al.* 2014). It alters the ecosystem services, including water supply, hydrological functioning, herbivores gazing potential and soil quality. In Africa, *Prosopis invasion* is a leading cause of unfavourable impacts on local community structure and functioning and increases their vulnerability. It includes potential loss of land rights for local livestock herders, and conflict over limited natural communities.

P. juliflora is most extensively distributed woody species in arid and semi-arid tropics in India, but its spread is being proclaimed as disaster in some quarters. Once the species find optimum soil and climatic condition for the growth and development, it rapidly increase in other parts of grasslands in very little time.

It would be appropriate to cite the advancement of *P. juliflora* in Kucch region of Gujarat. The state forest department of Gujarat initially planted P.*juliflora* on about 31,550 ha of Banni grasslands of Kucch to check the advancement of Rann (salt desert). The prevailing conditions in Banni, including successive droughts, increasing salinity and excessive grazing pressure, provided highly suitable environment for the growth and spread of the species. The ecological succession changed the structure of vegetation complex and entire area got dominated by P.juliflora in terms of distribution, abundance, basal cover, canopy cover, etc. It has been reported that area under P.juliflora increased 81% in 12 years. The encroachment of species in productive grassland was the result of failure of effective management system.

Characteristics of Prosopis juliflora

- They are very hardy, tolerating wide range of temperature, water, soil, and atmospheric humidity
- They grow vegetatively and/or through seeds, and it produces huge numbers of seeds with efficient dispersal mechanisms, high germination success in invaded regions.
- They have fast growing ability, dormant of seeds and attractive taste of pods for many live stocks, seed maintaining viability in the livestock and wild animals

droppings, it resistance to browsing and high ability of re-growth (Shiferaw et al. 2004).

- They are highly allelopathic in nature, and it produces certain alleleo chemicals to discourage the nearby plants, which grows around them.
- It used high water efficiency (Felker et al. 1983), contribute to its invasion. Based on this character and ecology, Prosopis juliflora has become the invasive species in India.

5.3 Ecology of Prosopis juliflora

The ecology of *P*. juliflora was studied for more than 40 years (Chinnimani, 1992). It is a pioneer species with rapid colonizing tendency. It thrives well in regions with 50-1200 mm rainfall and temperature up to 48°C. It is adapted to grow in all types of soils including acid and alkaline soil with wide range of moisture conditions. It tolerates strongly in saline soils and seasonal water logging. It is highly drought resistant. It survives well even at places 1200 m above sea level and in places where other trees fail to grow, but cannot grow in frost prone areas. More than forty-four recognized species of the genus *Prosopis*, have been identified and listed by Burkhart (1976). All *Prosopis species* can survive in low annual rainfall and very lengthy dry periods (Pasiecznik *et al.* 2001). *Prosopis has* a lesser competition and greater security (from grazers/predators) than in its native habitats (Abbasi and Nipaney, 1986; Ganesh *et al.* 2005; Walter, 2011). P. juliflora pods have nutrient poor embryos with nutrient rich seed coats. It was suggested that leaching of nutrients from the seed coat aids seedling establishment by assisting rapid growth of the embryo following germination and the creation of a favourable micro environmental conditions (El-Sharkawi *et al.* 1997).

A study by (WII) Wildlife Institute of India (2018), 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, analysed the spread, ecological aspects, and socio-economic aspects of *P. juliflora* invasion in Tamil Nadu especially at three important agro-climate zones including the Sathyamangalam Tiger Reserve. It was found that wetlands in the arid region are highly susceptible to *Prosopis* invasion and these wetlands were once used by migratory birds in large numbers but not nowadays that might be due to high abundances of invasive species. Wild animals seemed to have played a major role in spreading the invasive species inside the forested landscape whereas in the Southern Zone and Cauvery Delta both the domestic and wild animals (largely birds) are responsible for spread of these invasive 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, it has livelihood values in the Southern Zone especially Ramanathpuram and adjoining districts of Tamil Nadu.

Therefore, 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.

Further, the study observed that the clearing invaded land and continuously using it for crop farming would reduce the invasion in the Southern and Cauvery Delta zones. The study also found that the available nitrogen, phosphorus and organic carbon in the soil were high in highly invaded areas compared to less or non-invaded sites especially in the Southern Zone. However, the basal cover of native herbaceous vegetation and native tree diversity were found to be much reduced under high *P. juliflora- L. camara* invaded areas. Results from 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.

Extensive efforts are required to control *P. juliflora and L. camara*, by chemical, biological, and mechanical means. There is no strategy to even control these weeds; let alone eradicate them and no strategy, has achieved any enduring success especially inside the Protected Areas and forested landscapes. At best *P. juliflora and L. camara* spread can be halted by actions such as clear cutting/up-rooting followed by burning of the stump of *P. juliflora* and keeping up-side down of stump of *L. camara*. Alternatively, ways can be found to utilize the existing stands of *P. juliflora* so that frequent harvesting can exert a check on its expansion. Minimum, 10 years weed management plan should be made mandatory of all Management Plans of all Protected Areas and other reserve forests of Tamil Nadu to successfully halt the expansion of these invasive species so that the native biodiversity is conserved.

6. Utilization of Prosopis juliflora

In India, *P. juliflora* is mainly known for its firewood value and as a weedy infestation. Although the pods are used extensively as a livestock feed and, in tropical arid and semi-arid regions, provide a substantial amount of the livestock ration, the species is not given the credit it deserves.

The potential utilization of *P. juliflora*, although some of the uses are not yet adopted in India are summarized below:

6.1 Wood as direct fuel

P. juliflora wood is an important source of domestic fuel for most rural households in tropical arid and semi-arid India. It is the most easily available wood resource in these regions. The wood burns evenly and does not spark or smoke excessively. The calorific value of wood is quite high (4200 kcal/kg).

The positive qualities of firewood are present even at the juvenilestage and this allows green branches to be burned for cooking food after sun drying for only a day or so.

P. juliflora wood is also used as an industrial fuel, especially in small scale industries. As the industrial processes require a large quantity of wood, stems of over 10 cm in diameter are often used.

Electricity from P. juliflora.

P. juliflora wood has been considered as a fuel for generation of electricity, either by direct burning or via gasification. The woody biomass is low in sulphur and, therefore, not as polluting as other sources such as coal. Much research and development efforts are still required in this direction. If a foolproof procedure is developed to convert P. juliflora biomass into electricity, the vast available resource of the species can be utilised profitably.

6.2 Wood as charcoal

Firewood is bulky and expensive to transport as it is a low value product. Conversion to charcoal reduces the weight and increase the energy and economic value of the product. Charcoal is consumed mostly in urban areas in restaurants, bakeries, small-scale iron works, and for parching and popping food grains like corn and rice for snacks.

Charcoal is often produced at a considerable distance from the point of consumption. In the southern districts of Tamil Nadu, charcoal manufacturing from *P. juliflora* forms an integral part of daily activity of a large part of the rural population. Revenue earned from charcoal manufacture plays a vital role in rural livelihoods of these areas. To produce 1 kg charcoal, approximately 6-9 kg P. juliflora wood is required, depending on the method used.

6.3 Wood as timber

In Tamil Nadu, use of *Prosopis* wood in furniture industries is very limited, because of nonavailability of straight bole trees and to some extent because of a lack of knowledge. In other countries, *Prosopis* species are widely used for making furniture because of their high-quality wood. The wood quality is comparable to shisham or Indianrose wood (*Dalbergia latifolia*) and Indian teak (Tectona grandis)

6.4 Prosopis sawmills

In Tamil Nadu, at the moment, large stands of well managed *P. juliflora* trees are not available (with very few exception). *Prosopis wood* has been assessed for use in making many products including gunstocks, drink barrels, musical instruments, and pencils, and is commonly used for making small craft items. In India, there isincreasing use of *P. juliflora* wood of the species as timber for manufacture of furniture, small craft items and agricultural implements.

6.5 Pods as animal feed

P. juliflora pods have long been fed to cattle, sheep, goats, camels and horses in India. Livestock consume ripe or unripe pods directly in most cases. In arid and semi-arid landscapes, it is common to find a herder with his/her animals around the trees during the fruiting season. Animals consume naturally fallen pods or pods made to fall by the herder, as soon as they touch the ground. More than 60% of pods are consumed raw by livestock.

Prosopis pod yields

No systematic information regarding pod production in India is available. An extensive survey was carried out by the scientists of CAZRI, Jodhpur, India during 1991-92, in parts of Gujarat, Rajasthan and Uttar Pradesh. Pod production from more than 50 trees was assessed. Average pod production was approximately 20 kg/tree witha range of 5-50 kg/tree. A report from Brazil indicated that in a well-managed plantation (spacing 10 x 10 m) of P. Juliflora, an average 6t pods/ha/year are produced with some trees producing as much as 170 kg of pods annually.

Some efforts have been made to use the pods as a processed livestock ration. The pods are broken into 4-5 cm long pieces and dried at 60^oC for 8 hours to reduce the moisture content below 7%. These pods are then ground in a disc-mill setting the gapbetween two discs at 3-4 mm to allow endocarp and seeds to passwithout breaking. Then they are sieved through a 1.2 mm sieve. In thisway, *P. juliflora* pod flour can be prepared for cattle feed. The pod flour isthen mixed with wheat straw, groundnut husk, cotton seed, rice husk, etc. But this has not been explored in Tamil Nadu.

The great value of *P. juliflora* as fodder lies in its pods. *P. juliflora* pods are very palatable and provide good nutritive value to cattle, sheep, goats, camels, and horses. The ripened pods, on average contain the following:

Table 2	

Moisture	12%
Protein	10%
digestible protein	8%
fat (ether extract)	2%
fiber	14%
total soluble carbohydrates	55%
calcium	0.20%
phosphorus	0.15%

6.6 Pods as human food

The pods of the native Indian *Prosopis species*, *P. cineraria*, are widely used as human food in the Thar desert region. The green and dried pods of P. cineraria, commonly known as sangri are cooked as a vegetable.

- Pod flour in confectionery
- Pods as coffee substitute
- Pods for preparation of Prosopis syrup

6.7 Medicinal Uses

P. juliflora has been shown to have several medicinal uses including the following *(source: Managing Prosopis juliflora: A Technical Manual)*

- *P. juliflora* syrup is given to children showing weightdeficiencies or retardation in motor development.
- *P. juliflora* syrup is considered to increase lactation in breast-feeding mothers.
- *P. juliflora* syrup is used in preparation of expectoration purpose.
- Coffee prepared from *P. juliflora* pods is considered goodfor digestive disturbances and skin lesions.

6.8 Indirect uses

- Honey and bees wax: *P. juliflora* is a major source of honey
- **Agroforestry applications:** Farmers prefer *P. juliflora* only on farm boundaries as wind break and/or living fence.
- Soil conservation and amelioration

• **Craft uses of** *Prosopis Juliflora*: *P. juliflora* can be utilised in many other ways than described above depending on the socio-economic, cultural, and agro-environmental situation in different parts of the country where it grows. For example, with the use of indigenous technical knowledge of rural folk, bushygrowth of the species can be utilised in basket making, which is remunerative. Slightly larger stems, having diameter of 10-12 cm, can be used in making small kitchen implements, commonly used in Indian households, and craft items.

7. Existing Policy Framework

7.1 Tamil Nadu Policy on Invasive Plants and Ecological Restoration (TN PIPER):

Exotic weeds, invasive plant species grow in large numbers in most of the forests of the State, affecting the natural forest environment and the richness of the forest habitat. This is the major challenge to forest management. This is a major threat to local biodiversity of forests. Knowing the importance, the Government made announcement on the floor of Legislative Assembly on 03.09.2021 to formulate a separate policy on the removal of alien weeds found in the forest of TN and for the eco restoration of degraded forest.

The policy was approved on 13.07.2022 and it addresses highly invasive, habitat degrading plant species in the forest areas of Tamil Nadu for removal and management. The principal focus is laid upon developing / elaborating strategies, methodologies, and protocols for management for the most problematic weeds in forest areas to start with, on a priority basis which needs immediate attention to restore the habitat health in the wildlife habitat to support wildlife survival as well as to avoid straying out of wild animals. The policy has been drafted with the following objectives,

7.2 Objectives

- To develop a comprehensive policy framework for invasive alien plant species control and management in terrestrial and freshwater ecosystems along with ecological restoration of habitats in Tamil Nadu
- To identify and list invasive alien plant species of Tamil Nadu, demarcate, and assess the area infested, and prioritise problematic invasive alien plant species for appropriate removal or control measures
- To link invasive alien plant species management with appropriate methods and measures for ecological restoration of natural habitats to revive native ecosystems and species of Tamil Nadu

- To identify the best practices and Standard Operating Procedures for removal, disposal, and elimination of priority invasive alien plant species in Tamil Nadu
- To strengthen the management response and identify appropriate legal and institutional mechanisms

The management of invasive species encompasses the prevention, mitigation, containment, and restoration activities which needs meticulous planning of operational and administrative tasks. Better way of planning is to organize the tasks into an annual/ periodic work cycle which would serve as an easy record of reference for those responsible for implementation but may not be part of the planning process. The thumb rule shall be that invasive plant eradication activity at any infested site should be continuously monitored and invariably succeeded by ecological restoration at the site without any delay or time-gap to derive the desired result.

7.3 Invasive Removal and Restoration Planning (IRRP)

The systematic planning process herein is referred to as the Invasive Removal and Restoration Planning (IRRP). The IRRP will involve several stages:

A. Preparation of IRR Plan: Mapping of invasives, stratifying and selecting area, identification of benchmark sites or reference ecosystems to guide restoration, re-vegetation planning, local work study, demarcation of work area, preparation of plan of operation

B. Plan Approvals: Plan approvals to be sought and obtained as required for pro-rata, work area, benchmark sites, native plant nursery, and periodic plan of operations (PPO)

C. IRR Implementation: Implementation of invasives removal, survey of native vegetation in benchmark sites, native plant nursery establishment, ecological restoration after removal, setting up monitoring photo points, periodic plan, and calendar of operations

D. Continuous Monitoring Plan: Continuous long-term monitoring using photo-points, quadrat sample plots, perambulation survey, and assessment by evaluation committee, record keeping and mid-course-correction.

7.4 Nodal Agency:

he policy has recommended the Tamil Nadu State Biodiversity Board to function as the nodal agency in implementing and coordinating all matters related to this policy

Though Tamil Nadu has come up with a dedicated policy on invasive alien species and Ecorestoration, the policy must be converted in to action plan and implemented on war-footing basis. Having understood the gravity of the issue caused by the invasive species in the biodiversity rich forests of Tamil Nadu, the State Planning Commission decided to come up with immediate action points as recommendations to effectively manage the invasive plant species reported in Tamil Nadu.

8. Recommendations

After several detailed discussions with experts related to the Effective Management of invasive plant species in Tamil Nadu since October 2022 at the State Planning Commission, it was decided to organize consultative workshops exclusively for forest invasive species and Prosopis juliflora in southern districts by inviting experts, related departments and stakeholders. Accordingly, a two-day international workshop on the Management of Forest Invasive species in Tamil Nadu was organized in February 2023 in association with Forest College and Research Institute, Mettupalayam, and a one-day workshop on 'Effective Management of Prosopis juliflora in Southern Districts of Tamil Nadu' was organized in association with Tamil Nadu Agricultural University and Research Institute, as a State-level workshop in March 2023 at Madurai, with reputed organizations at the national and state levels, subject matter experts, other state forest departments, research organizations, civil society, industries, and other stakeholders.

Based on the insights gained from administrators, technical sessions, discussions with industrialists, environmentalists, scientists, farmers, and other beneficiaries, the State Planning Commission drew recommendations on these two topics. The following recommendations are exclusively made for the effective management of Prosopis in Tamil Nadu.

8.1 Differential and effective management of Prosopis

- i. Effective management of Prosopis juliflora must be undertaken in a phased manner to maintain ecological balance by categorizing areas as complete removal zones and restricted removal zones. A state-level strategy is required.
- ii. Complete removal zones must include forests, protected areas, water bodies, river banks, agricultural fields, and other government and private lands in identified areas. Prioritized areas for immediate phased removal within 3 years should include invaded sites of biodiversity importance, such as protected areas or habitats of threatened or endemic species (including buffer areas), and invaded sites of watershed importance, such as riverine tracts, stream sides, swamps, and water catchments important for wildlife or downstream communities. A local management plan at the district level should be developed for this purpose (reference may be made to the TNPIPER policy of the Tamil Nadu Forest Department).
- iii. Restricted removal zones include water bodies, river banks, other government lands, and private lands in identified dry districts where Prosopis is considered an important

means of livelihood. In these areas, Prosopis can be removed in a phased manner (approximately 7 years) by planting native trees with equal commercial and ecological value. Alternatives to Prosopis should be identified before removal.

- iv. Removal of Prosopis from productive lands should be done only after thorough scientific analysis and spatial mapping of core removal zone and buffer zone. Removal should be carried out in both the core and buffer zone to avoid spread of seeds. Grazing should be banned strictly in those areas where Prosopis is removed to avoid the spread of seeds through livestock.
- v. Removal should begin initially from government lands such as forests, water bodies, large tracts of fallow lands adjacent to forests or water bodies and then extend to private lands. Schemes like MNREGA or KAVIADP can be effectively used for this purpose.
- vi. Funds may be provided to remove Prosopis on private lands as well by devising a business plan model.
- vii. Replantation with location-specific native tree (preferably fast growing) species (Salvadora persica, Morinda tinctoria, Bauhinia racemosa, Delonix elata, Thespesia, Palmyra, Sapindus emarginatus, Mitragyna parviflora, Acacia nilotica, Acacia leucophloea, Diospyros montana, Phoenix sylvestris, Acacia planiformis, Ziziphus mauritiana, etc.) should be initiated immediately after Prosopis removal in complete removal zones and restricted removal zones to prevent regrowth from the existing soil seed bank.
- viii. To ensure ecosystem sustainability, Prosopis removal inside forests at an average rate of 5000 hectares per year in a 5-year restoration cycle with the objective of completing the entire removal in 10–15 years, with a 5-year restoration cycle for each year, is recommended.
- ix. Prosopis shall not be disturbed temporarily in areas where prevailing site conditions are hostile for regular agricultural activities and no other livelihood sources are available for public survival. However, alternatives for Prosopis must be identified in due course to replace it, and alternate employment opportunities must be explored for people solely dependent on Prosopis for livelihood.
- x. Prosopis in water bodies must be removed as a priority within 3 years and replaced with tree species (around water bodies) like Acacia nilotica or any other tree of commercial and ecological importance, such as Terminalia arjuna, Syzygium cumini, Mitragyna parvifolia, Madhuca longifolia, Ficus racemosa, etc. The choice of tree species may be made in consultation with local communities, and non-native and exotic tree species should be avoided.

- xi. The entire plan of action for removal and replanting must be framed by the Tamil Nadu Biodiversity Board with the assistance of TNAU (Tamil Nadu Agricultural University) and an expert committee.
- xii. Involvement of Panchayat Raj Institutions (PRIs) and local communities in the removal and monitoring process is crucial.
- xiii. Establish a buffer zone of "No Prosopis" within a 10 km radius around Protected Areas.
- xiv. Set up a "Biomass Power Plant" by TNEB to incentivize eradication can also be considered.
- xv. Conduct awareness programs among communities where Prosopis is intense to garner better cooperation during removal.
- Allocate a minimum quantum of work for Prosopis juliflora removal under MNREGA (Mahatma Gandhi National Rural Employment Guarantee Act) until the panchayat is Prosopis-free.
- xvii. Procure Prosopis pods for commercial production of animal feed by "Aavin" for distribution to its members.

8.2 Restoration of Prosopis infested lands

- Tree planting has to be promoted to safeguard the forests and to meet out the fuel and energy needs of the industries and for ecological, social, and economic benefits of farmers/ other beneficiaries
- Gaining the experience from restoration of banni grasslands (Gujarat), the highly saline
- *Prosopis infested* soils has can be restored with suitable grass species

8.3 Value addition to restrict spread of Prosopis and to promote wealth out of waste

- Value addition has to be carried out for effective management of *Prosopis because* of its invasiveness, ecological disturbances and challenges posed by it. Value addition is strictly not to promote *Prosopis juliflora* but for the management of removed *prosopis*.
- To prevent the further spread of *Prosopis through* seeds, value addition of pods is recommended. The mature pods shall be used for pod-based concentrate/ pod flour based multi-nutrient feed block / pod based densified block for the local livestock.

Cottage industries can be promoted and entrepreneurs be trained at CAZRI, Jodhpur. This will provide employment opportunities and prevent germination of seeds and spread of *Prosopis*. Seed dispersal through cattle and wild animals will be prevented.

8.4 Promoting entrepreneurship for effective management of Prosopis

- Cottage industries can be promoted for pod based cheaper concentrate ration / pod flour based multi-nutrient feed block / pod based densified block and entrepreneurs can be trained at CAZRI, Jodhpur. This will provide employment opportunities
- Vast opportunities are available for start-ups and cottage industries in the *Prosopis* value added products like biomass power, briquette making, charcoal, biochar, activated carbon, wood gasification, cut wood market and *Prosopis* gum.
- Green energy consortium has to be promoted to meet out the increasing energy crisis and to effectively manage *Prosopis*
- Forest College and Research Institute, Mettupalayam shall provide training to the interested participants. The interested MABIF incubates shall be linked with Agroforestry consortium at FC & RI, Mettupalayam. Dean AC & RI, Madurai and Dean, FC & RI, MTP shall co-ordinate and provide opportunities to the interested participants and promote entrepreneurship.

8.5 Research areas to be focused:

- Other alternates to *Prosopis with* the characteristics of fast growing, wide pH adaptability, drought tolerance, more yield, short rotation, disease resistance, native strains, are to be identified
- Impact of the *Prosopis juliflora* on ecology, environment, agriculture, livelihood opportunities has to be extensively studied and validated to understand its management
- TNAU has to explore the alternate land use patterns with the suitable agricultural, horticultural and forestry species for *Prosopis infested* areas. Research has to be focused on dryland agriculture and horticulture suitable for Southern districts for reaping more economic benefits by the farmers
- TNAU has to identify the suitable grass species for restoration of saline *Prosopis infested* lands
- Research is required to provide unconventional solutions to the management issue and disputed global *Prosopis challenges*.

 Research on Biological control, Hybridization with native species, Survey and Mapping.

8.6 Policy Decisions

- Continuous means to monitor the effectiveness of control measures and adjust management strategies is necessary. The monthly progress of removal of *prosopis* and replantation activities must be recorded and reported.
- Regularly assess the extent of *Prosopis infestations*, monitor the response of native vegetation, and evaluate the success of control methods. This allows for adaptive management and the modification of strategies based on the observed outcomes.
- To effectively manage the control of *Prosopis*, it is necessary to develop and adopt regional state strategies and management/action plans. To establish frameworks for *Prosopis* management and research, such national policies and plans are crucial.
- Special schemes with financial assistance have to be formulated to address removal in government and private lands
- With reference to *Prosopis management*, policies are to be framed to manage absentee landlordism and corporates holding large lands infested with *Prosopis*
- Special schemes to promote youth in agriculture in Southern districts must be framed.

In addition to those listed above, for detailed understanding on the gravity of the issue posed by the invasive plant species in Tamil Nadu, it is suggested to read the report **on "Status of Forest Invasive Species in Tamil Nadu & Suggestions to Improve the Management of Invasive Species"** prepared by State Planning Commission for effective management of *Prosopis juliflora* infested areas.



Summary of One Day State Level Workshop on Effective Management of *Prosopis juliflora* in southern districts of Tamil Nadu

The workshop on "Effective Management of *Prosopis juliflora* in Southern Districts of Tamil Nadu" was jointly organised by State Planning Commission, Chennai and Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, on 10.3.2023 at College Seminar Hall, AC & RI, Madurai.

Invited experts, participants and organizers of the workshop

The invited experts, participants and organizers of this workshop included Member Secretary and Member, State Planning Commission, Additional Principal Conservator of Forests, District Collectors, District Forest Officers, Deans of Agricultural College & Research Institute, Community Science College and Research Institute and Forest College and Research Institute, Joint Director of Agriculture, Scientists from CAZRI in Rajasthan, Gujarat Institute of Desert Ecology, Institute of Forest Genetics and Tree Breeding in Coimbatore, Tamil Nadu Agricultural University, Madurai Kamarajar University, Manonmaniam Sundaranar University, Ashoka Trust for Research in the Ecology and the Environment, Joint Director of Horticulture, Deputy Directors of Agriculture, Deputy Directors of Horticulture, Officials from forest department, industrialists, NGOs, farmers, KAVIADP beneficiaries, other beneficiaries whose livelihood are dependent on *Prosopis*, post graduate and doctoral students of Agricultural College and Research Institute. Totally 122 participants were registered in this workshop. The invited speakers for this workshop include

Invited Experts	Topics		
Theme 1: Prosopis juliflora: Current status and its Implications			
Dr.D. Narasimhan, Associate Professor (Retd.), Madras Christian College, Chennai	<i>Prosopis juliflora:</i> Eradicate or Manage?		
Prosopis juliflora in other States			
Dr. J.C. Tewari Retired Principal Scientist, CAZRI, Jodhpur, Rajasthan (Central Arid zone Res. Inst.)	Paradigm shift in <i>Prosopis juliflora</i> R &D:A Case of Indian Arid Zone		
Dr. Soumya Dasgupta Scientist, Gujarat Institute of DesertEcology, Gujarat	Implications of <i>Prosopis</i> , an invaderin the grassland of India, incurring grassland woodland transition		

Table 3

Theme 2: Ecological impact of Prosopis juliflora		
Dr.A.Rajasekaran, Scientist – C Institute of Forest Genetics & Tree Breeding, Coimbatore	Ecological Impact of Prosopis juliflora	
Dr.S.Sandilyan Founder & Director (3 rd Planet Nature Conservation & Research Foundation – Trichy) Former Fellow on Invasive Alien Species, NBA	Cascading impacts of <i>Prosopis juliflora</i> Invasion on India Bio-Diversity.	
Theme 3: Effective Management of Prosopis juliflor	ra	
Dr.V.Naganathan, I.F.S.APCCF (Wildlife)	Controlling <i>Prosopis</i> spread and exploring alternatives	
Theme 4: Livelihood opportunities associated with <i>I</i>	Prosopis juliflora	
Dr.K.T. Parthiban, Dean (Forestry) FC & RI, Mettupalayam	<i>Prosopis juliflora</i> utilization & opportunities for rural livelihood	
Theme 5: Demand and Supply of <i>Prosopis juliflora</i> to Industries		
Thiru. Anup Dubey Sri Kashi Vishwanath CharcoalManamadurai	Use of <i>Prosopis juliflora</i> in Charcoal & other industries	
Thiru.G.Loganathan, Loganathan Charcoal, Parthipanoor,Manamadurai, Ramanathapuram		
Thiru. Syed Ibrahim Timber Industry – Prosopis Madurai		
Theme 6: Civil societies' perspectives on Prosopis ja	uliflora	
Thiru. R. Kannan EnvironmentalistDindigul	Practice adopted in Dindigul (case study)	
Farmers and KAVIADP beneficiaries		
Thiru. V. PalanisamySeyyamangalam Kamudhi Taluk, Ramanathapuram Dist.	Voice of people	
Thiru.K.KannanAbiramam PO Kamudhi Taluk, Ramanathapuram District		
Thiru. M. Malaisamy, State Secretary, (PCFPCL), Ramnad		
Thiru. Muthuramalingam, Kamudhi, Ramnad		
Thiru. K. Krishnamoorthi, Ramnad		
Thiru. M. Kannapan, Ramnad		
Thiru. C. Thangam, Madurai	Voice of people	
Thiru. L. Adhimoolam, Thirubhuvanam (po), Sivagangai dt		

Beneficiaries solely dependent on Prosopis
Thiru. M. Ambethkar, Paramakudi, Ramanad
Thiru. A. Ramachandran, Paramakudi, Ramanad



Figure 10 : Invited speakers & participants of the workshop



Figure 11: Experts, participants & organizers of the workshop

Inaugural Session

The inaugural session began traditionally with lighting of the lamp followed by welcome address by Dr. P.P. Mahendran, Dean, AC&RI, TNAU, Madurai. Opening remarks was offered by Tmt. S. Sudha IFS, Member Secretary, SPC, Chennai. She highlighted the main aim of the workshop was to formulate new strategy to handle the issue of *Prosopis* and provide recommendations to the State Government. Prof. Sultan Ahmed Ismail, Member, SPC, Chennai delivered the felicitation address where he emphasized on solutions with new dimensions for effective management of *Prosopis*. In the felicitation address by Th. K. J. Praveen Kumar, Additional Collector, Ramanathapuram, he threw light on the ground reality in Ramanathapuram district which is highly infested with *Prosopis* due to absentee landlordism. He conversed on saline soils in 20 firkas and on the livelihood opportunities provided by *Prosopis* in generating employment opportunities in many villages through charcoal industries and fuel wood. He further, requested for revised tariff from forest department for *Prosopis* removal as the current exorbitant rate poses problems in removal of *Prosopis* in government lands. This was followed by the felicitation address by Th. Gurusamy Dabala, IFS., where he discussed on the change in land use pattern due to Prosopis infestation and underlined the need for more research on value added products for effective management of Prosopis . Finally, Dr. S. Aneesh Sekhar IAS, District Collector, Madurai, delivered the special address. In his address, he discussed on positive and negative impacts of *Prosopis* and stressed on the requirement of scientific evidences. He also accentuated to formulate strategies to convert waste to wealth for effective Prosopis management.



Figure 12 :Inaugural session of the workshop

Technical Session

The technical session included seven presentations by subject experts from Madras Christian College, Tamil Nadu, Central Arid Zone Research Institute, Rajasthan, Gujarat Institute of Desert Ecology, Gujarat, Institute of Forest Genetics and Tree Breeding, Coimbatore, Non-Governmental Organization - 3rd PlanetNature Conservation & Research Foundation, Trichy, Additional Principal Chief Conservator of Forests (Wildlife), Chennai and Forest College and Research Institute, Mettupalayam. The technical session comprised of four theme areas *viz.*, *Prosopis juliflora*: Current status and its Implications, Ecological Impact of *Prosopis juliflora*, Effective Management of *Prosopis juliflora* and Livelihood opportunities associated with *Prosopis juliflora*. The deliberations by the experts are as follows

- 1. Dr. D. Narasimhan, Associate Professor (Retd.), Madras Christian College, Chennai. Presentation Topic: *Prosopis juliflora:* Eradicate or Manage?
 - Only two species occur In Tamil Nadu *Prosopis cineraria* Native to Africa, Gulf Region, and to Semi-Arid Tracts of India and *Prosopis juliflora* which was introduced from Tropical America and became highly invasive
 - Prosopis juliflora is present in Tamil Nadu in most of the districts and drier southern districts such as Thoothukudi, Pudukottai, Ramanathapuram, Sivagangai, Virudhunagar, Tirunelveli, Vellore and Nagapattinam host dense strands of *P. juliflora* are present
 - Reasons of invasion includes abandoning agriculture, migration of landowners to cities, stray cattle population, and poorly managed waterbodies
 - Experience has clearly shown that invasive species cannot be eradicated. E.g., *Eichhornia, Parthenium, Eupatorium, Lantana*, etc. However, invasives can be better managed when used efficiently for biofertilizers, fibers, packaging materials, and for various other uses
 - Major threat of this species is invasion of forest and reduction in fodder crop availability and thereby, in sanctuaries birds and deer lost their shelter
 - It should be removed from forest, water bodies and in agricultural land where as in all other unproductive and problem soil land it must be managed.



Figure 13: Interaction with the participants

- Dr. J. C. Tewari, Principal Scientist (Retd.), Central Arid zone Res. Inst., Jodhpur, Rajasthan. Presentation topic: Paradigm shift in Prosopis juliflora R &D: A Case of Indian Arid Zone
 - The species is found distributed from Haryana in north to Tamil Nadu in down south. In east-west direction, species occurred from Kuchchh in Gujarat to drier parts of north-east Orissa
 - In 1930's aerial seeding of *Prosopis juliflora* was done in Rajasthan, and was declared 'Royal Plant'. However, 'Royal Plant' turned into 'disaster' because of the exceptionally wide ecological amplitude, presence of sharp thorns and dense bushy impenetrable thickets that rapidly invaded pastures, rangeland, agricultural lands, irrigation channels, water courses, etc.
 - 'Disaster' was turned into a 'Valuable' by recognizing the diverged products derived from it.





Figure 15

• Pods are an important source of fodder in arid tropics. Nutritionally they are very rich with high carbohydrate content and also have good protein content (10%). *Prosopis juliflora* Pod Based Cheaper Concentrate Ration increased milk yield by 25% over conventional feed.





- *Prosopis juliflora* Pod Flour Based Multi-nutrient Feed Block provided balanced nutrients.
- *Prosopis juliflora* Pod Based Densified Block Ground pods were compressed under a pressure of 160 kg/cm² to make it as a block. Major advantages include easy to handling, storage and transportation.





- Other products include Instant juli coffee, juli syrup, human food products (biscuits, sugary concentrate, *Prosopis* fine flour), *Prosopis* gum and pharmaceutical products
- Voluntary partners attached with consortium for green energy were Transtech Green Power Pvt. Ltd. Jalore, Rajasthan, Abellon Clean Energy Gujarat, and Amrit Agro Industries, Basni, Jodhpur, Rajasthan.



Figure 18: Green energy production using Prosopis

- 3. Dr. Soumya Dasgupta, Scientist, Gujarat Institute of Desert Ecology, Gujarat, Presentation topic: Implications of Prosopis, an invader in the grassland of India, incurring grassland woodland transition
 - The species is the dominant tree in Gujarat accounting 14.7% of trees of the State in 2009
 - The Gujarat State Forest Department during late 1950s planted exclusively *Prosopis* in about 31,550 ha along the northern fringes of Banni grasslands of Kachchh to check the advancement of Rann
 - Frequent droughts, increasing salinity (the major causative factor) and extensive grazing pressure in Banni provided a highly suitable environment, enabling *Prosopis* to spread in entire Kachchh with high density in Banni grassland



Bhirandiyara Grassland Restoration Plot - Before Amendments

Bhirandiyara Grassland Restoration Plot - Salt Deposition just after a shower

Figure 19 : Restoration of grassland infested by Prosopis, Gujarat

• The grasslands were restored by ploughing, adding amendments forming broad slopes (1.5m wide X 0.3m height) and narrow slopes ((1m wide X 0.6m height) and finally increased the grass productivity from 248 kg/ha to 3600 kg / ha



Figure 20 Increased grass productivity in restored grassland, Gujarat

Theme 2: Ecological impacts of Prosopis juliflora

- 4. Dr. A. Rajasekaran, Scientist C, Institute of Forest Genetics & Tree Breeding, Coimbatore. Presentation Topic: Ecological Impact of *Prosopis juliflora*
 - Invasive nature of *Prosopis* is due to rapid reproduction (630,000–980,000 seeds/year) and growth, phenotypic plasticity (ability to adapt physiologically to new conditions), soil seed bank, high dispersal ability, ability to survive in a wide range of environmental conditions and synthesis of allelochemicals (L- tryptophan, 3-oxo-juliprosine)
 - Apart from allelopathic effects against native species, it reduces germination percentage in agricultural crops. However, several native plants have been found growing along with *P. juliflora* (*Azardiracta indica, Vachellia leucophloea, Borassus flabellifer, Lannea coromandelica, Ailanthus excelsa, Millettia pinnata, Morinda citrifolia, Syzygium cumini, Acacia nilotica*)
 - Impact on Biodiversity includes reduction in native species diversity, loss and degradation of grasslands, farmlands, and rangelands
 - In Ranthambore National Park, *P. juliflora* is potentially reducing forage availability for wild herbivores as well as for cattle. Invasion of *P. juliflora* has shown to replace natural habitat in India's premier bird reserve, the Keoladeo National Park. At Vettangudi Bird Sanctuary, significant threat to the nesting success of wetland birds. *P. juliflora* is reported to change local bird assemblage patterns, prey-predator interaction, nesting season, or increase the rate of nest predation
 - Ungulates such as feral horse and wild boar attracted to the highly sugary pods. Most seeds were reported in pellets of feral horse and wild boar in Point Calimere Wildlife Sanctuary, Tamil Nadu (Chandru *et al.* 2020)
 - Spatial mapping of *P. juliflora* invasion using satellite images in twenty-five districts of Tamil Nadu has been completed. About 6.82 Lakhs ha area (About 5% of Tamil Nadu) has been invaded by *P. juliflora* in these districts. Southern districts *viz.*, Virudhunagar (56285 ha), Sivagangai (59700 ha), Thoothukudi (73403 ha) and Ramanathapuram (115434 ha) hosts predominate strands of *Prosopis*
 - Positive impacts of *Prosopis* includes enrichment of macronutrients in invaded lands, neutralization of soil pH, accumulation of heavy metals, grows - highly sodic and mine soils, overburdened dumps and in nutrient- lean wastelands, fly ash dumps, sand dune stabilization, greenbelt development when the land is unsuitable to support other trees

- Identifying and implementing economically feasible *P. juliflora* management strategies using experiences from other countries is essential and comprehensive information on impacts of the species will help in effective management
- Research on restoration of invaded landscapes with native species/ for agricultural activities using microbes and other scientific interventions.



Figure 21

- 5. Dr.S.Sandilyan, Founder & Director, (3rd Planet Nature Conservation & Research Foundation Trichy), Former Fellow on Invasive Alien Species NBA Cascading impacts of *Prosopis juliflora* Invasion on India Bio-Diversity. Presentation topic: Cascading Impacts of *Prosopis juliflora* invasion on Indian Biodiversity
 - In Keoladeo Ghana and Ranthambore national parks in Rajasthan, Prosopis replaced the dominant trees including Acacia nilotica (Gum Arabic), Mitragyna parvifolia (Kadamba), Prosopis cineraria, Salvadora oleoides (Bada Peelu), Salvadora persica and Ziziphus mauritiana (Indian jujube (Mukherjee, et al 2017)
 - Prosopis has colonized 5 out of 17 bird sanctuaries, other sanctuaries are also prone to invasion (Chandrasekaran et al., 2014)





- The forested landscapes of Tamil Nadu, especially Sathyamangalam Tiger Reserve has recorded low abundances of wild ungulates in Sathiyamangalam Tiger Reserve (Sivakumar, et al 2018)
- Invaded lands (Delhi, Rajasthan, and Gujarat) showed 56 63% reduction in species richness compared to the non-invaded sites (Kaur *et al.*, 2012)
- Bridgehead effect type of control mechanism needed to control *Prosopis* in Ramanathapuram, Thootukudi, Thirunelveli and Sivagangai districts
- A mini-Punjab in Tamil Nadu- (100 acres of Akal Farms in village of Vallandai). Hardworking farmers from Punjab have turned a 'deserted or abandoned' arid farm land into an oasis of lush green orchards in drought-prone Ramanathapuram in southern Tamil Nadu.



Figure 23 : Restored Prosopis infested lands in Ramnathapuram

Theme 3: Effective Management of Prosopis juliflora

- 6. Dr. V.Naganathan, I.F.S., APCCF (Wildlife), Chennai. Presentation topic: Controlling *Prosopis* spread and exploring alternatives
 - Trees outside forest will only protect trees inside forest and this avoids threat to existing forest
 - Fuel wood and fuel-based tree use (charcoal, briquette, *etc.,*) are major demand of market on daily basis. It has serious impact on existing village forest and threat to natural forests
 - *Prosopis* management in Tamil Nadu should be comprehensive and categorized as Complete removal zones, Restricted removal zones and tentative removal zones
 - Complete removal zones include forest, protected areas, water bodies, river banks, agricultural fields, other government, and private lands in identified areas



Figure 24 Differential management of Prosopis juliflora

- Restricted removal zones include water bodies, river banks, other government lands and private lands in identified dry districts where *Prosopis* is the only livelihood
- The identified districts under tentative removal zone include Ramanathapuram, Ranipet, Pudukkottai, Thoothukudi, Sivagangai, Virudhunagar, Viluppuram, Tirunelveli, Thiruvannamalai, Namakkal, Karur and Madurai.
- *Prosopis* may be allowed in areas where the prevailing site conditions are hostile for regular agricultural activities and no other livelihood sources are available for public for survival.

Category	Invasive removal priority	Timeline
I	invaded sites of biodiversity importance - protected areas or are habitats of threatened or endemic species (including buffer areas) invaded sites of watershed importance - riverine tracts, stream sides, swamps, and water catchments important for wildlife or downstream communities	1 st to 3 rd year
II	All other invaded sites except coastal areas	4 th to 7 th year
III	Invaded sites in coastal areas	8 th to 10 th year

Table 4 : Prioritization of areas for Prosopis removal

Effort needed Inside forest: 20000 hectares spread in the state

- Proposed to remove 2000 ha per year in 5-year restoration cycle.
- Aims to complete in 10 yrs with 5-year restoration cycle for each year

Effort needed Outside forest

- Survey needs to be done comprehensively covering all private and government lands having *Prosopis* growth
- Special schemes to address removal in government and private lands

Alternative

• Other alternatives with the characteristics of fast growing, wide pH adaptability, drought tolerance, more yield, short rotation, disease resistance, native strains, are to be identified through research



Figure 25

Theme 4: Livelihood opportunities associated with Prosopis juliflora

- 7. Dr. K.T. Parthiban, Dean (Forestry) FC & RI, Mettupalayam. Presentation Topic: *Prosopis juliflora* utilization & opportunities for rural livelihood
 - Mechanical removal of *Prosopis* include uprooting, bulldozer pushing, blade ploughing, slashing, and digging out the roots followed by chipping
 - Vast opportunities are available for cottage industry formation in the *Prosopis* value added products like biomass power, briquette making, charcoal, biochar, activated carbon, wood gasification, cut wood market and *Prosopis* gum
 - Briquette making is adapted by Yuvanidhi International Ltd., Ramanathapuram. Briquettes have high calorific and thermal value and low ash content
 - Value addition of *Prosopis* into various products will reduce carbon emission and will pave way to carbon neutrality or carbon negativity
 - Consortium of industrial agroforestry and agroforestry incubator is functioning at FC & RI, Mettupalayam for streamlining marketing and to bring together the local people as a company to encourage entrepreneurship through value addition and marketing.



Figure 26

Theme 5: Demand and Supply of *Prosopis juliflora* to IndustriesMr. Syed Ahmed, Timber industry, Madurai

- He has an experience of 35 years in timber industry. He procures *Prosopis* wood from southern regions of Tamil Nadu and markets to various other industries.
- He is willing to adopt briquetting technology as there is large demand from the biscuit making industries. He wants to be trained in this aspect and is willing to provide employment opportunity through this business.



Figure 27

Theme 6: Civil societies' perspectives on Prosopis juliflora Mr. R. Kannan, Environmentalist, Dindigul

- With the assistance of the Government of Tamil Nadu, 117 acres infested with *Prosopis* were cleaned by engaging 15000 people in 77 days by laying 8 borewells and digging 2 wells and planted 40000 trees in 4 hrs and created world record.
- In 2023, 12 lakhs trees species were planted under Green Tamil Nadu Mission in Dindigul, Tamil Nadu, with the support of students, NGOs, environmentalists, government officials, staff, MGNREGA workers. This will favor biodiversity conservation, promote species diversity, and water conservation.



Figure 28 : Restoration of Prosopis infested lands by tree saplings planting at Idayakottai, Dindigul by Th. R. Kannan and his team

• He requested to distribute quality tall tree saplings and monitor it strictly and requested for 25 lakh seedlings for planting during 2023-2024 and avoid free seedling distribution. He also emphasized to involve local panchayat leaders, presidents, and councillors for success of the project.

Voice of People and discussions:

- In this session, farmers, KAVIADP beneficiaries and other beneficiaries solely dependent on *Prosopis* for livelihood participated and registered their views on *Prosopis*. Scientists and environmentalists also shared their experiences.
- Th. K. Kannan, Ramnad dt., has joined the meeting to oppose *Prosopis*. However, after the presentation of the Dean (Forestry) on livelihood opportunities provided by *Prosopis*, he wants the engineering graduates at his villages to take up value addition of *Prosopis*. He wants to form an organisation and create employment opportunities through *Prosopis* value addition (Charcoal, briquetting, biochar etc.)
- Th. V. Palaisamy, Ramnad dt., has eradicated *Prosopis* in 1450 acres in Ramanathapuram, Virudhunagar and Thoothukudi districts. He recommended to plant jamun in tanks to improve soil fertility and wants the government to formulate action plans to restore tanks by removing *Prosopis* and planting native trees like jamun. He also discussed absentee landlordism and large land holdings by corporates as the major reason for *Prosopis* infestation.
- Th. M. Malaisamy, State Secretary (PCFPCL), Ramnad, registered his voice to eradicate *Prosopis*. According to him, plant species like elanthai (*Zizypussp*), greens, medicinal plants are lost because of *Prosopis* infestation. He wants the government to take up management strategies it under wartime basis. He pleaded to explore novel energy sources like solar and battery- operated methods rather than exploring *Prosopis* as energy source.
- Th. Muthuramalingam, State Secretary, Ramnad dt., stated that water bodies infested with *Prosopis* poses huge problems and has led to loss of tree species like manjanathi, vavarasu and poovarasu. According to him, the lands where small millets, ground nut, chilies, sorghum were cultivated is the home for *Prosopis* thicklets now. He recommends eradication of *Prosopis* and is against value addition and profit making using *Prosopis*. Eradication will not cause reduction in employment, as pulses and millets can be cultivation in these areas. Long term planning is essential and three V year plans are required to effectively eradicate *Prosopis*. People are ready to undertake agriculture in the lands infested with *Prosopis*, if cleared and given to them.
- Th. L. Adhimoolam, Thirubhuvanam, Sivagangai dt., stated that *Prosopis* has changed the direction of water flow of rivers. It has changed their traditional way of living by agriculture. *Prosopis* thickets provides the shelter to deer, ox, monkeys, wild boar which interferes in agriculture.

• Th. M. Kannapan, Ramnad dt., proposed to undertake survey of *Prosopis*, eradicate in important places, value addition will lead to farmers plight, special funds must be allotted by government to eradicate *Prosopis*. He also highlighted the issues on depleting water resources.



Figure 29

- Dr. Sivakumar, Professor, AC & RI, Madurai, stated that creating a water linking connection near Vallanadu for approx.10 km will solve the problem of water availability as river Thamarabarani will flow into Ramnathapuramthrough this linkage.
- Th. A. Rajasekaran, Parthibanur, Ramanathapuram is solely dependent on *Prosopis* for his livelihood. Per day earning through *Prosopis* is Rs. 1000 by his family from *Prosopis*. The village is completely dependent on *Prosopis* and 50 lorries /day carries tonnes and tonnes of *Prosopis* from the village. The revenue earned through *Prosopis* sustains the daily needs, education, and marriage expenses of their children.
- Th. M. Ambethkar, Parthibanur, Ramanathapuram revenue through *Prosopis* is obtained throughout the year, harvesting cycle is short because of the rapid growth after every harvest. He stressed complete removal should not be done.



Figure 30

- Dr. Ravichandran recommended planting of jamun, ficus, illupai in tanks to stabilize water bodies. The amount of water used by *Prosopis* is comparable to other crop like mango, tamarind, cineraria. *Prosopis* produces a greater number of lateral roots than the main tap root. It does not require more water due to the thick leaves and other water saving adaptations.
- Dr.T.Badrinarayanan (Ophthalmologist, Ornithologist and Environmentalist), emphasised comparison of strands of *P. juliflora* with *P. cineraria* per unit area rather than the single plants to draw meaningful conclusions.



Conversion of Prosopis-Occupied lands into Paddy-producing lands: Case study of Nelmadur Panchayat in Paramakudi Taluk, Ramanthapuram district

Introduction

Prosopis juliflora, an invasive species, has posed significant challenges to land management in various regions. Nelmadur village, located in [insert location], faced similar issues with nearly 600 acres of land occupied by Prosopis juliflora. However, a concerted effort led by local authorities and community members aimed to address this issue and transition towards sustainable land use practices.

Background

In Nelmadur village, Prosopis juliflora had taken over vast stretches of land, particularly in rainfed areas where traditional agriculture struggled to thrive. Recognizing the detrimental impact of this invasive species, the Block Development Officer (BDO) and Panchayat president initiated efforts to motivate villagers to remove Prosopis juliflora.

Initiative

The BDO and Panchayat president employed a multifaceted approach to encourage Prosopis removal. They leveraged community engagement strategies, involving youth to convince elders of the village about the benefits of Prosopis removal. Additionally, government schemes such as NREGA and Kurungadugal were utilized to clear Prosopis-infested lands. Monetary incentives were provided, with fines imposed on individuals failing to comply with removal directives.



before

After

Implementation

Through collective efforts, Prosopis juliflora was successfully removed from 500 acres of land designated for paddy cultivation. The use of heavy machinery like JCBs facilitated the removal process, while community labor contributed significantly. Meanwhile, rainfed lands, totaling approximately 100 acres, continued to host Prosopis juliflora due to villagers' reluctance to engage in traditional agriculture.

Outcomes

The removal of Prosopis juliflora led to the restoration of agricultural lands, with paddy cultivation replacing invasive vegetation. Government incentives and community-driven initiatives resulted in increased awareness and participation in Prosopis removal efforts. Furthermore, alternative livelihood opportunities emerged, including the conversion of Prosopis biomass into biofuel and charcoal production, providing additional income for villagers.

Challenges and Solutions

Despite successful removal efforts, challenges persist in rainfed areas where Prosopis juliflora still dominates. Continuous support from government departments and community involvement remains crucial in addressing these challenges. Promotion of drought-tolerant alternative crops and ongoing removal initiatives in water bodies by relevant authorities aim to prevent seed dispersal and regeneration of Prosopis juliflora.

Conclusion

The case of Nelmadur village illustrates the importance of collaborative efforts in sustainable land management. Through effective community engagement, government support, and the adoption of alternative livelihoods, Nelmadur village has made significant strides in combating the menace of Prosopis juliflora. Continued vigilance and proactive measures will be essential in ensuring long-term sustainability and resilience against invasive species.

Transformation of Panchayat land from Prosopis occupied into horticulture: Case Study of M.Karisalkulam, Kadaladi Taluck, Ramanathapur District.

Introduction

Prosopis Juliflora, a highly invasive species, had encroached upon approximately 350 acres of panchayat land in a rural village, posing severe threats to agricultural activities and the local ecosystem. This case study examines the collaborative efforts undertaken by the villagers, government officials, and local authorities to address this pressing issue.

Background

The infestation of Prosopis Juliflora was a result of various factors, including land abandonment, spread of seeds by cattle, and ineffective land management policies. The invasive species had proliferated across panchayat lands, water bodies, and revenue department territories, significantly impacting the livelihoods of the villagers dependent on agriculture.

Strategies

Community Mobilization: The village leaders, including the Panchayat president and Block Development Officer (BDO), played instrumental roles in raising awareness about the detrimental effects of Prosopis Juliflora and mobilizing the community for action. Particularly, Gram Panchayat president explained the community about the danger of loosing 'agriculture land' category of their lands, if not removed prosopis. Also, alternate crop proposed, maize, provided good yield and income in their lands. The lands are rainfed in nature, however, maize provides double the amount of income (Rs. 15000-16000) they received from prosopis (around rs. 5000-6000).

Government Support: The villagers leveraged government schemes such as NREGA and Kurungadugal for land clearance activities. Additionally, the provision of financial incentives for Prosopis removal incentivized participation.



Before



Outcomes

Through concerted efforts, the villagers reclaimed rainfed lands from Prosopis Juliflora infestation and transitioned to agriculture, primarily focusing on millet cultivation, maize and other cash crops. The successful removal of Prosopis Juliflora not only restored agricultural productivity but also contributed to biodiversity conservation and improved water resource management. It provides more income to villagers as well. Each acre provides Rs. 10000 per year extra income to farmers.

Challenges

Removing Prosopis juliflora has proven to be an arduous endeavor, primarily due to its resilient root system and remarkable ability to regenerate rapidly. The extensive network of roots intertwining beneath the soil poses a formidable challenge, often necessitating specialized equipment such as JCBs for effective extraction. However, the limited availability of resources, including funding for such machinery, exacerbates the difficulty of the task.

Furthermore, entrenched mindsets within the community present significant barriers to successful eradication efforts. Many community members have become dependent on Prosopis-based income streams, whether through the utilization of its wood for fuel or its thorns for handicrafts. Consequently, attempts to mobilize the community towards eradication initiatives are often met with resistance, as individuals fear the loss of their livelihoods.

Interestingly, while the presence of Prosopis juliflora poses numerous ecological and economic challenges, it also paradoxically offers a source of employment for local residents. Value addition activities such as crafting furniture or producing charcoal from Prosopis wood provide vital sources of income for communities in regions where alternative job opportunities are scarce. Even when individuals opt to clear Prosopis from their own lands and transition to other crops, they often find themselves drawn back to Prosopis-related work in neighboring villages, reflecting the persistent allure of its economic benefits.

Thus, the struggle against Prosopis juliflora transcends mere physical removal efforts; it necessitates a comprehensive approach that addresses not only the ecological impact of the invasive species but also the socioeconomic dynamics at play within the affected communities. Finding sustainable solutions that offer viable alternatives to Prosopis-based income while simultaneously mitigating its spread remains a formidable challenge requiring innovative strategies and collaborative efforts from all stakeholders involved.

Conclusion

The case study illustrates the power of community-led initiatives and multi-stakeholder collaboration in addressing environmental challenges. By combining traditional knowledge with innovative approaches and government support, the villagers not only mitigated the threat posed by Prosopis Juliflora but also laid the foundation for sustainable land management practices. The lessons learned from this endeavor can serve as a blueprint for similar initiatives in combating invasive species and promoting environmental sustainability in rural areas.

Case study: Transforming Barren Lands infested with *Prosopis juliflora* into Horticulture Park

Background

Thaduthalangkottai Gram Panchayat, situated in Paramakudi taluk, faced a significant challenge three years ago when 35 acres of its lands adjacent to a pond became overrun by Prosopis juliflora. This invasive species had rendered the land seemingly barren, impeding agricultural activities and economic development in the region. Recognizing the potential of this land and driven by the vision to revitalize it, the Panchayat President, in collaboration with the Block Development Officer (BDO), embarked on a mission to convert the seemingly desolate area into a thriving horticultural park.

Initiative

With support from the District Horticulture Department and utilizing Panchayat funds, the Panchayat undertook the daunting task of eradicating the invasive Prosopis from the lands. This involved not only the physical removal of the trees but also the meticulous extraction of their extensive root systems, ensuring a clean slate for future development.

Under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), the Panchayat leveraged local labor to clear and divide the land into four distinct portions:

Nutrition garden: A section dedica**t**ed to cultivating nutrient-rich vegetables, providing essential sustenance to the local community.

Water supply: A small pond was dug within the land to ensure a sustainable water source for irrigation purposes, enhancing agricultural productivity.

Moringa Plantation: Moringa, known for its nutritional benefits, was cultivated in a designated area, further enriching the nutritional value of the produce.

Horticulture Trees: Bordering the land, trees conducive to horticulture were planted, enhancing the aesthetic appeal and ecological diversity of the area.



before



Impact

The transformation of the once-barren land into a vibrant horticultural park yielded multifaceted benefits for the community. By providing fresh, nutrient-rich vegetables, the nutrition garden not only improved food security but also empowered local women's groups and workers involved in its cultivation. Moreover, the establishment of sustainable water sources and the cultivation of valuable crops such as moringa and horticulture trees contributed to the economic prosperity and ecological resilience of the region.

Challenges and Future Opportunities

While significant progress has been made in reclaiming Panchayat-controlled lands from Prosopis infestation, challenges persist in addressing the spread of the invasive species in lands under the jurisdiction of the revenue department. Efforts to collaborate with relevant authorities to clear Prosopis . This specifically applied to waterbodies that are not controlled with panchayat.

Conclusion

The case of Thaduthalangkottai Gram Panchayat serves as a testament to the transformative power of community-driven initiatives in reclaiming and revitalizing degraded lands. By leveraging local resources, governmental support, and innovative approaches, the Panchayat not only overcame the challenges posed by Prosopis infestation but also ushered in a new era of sustainable agriculture and economic development in the region. As similar initiatives continue to unfold, the prospect of converting barren lands into thriving hubs of productivity and biodiversity becomes increasingly attainable, offering hope for a brighter and more resilient future for rural communities worldwide.

The Effective Management of Prosopis juliflora in the Southern Districts of Tamil Nadu

Invasive alien plant species like Prosopis juliflora are a major driver of biodiversity loss and pose threats to our ecosystems, economies and communities.

This report is an outcome of an international workshop organised by the State Planning Commission, in order to improve the knowledge and strategies for the effective management of forest invasive species in Tamil Nadu on the effective management of forest invasive species.

The purpose of this report is to document comprehensive actions, encourage sustainable handling, and support data-driven decisions related to the management of this invasive plant.

Publication by:

A STATE LAND USE RECEIPTION

Tamil Nadu State Land Use Research Board | TNSLURB

State Planning Commission, Ezhilagam, Chepauk, Chennai 600 005



To know more → www.spc.tn.gov.in

Contact us → +91 44 28528551

Write to us → tnspc.tn@nic.in