

BIOINVASION

ENVIS Newsletter on BIOLOGICAL INVASION

Vol. no. 2 September 2020

HK Photography



Chromolaena odorata



Ministry of Environment, Forest
& Climate Change



AMRITA
VISHWA VIDYAPEETHAM
— DEDICATED TO BE UNIVERSAL —

School of
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ABOUT ENVIS



Environmental Information System Centre MOEFCC recourse partner Amrita Vishwa Vidyapeetham on is established to disseminate scientific, technical, and semi-technical information on various issues related to biological invasion (Invasive Alien Species) and conduct related research and extension activities.

ENVIS network has been designed as the National Focal Point (NFP) for INFOTERRA, a global environmental information network of the United Nations Environment Programme (UNEP)

Some of the objectives of the Envis Centre (Invasive Alien Species) are:

1. To promote, implement, and coordinate Green Skill Development Programme (GSDP), an initiative to skill youth in environment, forest, and wildlife sectors and enable them to be self-employed. E.g., lantana craft and furniture making, herbal kitchen gardening of native species.
2. To implement and coordinate National Environment Survey (NES) a Grid-based Resource Information and Decision Support System (GRIDSS) for sustainable management of natural resources to fill in data gaps with respect to various environmental parameters such as emission inventory and pollution; forest and wildlife (flora and fauna); wetlands; rivers and other water bodies; public health, etc.
3. To implement and coordinate a Community-driven Environmentally Sustainable Village Programme (CESVP) with the objective of mobilizing communities on environmental issues, creating decentralized models of development to empower local communities and build an awareness driven atmosphere in villages to adopt environmentally sustainable practices at community level.
4. To build a repository and dissemination centre in Environmental Science, Information and Management (ESIM) with focus on biological invasion.
5. To support and promote research, development and innovation in ESIM theme: Biological Invasion.
- 6 To promote national cooperation and liaise with agencies concerned for exchange of environment and biological invasion related information.

Dr. Maya Mahajan

Bio Invasion

ENVIS Newsletter Biological Invasion

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Cover Photo
Chromolaena odorata
by Harikrishnan R K

Chromolaena odorata is a fast growing invasive alien shrub which poses threat to native vegetation in India. Native to South & Central America

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Biological invasion in Agro - ecosystems



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Invasive alien weeds are those that have become established where they did not previously occur and have been found to cause harm to the environment, the economy and in some cases to human health. For centuries people have moved plants both deliberately and accidentally around the world. However, with globalization of agriculture and increased trade and travel, there is greater risk of more such invasions now than before. The increased interest on invasive weeds in the recent past has also been due to the inclusion of the subject in the Convention on Biological Diversity. As per Article 8h of the CBD, parties to the convention agree to 'prevent the introduction of, eradicate or control those species which threaten species, habitats or ecosystems'. Rising human populations through out the tropical countries are putting increasing pressures on the remaining native vegetation for timber, pasture, cropland, fuel wood, living space, domestic and overseas tourism and transport corridors. These pressures both cause disturbance of the natural ecosystem and provide opportunities for weeds seeds to previously inaccessible and undisturbed ecosystems.

Factors Favouring Invasion

Fortunately, most introduced plants do not become invasive. Williamson's (1996) 'tens' rule of thumb of biological invasions suggests that only 10% of introduced species will become established in a host environment and that only 10% of the established invaders will become pests.

The extent to which an introduced plant naturalizes and spreads depends on the suitability of the new physical, chemical and biological environment in which it finds itself. If these factors are unsuitable, the plant is unlikely to become established. If some aspect of the environment is unsuitable the plant may persist until there is an environmental shift in its favour or perhaps until it evolves to meet the adverse condition. There are several examples of weeds undergoing such a lag phase after introduction, later becoming significant noxious weeds. A third requirement for establishment and spread of an introduced plant may be a suitable disturbance regime, which creates appropriate open niches for their invasion and naturalization.

Genetic Variability

Any weed introduced in to a new environment evolves in to a rapid invasive species, when the genetic variability is comparatively lesser. *Rubus alceifolius* with higher magnitude of genetic variability in it's native range (North Vietnam to Java) evolved itself as an invasive species in Madagascar with lesser genetic variability (Amsellem et al., 2000). Genetic introgression from *Rhododendron catawbiense* has been shown to impart cold tolerance on *R. ponticum*, a frequent invader in Britain and Ireland (Milne and Abbott, 2000).

Climatic and Edaphic factors

Casuarina equisetifolia has spread in California after the incidence of two hurricanes. In Cook islands, the invasion of *Casuarina equisetifolia* is reported to have been triggered by hurricane Sally in 1986 (Meyer, 2000). Frequent flash Flood is an important factor contributing for the invasion of some species with hydrophytic adaptations like *Marsilea quadrifolia* in India (Kathiresan and Gbehounou, 2016).

Biotic factors

Absence of natural enemies in the introduced range is another important factor contributing for the invasive potential of weeds as in the case of spread of *Eichhornia crassipes* in several parts of the world (Kathiresan, 2006); invasion of *Acacia longifolia* in South Africa and *Chrysanthemoides monilifera* in Australia (Weiss and Milton, 1984). Allelopathic potential of the invading species against the co-inhabitants in the introduced range is another factor

Prevention of invasion of weeds

The first line of defense against invasive weeds is prevention. Prevention revolves around the principle "no individual or organization has the right to move an undesirable taxon from where it is, to where it is not wanted or to where it will cause environmental and / or economic harm". Prevention could be achieved by producing commodities in 'weed free areas', 'mitigation of the contaminated commodity before shipment', insisting on 'permits or certificates' to move the commodity into an area, 'port of entry inspection' and 'safeguarded movement' of contaminated commodities until processing of the commodities (Eplee, 2000). Prevention by and large depends on legislation backed up by inspection procedures.

Raising awareness and education

Weeds are limiting the ability of the land to sustain healthy and natural functions. They reduce the property value and productivity of our lands. Our efforts to stop their advance have not kept pace with their spread. The general public is not informed and therefore not alarmed. Each country must develop a fact book to raise awareness to public, farmers, developmental agencies, legislators, fellow researchers, students, tourists and others about invasive plants. It should contain basic information about weeds in different ecosystems. It should highlight the dangers of invasive weeds, their identification, and their management. Interesting facts and figures with attractive pictures or diagrams will have better appeal. Organising events such as 'weed awareness week' (in USA) 'weed buster week' (in Australia) are few good ideas and should be followed in other countries as well. A new National Early Warning and Rapid Response System for Invasive Plants is being developed for practice in USA (Westbrooks et al., 2001).

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Impact Of Bio-Invasive Plant Species Along Altitudinal Gradients In Tropical Forest Ecosystems Of Tamil Nadu

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Development has its negative impacts and it is seen in habitat destruction and fragmentation of forest landscapes. The forest clearing is invaded and gregariously populated by exotic plant species originating from non-forest regions like agriculture, plantation and human settlements. These exotic species extensively alter the landscape and the fragile ecosystem. These invasive exotic species compete with the native species for the available nutrition and water and unfortunately having more adaptable nature, succeed significantly. This situation pushes the native plant species to the verge of extinction. These altered forest landscapes lead to loss of plant diversity, increased forest fires and finally to degradation. The situation calls for management of these invasive species. The present article focuses on the distribution and impact of some prominent invasive species in different habitats of tropical forest ecosystems in Tamil Nadu.

High Altitude forests

This high-altitude zone comprises the tropical montane evergreen (Shola), wet and dry evergreen, tree savannas and grassland forests with rich plant diversity. They are normally seen in the valleys of Western and Eastern Ghats of Tamil Nadu. These forest landscapes are interspersed with anthropogenic buildups like plantations, road networks, shifting cultivation and mining activities. The major plantation seen here is *Acacia mearnsii* (Wattle) and it encroaches into the adjoint forest lands, thereby altering the native species

composition. It is reported to secrete certain secondary metabolites in its bark, which drop and affect the forest soil fertility, restricting the growth of sensitive native species. Similar is the case with *Coffea arabica* (coffee) plantations too. Its seeds intrude into the adjoining forest area and grows gregariously covering the lower canopy of the forests, and in the process denying space and sunlight to the growing native tree seedlings. In low altitudes (<2000 meters) the natural forests are extensively fragmented and occupied by the extensive growth of an introduced ornamental plant *Lantana camara* which is seen in both inside sun exposed areas and on the fringes of the degrading vegetation. They along with *Pteridium aquilinum*, a fern species, inhabits the available areas in the zone. These species are excellent source of fuel for forest fires. The resilient and adaptive nature of the fern rhizomes is such that they stay protected underground even after a major fire and revive in a suitable environment. The fern is also reported to produce some allelopathic compounds which drops on the forest soil making it inhabitable for the growth of the native species.

Middle latitude forest (500-1500m)

This zone comprises the semievergreen, moist deciduous, dry deciduous forest and woody Savanna grasslands in both Western and Eastern Ghats. Invasive species like *Ageratum conizoides*,

Cymbopogon citratus, *Chromolena odorata*, *Lantana camara* & *Pteridium aquilinum* are seen here. *Ageratum conyzoides* is a very common weed, distributed in the periphery of the dry deciduous and open forests which are normally found in denuded areas in the low altitude areas. On the other hand, *Cymbopogon citratus* (a grass species) effectively replaces the native grass species of woody savanna, putting the whole area under fire risk zone. The grass species affects the germination of native flora, and aftermath of forest fire, has a tendency to rapidly reoccupy the available land. Similar, is the case with the fern species *Pteridium aquilinum*, whose potential is discussed earlier. It occupies mostly the Savanna forests. These species which occupy the forest tracts display a monoculture like appearance putting the whole area under potential fire risk. Nevertheless, there are regular reports of forest fires and these invasive species contribute to it significantly.

Low altitude forest (Foothills to 500 meters)

This zone comprises the largest area under the naturally vegetated areas in both the Eastern and Western Ghats. They comprise the forest types like dry Deciduous, Scrubs, Thorn and Riparian. These forests are dominated by invasive species like *Lantana camara*, *Chromolena odorata*, *Ageratum conyzoides* and *Prosopis juliflora*. The habitation of *Prosopis juliflora* (a small tree or shrub species) is rampant on the foothills and exposed forest tracts. This *Prosopis* sp. also produces certain secondary metabolites similar to *Pteridium*, affecting the native species growth and germination. Here *Lantana camara* is among the best adapted invasive species found in almost all the latitudes and forest types as discussed in this study. It is nevertheless a very common weed, distributed in the fringes of the dry deciduous and open forests. Similarly, *Chromolena odorata* dries rapidly during summer and significantly promote

wild bushfires in Bamboo forests in the foot hills. *Ageratum conyzoides* occupies all the available space including the riparian forests creating a competitive environment with the native species.

As a conclusion it is found that the species *Ageratum conyzoides*, *Cymbopogon citratus*, *Chromolena odorata*, *Coffea arabica*, *Lantana camara* and *Pteridium aquilinum* are the dominant invading species in both the Western and Eastern Ghats. If their growth and spread is not controlled, then they may significantly occupy all the exposed vegetated areas which, in due course may be irrevocable in future. The native plant species and its immense treasure will be lost to humankind forever. The forest policies could include management of such invasive species. Possibilities of systematic destruction of these invasive species and research on their potential alternate uses is a positive approach on its management. For example, *Lantana* sp. wood is reported to have a potential to be used as furniture and *Cymbopogon* sp. is used in herbal tea as a rejuvenator or as essence. On the other hand, rehabilitation of the affected forest areas with native saplings will somewhat succeed to some extent in some areas, but not in erstwhile climax forests because revitalizing the area with the fragile and vulnerable species is very difficult. Formation of micro reserves is a promising approach and needs to be researched and effectively utilized.



Webinar on Is Quarantine due to Covid19 helping nature to heal?



Dr. Maya Mahajan

Recognizing the International Biodiversity Day on 22nd May, The Environmental Information System (ENVIS) Resource Partner for 'Science-based management of biological invasion/invasive alien species in India', at Amrita Vishwa Vidyapeetham (AVVP), Coimbatore, conducted a webinar on the topic 'Is Quarantine due to Covid19 helping nature to heal?.'

Dr Maya Mahajan (ENVIS Coordinator and Associate Professor, Amrita Vishwa Vidyapeetham), Ms Chinmai Hemani, Dr Aruna R, and Sony RK were the keynote speakers in the webinar attended by around 140 participants composed of students, professors, researchers and environmental professionals from various parts of India.

Dr Maya moderated the Session and discussed the background of the subject in her elaborative speech. Documentaries on the impact of lockdown on the environment in India and other countries were screened. She discussed the decrease in the level of greenhouse gases (CO₂, NO₂) in several nations like China, Italy, US and India, that is clearly visible in NASA images. She further mentioned that there is a 25% decrease in GHG levels in China and around 200 million tons of carbon dioxide has reduced just during two months of lockdown period. Pollution levels are drastically down in Delhi, Mumbai, Chennai and Bangalore after just 21 days of lockdown.

The water quality in Ganga, Yamuna, and Venice canals has improved and dolphins and fishes are clearly visible. Animals are

roaming free on the roads in many counties. However, she raised concern on what will happen when the lockdown is lifted when we will go back to polluting probably at an even rapid pace in the name of economic growth. While she clarified that we cannot extend the lockdown to save the environment, she pointed out that we can slow down, understand the difference between the need and the greed, the essential and the non-essential, and thus adopt a sustainable development-oriented lifestyle. The lockdown proved that environmental damage can be reduced or reversed in such a short period with drastic actions and we should learn to

Invitation for Webinar on:
Is Quarantine due to Covid 19 helping Nature to heal?
On the occasion of
International Biodiversity Day
22 May 2020

Experts:
Session Will be led by

 Dr. Maya Mahajan, Associate Professor, Centre for Sustainability Future, Amrita University	 Ms. Chinmai Hemani, Climate Change and Sustainability professional, India	 Dr. Aruna R. Assistant Professor of Biology, Thiagarajar College, Madurai	 Ms. Sony R.K. Asst. Manager (Biodiversity), KJ Somaiya Trust
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Webinar will be on Zoom meeting
Meeting ID: 711 8803 4761
Password: 9JwNAL

Organised by
ENVIS Resource partner on "Science based management of biological invasion/invasive alien species in India"
**Amrita Vishwa Vidyapeetham (AVVP), Ettimadai,
Coimbatore- 641112, Tamil Nadu**

   **Friday 22 May 2020**
 **5 Pm - 6 Pm**

take preventive measures after lockdown which can lead to the continuous improvement of environmental quality.

Furthermore, while explaining health hazards due to air pollution, she discussed certain key facts from WHO reports which states that in China and India, more than 7 million and 1.2 million people respectively die every year due to air pollution. In reality, while this is a higher death rate compared to Covid19 pandemic, such a fact is not taken seriously by the concerned authorities. She quoted the study by Marshall Brookes of Stanford University, which observed how air pollution levels without lockdown could have killed 20 times more people in China than the number of people who died due to Covid19. Another research study also indicated that 4000 children and 73000 elderly people's life is saved due to the pollution avoided as a result of present lockdown in China.

However, she stressed that we should not undermine the threats posed by Covid19 and should take maximum precautions to fight the pandemic. She concluded the session by stating that on this International Biodiversity day, we should understand that every species has equal right to live on this planet and human beings are just a part of nature and we must respect nature.

Dr Aruna Ramachandran discussed what happened in the Wuhan wet market in China and the main reason behind the outbreak of the zoonotic disease, Covid19. She further explained why we should avoid wildlife trafficking and murdering.

Ms Chinmai Hemani discussed the similarity between corona pandemic and climate change and cited a UN report that considers corona a temporary event and climate change an ongoing long-term event, which requires global cooperation and support, to find a solution. She also discussed the

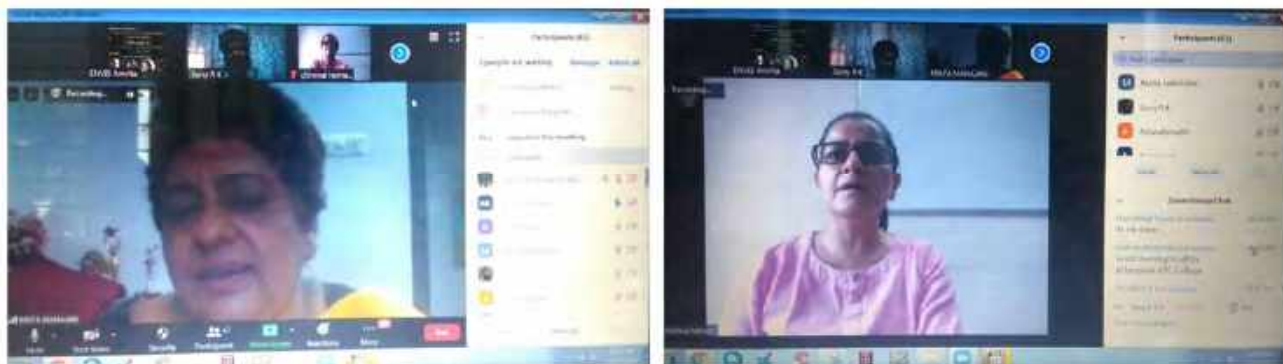
changes we can bring to the policymaking at the government level and individual level to promote a sustainable lifestyle.

Sony R K discussed the De-growth movement, which is happening around the world. He highlighted that Covid19 has led us to think about a just world in terms of economic and environmental sustenance.

Considering the overwhelming responses received from over 200 participants consisting college students, researchers and faculty members from various institutions, we conducted the webinar as two consecutive sessions, one from 5 to 5.40 pm and the other from 6.10 to 6.50 pm. We thank all the participants and speakers for their contribution and we look forward to organising such online sessions in coming days.

Tweet by MoEF&CC regarding our program





About Research Personnel

Dr Maya Mahajan is an environmental professional, a passionate, and committed environmentalist who is currently associated with the Centre for a Sustainable Future, at Amrita Vishwa Vidyapeetham, Coimbatore. She possesses more than 25 years of experience in research, training, advocacy and management of various sectors in Environment and Development - Biodiversity Conservation, Climate change and Sustainable Development, Participatory Forest Management, Wetland Ecology, Forest Ecology, Environmental Pollution and Environment Education while working with Research and Academic Institutes, NGOs and corporate sector across India. She has presented and published several scientific papers in books, National and International journals, and also become the keynote speaker for numerous international conferences including 6th Griha summit, Earth Science and Engineering, Environmental Governance & Sustainable development. Furthermore, She has also received several awards including International Women Achievers award in the field of Environment and sustainability by Venus International.

Ms Chinmai Hemani is a climate change and sustainability professional from Gujarat working under her proprietary firm RuChiNi ESP. She possesses a rich experience of over 7 years in research, community outreach with NGOs, corporates, and grant-based independent researches on climate change vulnerability assessment, adaptation planning, policy analysis wet climate change and sustainable development, and sustainable living. Being an avid nature lover, a traveller and follower of frugal living, she sincerely believes that wisdom from traditional knowledge, religion and ancient India can lead the world on the path to sustainable living. Prior to her works on climate change and her M Tech in climate change and sustainable development in 2013, she worked for over 8 years in the telecom domain.

Dr Aruna Ramachandran is an Assistant Professor of Botany at Thiagarajar College, Madurai. She completed her PhD at SACON and was selected as Darwin fellow during 2008 for which she visited the UK for research training. She has 12 Years of Research experience and has handled UGC and Tamil Nadu Forest Dept. projects.

Sony R K is currently working as an assistant manager at ICLEI-Local Governments for Sustainability, New Delhi. His work at ICLEI focuses on assessing land degradation in Himachal Pradesh, biodiversity mainstreaming efforts in Kochi City in collaboration with the city government and so on. He is in the final phase of his PhD research focused on the transformation of environmentalism in Kerala, from Ashoka Trust for Ecology and the Environment (ATREE). He was also a visiting faculty at the Trans-Disciplinary University, Bangalore, where he taught foundation course on sociology and qualitative research methods for Bachelors and Masters students in Conservation Future.

World Environment Day Celebrations by ENVIS Centre



Dr. Maya Mahajan

The United Nations Environment Programme (UNEP) initiated the observance of World Environment Day (WED) globally to celebrate the spirit of positive environmental action. Since 1974, it has been celebrated every year on 5th June: engaging governments, businesses, celebrities and citizens to focus their efforts on a pressing environmental issue. The WED theme 2020 is biodiversity – a concern that is both urgent and existential. Recent events, from bushfires in Brazil, the United States, and Australia to locust infestations across East Africa, India – and now, a global disease pandemic – demonstrate the interdependence of humans and the webs of life, in which they exist

World Environment Day (WED) was celebrated by ENVIS-RP AVV on June 5th 2020.

The major events included:

- National Webinar on the topic 'Earth is healing now. But, what happens after lockdown?'
- ENVIS newsletter release on the theme 'Biological Invasion'
- Poster Release on the topics of Invasive alien animals and plants
- E-book release on 'Faunal Diversity of Amrita Vishwa Vidyapeetham Campus'
- National Photography competition on 'Western Ghats Biodiversity'

**EARTH IS HEALING NOW....
BUT WHAT HAPPENS
AFTER LOCKDOWN?**

WEBINAR ON

WORLD ENVIRONMENT DAY

JUNE 5, 2020

4 PM I.S.T

EXPERTS

Dr. Maya Mahajan
Associate Professor
Centre for Sustainable
Future
Amrita University

Ms. Chinmai Hemani
Climate change and
Sustainability
Professional
Gujarat

ORGANISED BY ENVIS RP Amrita Vishwa Vidyapeetham

For registration, kindly send us your details on bioinvasion.envis@gmail.com

The National Webinar on the topic 'Earth is healing now. But, what happens after the lockdown?'

The webinar was conducted in two sessions. Dr Maya Mahajan, ENVIS Coordinator and Associate Professor at Amrita Vishwa Vidyapeetham led the Session and discussed how the environment is healing in a short period due to the lockdown in various countries and how these lessons learned during lockdown can be implemented to improve environmental quality post lockdown. Ms Chinmai Hemani, Climate Change and Sustainability Professional from Gujarat conducted the second session on adopting sustainability to protect environment post lockdown.

Around 27 participants from across the nation participated in the webinar. The initial session started at 4:10 pm where Dr Maya discussed the decreasing levels of



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greenhouse gases (CO₂, NO₂) in several countries like China, Italy, US, and India, as clearly visible in the NASA images. She further mentioned the 25% decrease in GHG levels in China with approximately 200 million tons of CO₂ reduced in just the two months of lockdown. The pollution levels are drastically down in Indian cities like Delhi, Mumbai, Chennai, and Bangalore in a brief 21 days of lockdown. She emphasized on need to learn lessons from the present situation and adopt sustainable development path ways during post lockdown period.

Ms Chinmai discussed the need for adopting a sustainable lifestyle to prevent climate change, where she explained how despite the nature being resilient, the impact of climate is long-lasting, with significant adverse health impacts. She also discussed the importance of low carbon emission and the reduction of the same through energy-efficient practices. She further stated that climate change would be one of the major responsible factors for the health crisis of the 21st century. She concluded the session by emphasizing the importance of cutting down the carbon footprint and adopting a sustainable lifestyle.

Environmental professionals, researchers and students from Tamil Nadu, Kerala, Karnataka, Maharashtra, Gujarat, Uttar Pradesh and Punjab actively participated and interacted in the Webinar.

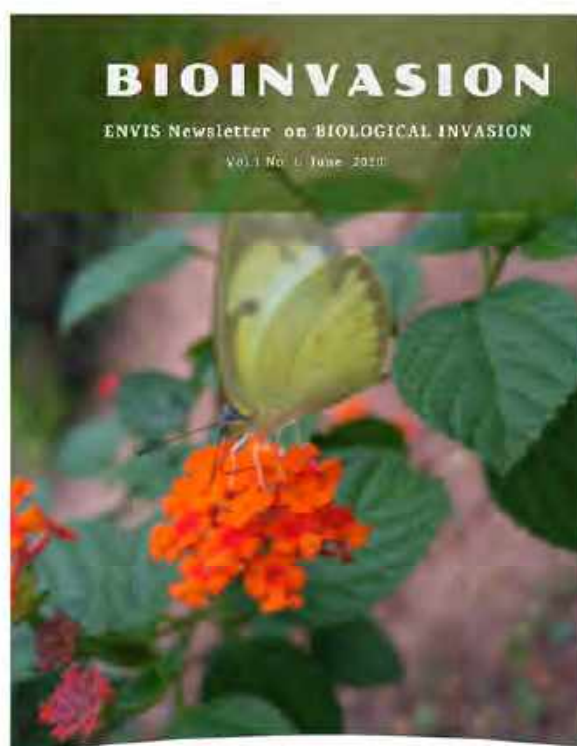


Release of ENVIS newsletter on Biological Invasion

ENVIS-Resource Partner, Amrita Vishwa Vidyapeetham (ENVIS-RP, AVV), also released its first newsletter 'Bio-Invasion' on this occasion. The newsletter covers articles on Impact of Invasive Alien Species on Ecosystems, Reports on Green Skill Development Programme (GSDP) on Lantana furniture and crafts in Siruvani (Tamil Nadu), Wayanad (Kerala), and Dahanu (Maharashtra), and activities conducted by ENVIS centre and Amrita Nature Club on various environmental events.

Please find the link of the newsletter below:

https://intranet.cb.amrita.edu/download/public/2020/csd/ENVIS_NEWSLATTER_JUNE_2020.pdf



ENVIS-RP AVV also released two posters on the occasion of WED, 2020. The first poster highlighted the impacts of the invasive alien flora of India and the other one emphasized the management of invasive alien fauna of India.



https://drive.google.com/file/d/1wBQx0paOjC7kTN3wDP_glueyBWSEcgyB/view

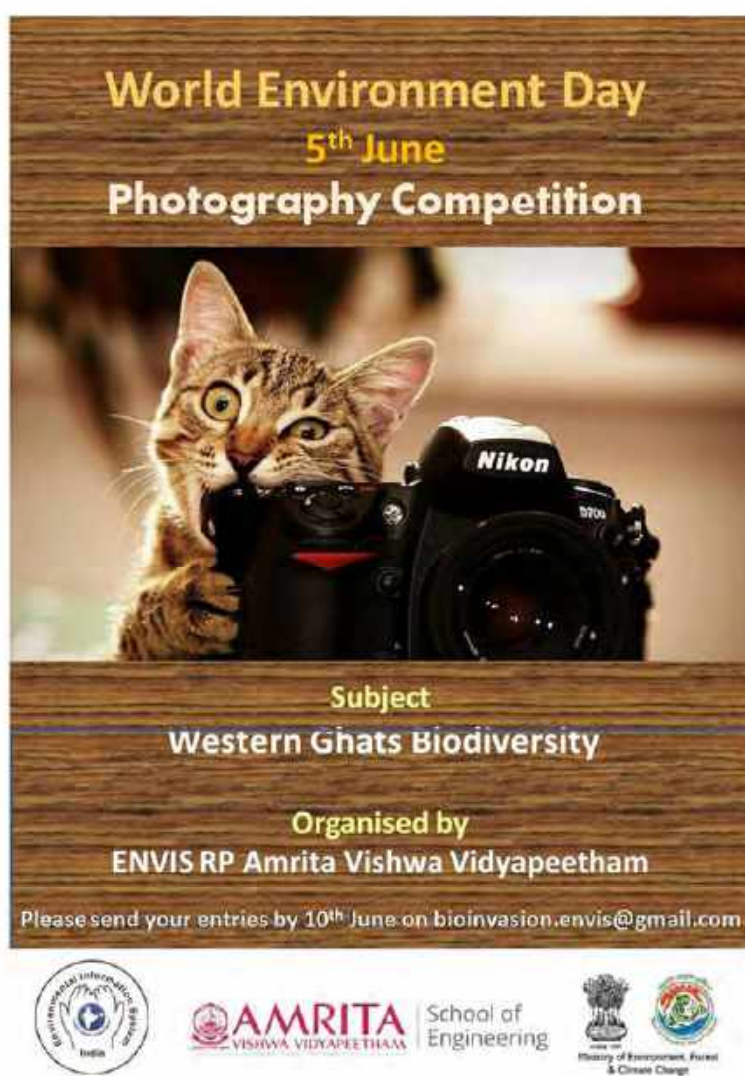
The book describes the faunal diversity of 400 acres of lush green Amrita Vishwa Vidyapeetham (Coimbatore) campus which is surrounded by a part of Western Ghats.



The report describes the diversity of butterflies, avifauna and other faunal groups such as mammals and reptiles in the campus. A total of 90 butterfly species, 114 species of birds, 21 species of mammals, and 17 species of reptiles have been recorded in the University campus and its environs. Among these 90 species of butterflies, two butterfly species such as Southern Birdwing (*Troides minos*) and Tamil Yeoman (*Cirrochroa thais*) are endemic to Peninsular India and Sri Lanka and Blue Mormon (*Papilio polymnestor*) is endemic to whole of India and Sri Lanka.

Photography competition on the theme 'Western Ghats Biodiversity'

A photography competition was conducted during WED 2020 on the theme 'Western Ghats Biodiversity', to generate awareness among the student community. Students and researchers from all over India have participated in the event by sending their entries.






World Environment Day
5th June
Photography Competition

Subject
Western Ghats Biodiversity

Organised by
ENVIS RP Amrita Vishwa Vidyapeetham

Please send your entries by 10th June on bioinvasion.envis@gmail.com.

  School of Engineering 

ENVIS RP AVV generated awareness among various target groups regarding Sustainable development, Sustainable lifestyle, Biodiversity conservation, and Management of biological invasion as part of the week-long celebration of World Environment Day.

HK PHOTOGRAPHY



First Prize: Harikrishnan R.K.



Second Prize: Ankush Chowdhury



First Prize: Amir Khan Ahmed



Second Prize: Kavitha Vijay



Photo by Kavitha Vijay



Third Prize: Guhan S



Third Prize: Kasturi Sule



Consolation Prize: Hesha Sikligar



Photo by Aravind R



Consolation Prize: Jithin Velayudhan



Consolation Prize: Aravind R

Alien earthworms of the Western Ghats biodiversity hotspot, India



S. Prasanth Narayanan
R. Anuja
Shailja Kumari
Vijo T. Kurien

A.P. Thomas
R. Paliwala
J.M. Julka³

Introduction

Aquatic and terrestrial habitats are home to several kinds of animals and among these annelids (segmented worms) form a major group. Earthworms are the most familiar annelids to people (Rouse and Pleijel, 2007). They are considered as one amongst the most ancient terrestrial animal groups, having possibly emerged in the late Precambrian, some 650-570 Ma (mega-annum = a million years) ago (Blakemore, 2012). But the evolution of earthworms and allied forms are obscured due to paucity of fossil records (Julka, 1993). Earthworms are characterized by hermaphroditism, reproductive organs in limited number of segments, and by direct development of eggs in a cocoon excreted by the clitellum (probable adaptations to life in a non-marine environment) (Timm, 2012), even though parthenogenesis and regeneration are common in some species (Gates, 1972). They occur naturally in all types of soils with sufficient food, moisture and temperature, commonly occurring in grasslands, forests, agriculture fields, gardens, kitchen drainages, composting pits, even in aquatic habitats, trees, etc., except where recent volcanisms, glaciations, inundation or desertification preclude them (Blakemore, 2012). At present 6000+ extant species earthworms of 18 families have been described (Anderson et al., 2017). As of now around 430 earthworm species/subspecies belonging to 10 families have been reported from India (Narayanan et al., 2019; Lone et al., 2020). In India, the Western Ghats and Western Coastal Plains are recognized as

Paliwal, 2005). Earthworms move into new areas either through active or passive dispersal methods (Edwards and Bohlen, 1996). Passive dispersion is common in the peregrine or exotic species of earthworms, which mainly happens through the anthropogenic activities (vermiculture or accidentally in soil around the roots of exotic plants) and transportation of cocoons in soil attached to the feet of birds or animals (Gates, 1972; Julka, 1988, 2014; Blakemore, 2012; Brown et al., 2006). Wide spread exotic or alien earthworms species were detected at the beginning of 20th century by Michaelsen (1903) and he termed them as 'peregrine', which are the species established geographically over wide areas and outside their native ranges. They are also called as anthropochorous, allochthonous or cosmopolitan species (Blakemore, 2012). Now a days several species established their colonies in different parts of the world. Blakemore (2012) stated that about 150 species are considered as peregrine on a global scale.

The Western Ghats is a chain of mountains and forms the most important topographic feature of the Peninsular India (Nair, 1991). This is biogeographically and ecologically an important formation of the Gondwanaland, with around 1600 km in length, running parallel to the western coast of peninsular India (located

between 8o 19'18" to 21o 16' 24" N and 72o 56' 2" to 78o 19' 40" E, cover an area of 164280 km²). Starting from the Tapi River in Gujarat, it passes through the states of Maharashtra, Goa, Karnataka, Kerala and ends in Kanniyakumri in Tamil Nadu (Davidar et al., 2005; Nayar et al., 2014). Western Ghats along with Sri Lanka is considered as one of the hottest hotspot of the world and also a world heritage site (Myers et al., 2000; Mittermeier et al., 2011). Average elevation is 1200 m, ranging from 300 to 2695 m above m.s.l. This region receives high rainfall from southwest and northeast monsoons (Nayar et al., 2014). The length of the dry season increases from south to north, because the southwest monsoon lasts longer towards south (Davidar et al., 2005). Humid and tropical climate prevails on the lower reaches of the Western Ghats, but places at an elevation of 1500 m and above experiences more temperate like climate with 15oC average annual temperature but (Nayar et al., 2014). Western Ghats harbors one of the fine tropical forests in the world. Tropical moist evergreen, moist deciduous, dry deciduous forests, scrub land, shola forest-grassland complex, Myristica swamps etc. are the major forest types found in this region (Davidar et al., 2005; Nayar et al., 2014).

Taxonomic studies on the oligochaetes of Western Ghats 'biodiversity hotspot' started towards the last part of the 19th century by the description of *Perichaeta* (now *Megascolex*) *lawsoni* from Nilgiris (in Tamil Nadu) by Bourne (1886). As of now, around 230 species are reported from the Western Ghats (Julka et al., 2009; Nair et al., 2010; Siddaraju et al., 2010; Narayanan et al., 2016a, 2017, 2019). The list of earthworms is being expanded by the discovery of several new taxa and new reports from the Western Ghats (Julka et al., 1997, 2004; Nair et al., 2010; Narayanan et al., 2017, 2019; Anuja et al., 2020). This includes considerable number of alien earthworm

species either from different zoogeographical realms or other parts of Asia.

Bourne (1886) described *Perichaeta mirabilis* from Naduvattam, now it is considered as a synonym of *Amyntas corticis* (Kinberg, 1867). Hence, it is supposed to be the first alien earthworm species recorded from the Western Ghats. However, the diversity and distribution pattern of alien earthworm species in the Western Ghats is still not fully understood. Here we have made an attempt to present a checklist of the entire taxonomically valid alien earthworm species recorded from this region. As Dubois (2017) stated, accurate taxonomic and faunistic checklists are basic works for all studies dealing with biodiversity.

Materials and Methods

This checklist is based upon the review of available published literature on the earthworms of Western Ghats. Major literature reviewed are of Stephenson (1923), Aiyer (1929), Julka (1988), Kathireswari et al. (2005), Kathireswari and Julka (2008), Siddaraju et al. (2010), Yadav (2014), Narayanan et al. (2016a,b,c,d, 2019) etc. Species are arranged in families along with species author, species are arranged alphabetically within families.

Results

Present study revealed the presence of 39 alien earthworm species belonging to 22 genera and 8 families (Table 1), which are from the Ethiopian, Nearctic, Neotropical, West Palaearctic and Southeast Asia regions. All species of the genera such as *Allolobophora*, *Amyntas*, *Aporrectodea*, *Bimastos*, *Dendrobaena*, *Dichogaster*, *Eisenia*,

Eiseniella, *Eudrilus*, *Eukerria*, *Gordiodrilus*, *Lumbricus*, *Metaphire*, *Nematogonia*, *Ocnerodrilus*, *Octolasion*, *Pheretima*, *Pithemera*, *Polypheretima*, *Pontodrilus*, *Pontoscolex* are exotic to Western Ghats. However, the records of certain species like *Amyntas agrestis*, *Lumbricus rubellus*, *Pheretima darleiensis* etc. need to be validated. Interestingly, three families, Benhamiidae, Eudrilidae and Rhinodrilidae are exotic to the region.

Table 1. List of exotic earthworms reported from Western Ghats

Sl. No	Family and species	Remarks
Family MONILIGASTRIDAE		
1	<i>Drawida barwelli</i> (Beddard, 1886)	Reported by Siddaraju <i>et al.</i> (2010), its record needs to be validated
2	<i>Drawida peguana</i> Gates, 1925	Reported by Siddaraju <i>et al.</i> (2010), its record needs to be validated
Family LUMBRICIDAE		
3	<i>Allolobophora chlorotica</i> (Savigny, 1826)	
4	<i>Aporrectodea rosea rosea</i> (Savigny, 1826)	
5	<i>Aporrectodea trapezoids</i> (Dugès, 1828)	
6	<i>Bimastos parvus</i> (Eisen, 1874)	
7	<i>Bimastos rubidus</i> (Savigny, 1826)	
8	<i>Dendrobaena octaedra</i> (Savigny, 1826)	
9	<i>Eisenia fetida</i> (Savigny, 1826)	
10	<i>Eiseniella tetraedra</i> (Eisen, 1826)	
11	<i>Lumbricus rubellus</i> Hoffmeister, 1843	Reported by George <i>et al.</i> (2017), this record needs to be validated
12	<i>Octolasion cyaneum</i> (Savigny, 1826)	
13	<i>Octolasion tyrtaeum</i> (Savigny, 1826)	
Family RHINODRILIDAE		
14	<i>Pontoscolex corethrurus</i> (Müller, 1857)	
Family ACANTHODRILIDAE		
15	<i>Pontodrilus litoralis</i> (Grube, 1855)	
Family EUDRILIDAE		
16	<i>Eudrilus eugeniae</i> (Kinberg, 1867)	
Family OCNERODRILIDAE		
17	<i>Eukerria kuekenthali</i> (Michaelsen, 1908)	
18	<i>Gordiodrilus elegans</i> Beddard, 1892	
19	<i>Nematogonia panamaensis</i> (Eisen, 1900)	
20	<i>Ocnerodrilus occidentalis</i> Eisen, 1878	
Family BENHAMIIDAE		
21	<i>Dichogaster affinis</i> (Michaelsen, 1890)	
22	<i>Dichogaster annae</i> (Horst, 1893)	
23	<i>Dichogaster bolawi</i> (Michaelsen, 1891)	
24	<i>Dichogaster modiglianii</i> (Rosa, 1896)	
25	<i>Dichogaster saliens</i> (Beddard, 1893)	
Family MEGASCOLECIDAE		
26	<i>Amyntas agrestis</i> (Goto & Hatai, 1899)	Reported by Siddaraju <i>et al.</i> (2010), its record needs to be validated
27	<i>Amyntas alexandri</i> Beddard, 1901	
28	<i>Amyntas corticis</i> (Kinberg, 1867)	
29	<i>Amyntas gracilis</i> (Kinberg, 1867)	
30	<i>Amyntas rodericensis</i> (Grube, 1879)	Reported by Siddaraju <i>et al.</i> (2010), its record needs to be validated
31	<i>Metaphire bahli</i> (Gates, 1945)	
32	<i>Metaphire birmanica</i> (Rosa, 1888)	Reported by Yadav (2014), its record needs to be validated
33	<i>Metaphire houlleti</i> (Perrier, 1872)	
34	<i>Metaphire peguana</i> (Rosa, 1890)	
35	<i>Metaphire posthuma</i> (Vailant, 1868)	
36	<i>Pheretima darnleiensis</i> (Fletcher, 1886)	Reported by Siddaraju <i>et al.</i> (2010), its record needs to be validated
37	<i>Pithemera bicincta</i> (Perrier, 1875)	
38	<i>Polypheretima elongata</i> (Perrier, 1872)	
39	<i>Polypheretima taprobanae</i> (Beddard, 1892)	

Existence of 52 exotic earthworm species has been documented from India (Julka 2014, Ahmed & Julka 2017; Narayanan et al., 2019). All species have been presumably introduced from other bio-geographical regions by human commerce (Julka, 1988, 2014). Of all the recorded exotic species from India, 75% are known from the Western Ghats. Gonzalez et al. (2006) stated that the effects and implications of invasive species in below ground terrestrial ecosystems are not well known compared to above ground terrestrial and marine ecosystems (Gonzalez et al., 2006). In India conservation and management of above ground biodiversity has been paid more attention as compared to that of belowground biodiversity (Julka and Paliwal, 2005). Alien earthworm's ecology, its effect on native species abundance, survival and other aspects of the exotic species are not studied in detail in our country. According to the recent reports by Narayanan et al. (2015, 2016b) the occurrence of the exotic invasive species such as *Pontoscolex corethrurus* (Müller, 1857) and *Metaphire houlleti* (Perrier, 1872) in Kerala State was reported around 123 years back (Fedarb 1898, Michaelsen 1910, Stephenson 1916), and now they are found widely colonized in the entire stretch of the state, irrespective of the edaphic, altitudinal and habitat differences (Narayanan et al. 2015, 2016c). The same is true in the case of *Amyntas alexandri* Beddard, 1901, *A. corticis* (Kinberg, 1867), and many species of *Dichogaster* and *Eudrilus eugeniae* (Kinberg, 1867) (Narayanan et al., 2012, 2016d). A few of them are reported from the deep interior forests of the Western Ghats. Majority of the reported lumbricids are from the cooler temperate like regions of the Western Ghats. Once an exotic species has become established in a new place, regional and species characteristics seem to be the key factors determining their spread (Gonzalez et al., 2006). Western Ghats has sustained extreme environmental degradations such

as deforestation, commercial tree plantations, unsustainable and intensive agriculture activities, excessive cattle grazing, unscientific road construction, industrial mining, urbanization etc. (Nair, 1991). These anthropogenic activities are helping the range expansion of many alien species and this further adding the nail to the plight of native species. Once an alien earthworm species is established in a region, it is found extremely difficult to eradicate them, same as the case of many alien invaders of other groups. Many regions of India remain unexplored for earthworm fauna, and the Western Ghats is not an exception.

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Impact of Mikania on ecosystems



Dr. Muthumperumal
Dr. Magesh G

Mikania micrantha is a fast growing vine, native to Central and South America. It was intentionally introduced into a number of countries and has since become a major weed in Southeast Asia and the Pacific and is still extending its range. It is called as mile-a-minute that has been listed as one of the world's top ten worst weeds (Cronk and Fuller, 1995) and later it has been listed as one of the 100 worst invasive alien species in the world (Lowe et al. 2001). Mikania is one of the most serious invasive species in plantations, agroforestry and agricultural systems, and natural forests in the moist tropical zones and Asia-Pacific region. This herbaceous mile-a-minute weed is known to cause substantial economic and ecological loss in forestry and plantation sectors where it introduced, particularly Asia-Pacific countries (Sankaran et al., 2008).

This weed grows rapidly up to 9 cm in 24 hour and can produce enormous amounts of seed, which can be dispersed by wind or by attachment to machinery, animal fur and human clothing or possessions (Choudhury 1972, Waterhouse and Norris 1987; Holm et al., 1991). After the establishment in the new environment, it can smother the existing vegetation by forming dense thickets. The phenotypic plasticity and altered gene expression in different environmental conditions may allow a species to occupy novel climate (Alexander and Edwards 2010). This phenomenon supports the distribution in different altitudinal gradient (Prabu et al., 2014). Elevated CO₂ concentration (Song et al., 2009), contrasting light, soil and water conditions (Zhang and Wen 2009) supports the spread of *M. micrantha* in various landscapes.



Invasion history

In India, *Mikania* has been observed a rapid growth in the state of Kerala and Assam over the years which affected the forests and tea plantations causing damage to the ecosystems and economy of the country.. This plant has been reported from 15 Indian states including Western Ghats with varying level of infestations (Banerjee and Dewanji 2012). The plant is reported to cause extensive damage in forests and plantations of northeast and southwest India by reducing growth and productivity of several plantation crops such as Oil palm, Rubber, Teak, Eucalyptus and Coconut (Sankaran et al., 2008).

Impact of *Mikania* on ecosystems

Once established *M. micrantha* can have a major impact on natural ecosystems, in particular forest communities. This species can smother native vegetation, eventually killing many plants including trees, decreasing biodiversity. *M. micrantha* also produces allelochemicals which have been shown to inhibit the germination of a number of agricultural seeds. *Mikania* also interferes with flowering, natural pollination by insects and the harvesting of crops (Day et al., 2012). The presence of the weed alters soil chemical characteristics and the soil microbial community, possibly creating a favourable condition for its prolific growth and spread (Li et al., 2006). Studies in southern China have shown that there is local adaptation at the genome level in *Mikania* and that is representing a major evolutionary mechanism for successful invasion wherever the species is introduced (Wang et al., 2008).

The volatile oil from *M. micrantha* flowers contains high concentrations of β -pinene and β -pinene, both of Terpenoids which are effective insect repellents Hao and Ge (1999). These diverse group of secondary

compounds with a variety of functions, playing an important role in plant-plant, plant-insect and plant-pathogen interactions. Baldwin et al. (2006); Cheng et al. (2007); Paschold et al. (2006). β -Caryophyllene is an important volatile sesquiterpene of plants that may serve as allelochemical to influence the neighbouring plant growth or as an indirect defence to attract natural herbivore enemies. β -caryophyllene was also a major sesquiterpene in *M. micrantha* stems leaves and flowers. This allelochemical inhibi the germination native species' seedling growth (Wang et al. 2009).

M. micrantha is an agricultural weed where it can rapidly grow and smother a large number of crops. This can result in large economic losses through a reduction in yields and an increase in costs for control of this species. There are few studies on the economic impact of *mikania* in plantations of Malaysia and Indonesia. Teoh et al. (1985) reported that it competes with immature rubber, oil palm and cocoa, and poses threat to tea, coffee coconut plantations and fruit orchards. Day et al., (2011) observed that in Papua New Guinea, this invasive vine smother the cash crops such as banana and taro often killing the plants, and it overgrows on cocoa plant. It also retards the growth and yield of young oil palms and coconut palms. This weed also ease flowering and pollination and interfere harvesting of coconut (by smothering fallen nuts), oil palm and cocoa plant.

Mikania can be found in tea plantations of Kerala and Assam In a pilot field survey made to identify the natural insect enemies of *mikania* to develop a sustainable control method, the pests recorded were polyphagous, and a number of them were pests on some crops (Abraham et al. 2002b). In this

context, the mirid bug *Helopeltis theivora*, which was found to be damaging to mikania in Kerala is a serious pest of tea in Assam and elsewhere (as the tea bug or tea mosquito); it is also a pest on cocoa in tropical Asia (Manabendra and Rudrapal, 2011).

In an other survey made to assess the occurrence, spread and severity of mikania infestation in natural forests, forest plantations and agricultural systems of Kerala part of Western Ghats, it revealed that the weed has become widespread in 35 years since it was first reported in the state (Nair, 1968). In the forest, majority of Teak and Eucalyptus plantations and other miscellaneous species were affected moderately, which includes *Acacia auriculiformis* and *Faulcataria molucanna* (Sankaran and Pandalai, 2004). Young teak trees are severely affected by Mikania more than any other timber species, probably because of the favourable conditions provided by the lighter canopy (Sankaran et al., 2001). Mikania infestation at this stage affects the growth and productivity of young trees and even smothers them (Muraleedharan and Anitha, 2000).

Controlling Measures

The current cultural practices and thin canopies favour mikania invasion in teak plantations in Kerala, and where the weed is not managed intensively and regularly, productivity and profitability are significantly reduced (Muraleedharan and Anitha, 2000). Under physical control Sickle weeding, uprooting and digging are the main measures for mikania in practice. Hoeing, shovelling, tilling and mowing are also used in frequently. Uprooting during the initial stages of growth is the most effective physical control method. Hoeing is used in tea plantations in Assam to remove mikania, especially in nurseries and young plantations (Rajkhwa et al., 2005; Puzari et

al., 2010). All of the physical control methods discussed above are generally labour intensive, expensive, time-consuming, unsustainable and inefficient in bringing about effective long-term control. This weed was reported under chemical control method using diuron + 2,4-D, followed by paraquat in the sugarcane plantation (Widyatmoko and Ryanto, 1986). Foliar herbicides, such as 2,4-D (sodium/dimethylamine salts), glyphosate, paraquat, diuron, oxyflurofen, dalapon and triclopyr, are widely used in plantations. This weed needs to be controlled before it flowers and sets seed (Barbora, 2001).

Sankaran and Pandalai (2004) developed a herbicide-based eradication to forest plantations in Kerala that was cheaper and more effective than mechanical interventions. Herbicidal control of mikania was attempted in plantations of teak. Herbicide treatment such as triclopyr + picloram (1.75 l/ ha), triclopyr (0.5 l/ha), glyphosate (2.5–5 l/ha) and diuron (1–1.5 kg/ha) were highly effective in controlling mikania in all three situations. It was also observed that after 3 months, weed biomass got reduced by 95%..

Conclusion

First and most cost effective approach to prevent the biological invasion is to restrain the introduction of alien species to a new locality. Therefore, regular field monitoring is very necessary for the early detection of introduction of the Mikania species in a new locality and rapid response; (removal of species) but people should be educated and made aware on alien species and its impacts.

Webinar on Locust Invasion Challenges & Management Strategies



Mr. Binish M.B.

Amidst the panic wreaked by the coronavirus pandemic, the western region of our country is facing large scale invasion from desert locusts. Aggressive swarms of crop-devouring short-horned insects have invaded more than two dozen districts covering almost half a lakh hectares of desert areas in western India. Rajasthan, Madhya Pradesh, and Gujarat have become the worst affected states. This attack among other threats could lead to a major food security crisis in the region explained Dr Maya during her introductory talk during the Webinar on locust invasion and its management strategies organised by the Environmental Information System (ENVIS).

Dr B A Daniel, Senior Scientist (Entomology) in Zoo Outreach Organization and the chair of IUCN SSC South Asian Invertebrate Specialist Group was the keynote speaker of the event.

Eighty-nine members including Environmental professionals, researchers and students from Tamil Nadu, Kerala,

Karnataka, Maharashtra, Gujarat, Uttar Pradesh, and Punjab actively participated and interacted in the webinar.

The keynote speaker discussed about the locust invasion, from the biology of the locust to the current invasion scenario and described how the pandemic adversely affected the management of locust invasion. He also presented the route map of the desert locust infestation between January and July 2020 using maps. Furthermore, he observed that in India, adult groups and swarms were maturing throughout Rajasthan.



Webinar ON

Locust invasion – Challenges and Management strategies

Expert Speech by

Dr. B A Daniel
Senior Scientist (Entomology),
Zoo Outreach Organization, India

TOPIC : DESERT LOCUST

Event Moderator

Mr. Binish M.B.,
Information Officer,
ENVIS RP, AVV

Event Coordinator

Dr. Maya Mahajan
Associate Professor &
ENVIS Coordinator,
ENVIS RP, AVV

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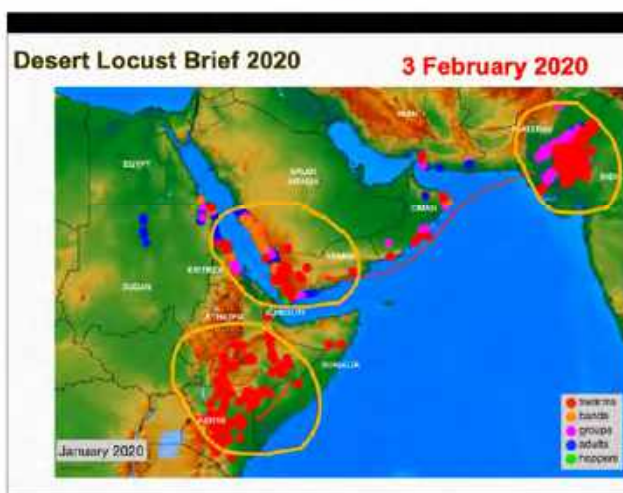
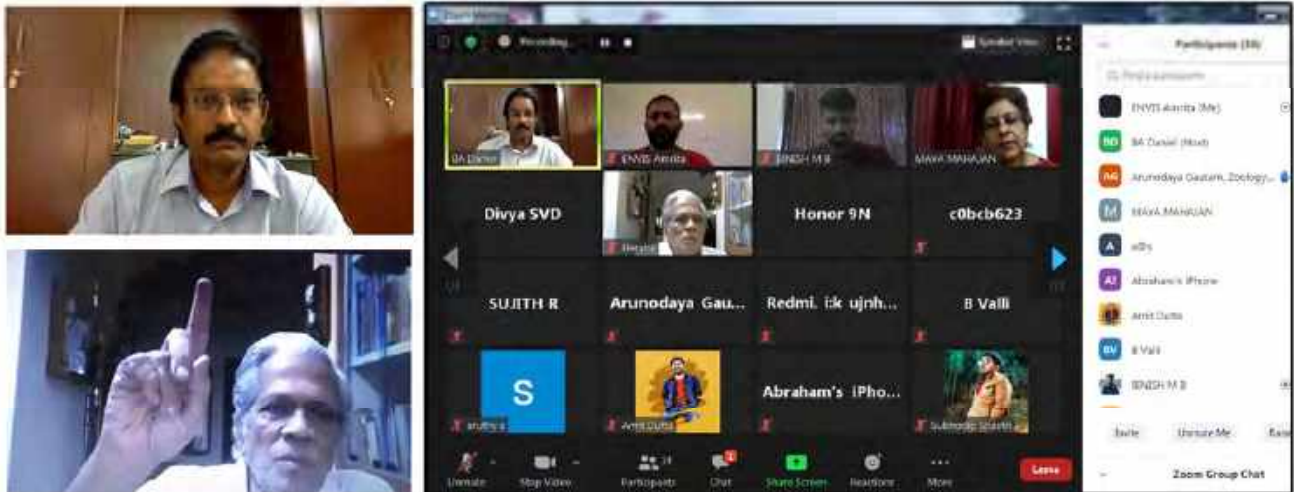
ENVIS RP, Centre for Sustainable Future

Amrita Vaidya Vidyasagaran (AVV), Coimbatore, Tamil Nadu

AMRITA
VISHVA VIDYAPEETHAM

Speaker also explained about how solitary locust becomes gregarious and how it affects agrarian ecosystems and food security. Further, he explained about management strategies using organophosphates, early warning and making sounds to drive them away etc

Participants including Dr Maya Mahajan asked several questions and expert speaker revealed many interesting facts about locust invasion. Webinar ended with the vote of thanks from Mr Binish M. B, Information officer, Envis Center.



Advances of Geospatial Applications in Environmental Management'



Dr. Magesh G

The Environmental Information System (ENVIS) Resource partner for 'Science-based management of biological invasion/invasive alien species in India' at Amrita Vishwa Vidyapeetham (AVV), Coimbatore, successfully conducted a webinar addressing the 'Advances of Geospatial Applications in Environmental Management' on July 27th.

Dr Maya Mahajan, Associate Professor & ENVIS coordinator (AVV), welcomed the dignitaries and led the session. Dr Magesh G briefed about GIS and its relevance in environmental management during his introductory speech. Mr Vinod P G, Managing Director of GeoVin solutions (P) Ltd., was the guest keynote speaker of the event.

Vinod P G is a GIS expert from Kerala working under his proprietary firm GeoVin Solutions (P) Ltd, a Geomatics based Consultancy firm at Thiruvananthapuram, Kerala. He discussed various applications of GIS in environmental management and gave an insight into various case studies of GIS works conducted at Kerala. Furthermore, he

depicted the importance of GIS and its applications in mapping and managing the Covid-19 pandemic during his concluding session.

The webinar was a grand success and received good appreciation from the participants. A total of 385 participants including Researchers from various organisations, academicians, environmental professionals, and postgraduate students from various states across the nation registered for the program.



ENVIS
Resource partner on
invasive alien species in India

Amrita Vishwa Vidyapeetham,
Coimbatore,
Tamil Nadu

Presents

WEBINAR ON:
**"ADVANCES OF GEOSPATIAL
APPLICATIONS IN ENVIRONMENTAL
MANAGEMENT"**

Speaker:

Vinod PG,
Managing Director,
GeoVin Solutions (P)Ltd.,
Thiruvananthapuram.

Date: 27 July -2020
5:00pm - 6:00pm

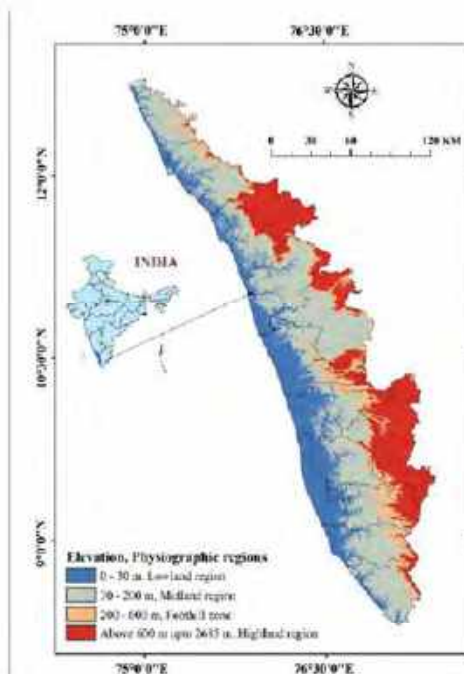
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Kindly join
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AMRITA
VISHWA VIDYAPEETHAM

Considering the overwhelming responses from the participants, the webinar was conducted as two sessions with the first session from 5 to 6 pm, followed by the

second session which was from 6.20 to 7.20 pm. The session concluded with an interactive session followed by a word of thanks for the speakers.



The SRTM (30 m resolution) data is the digital elevation model used. The satellite digital images (SRTM DEM) were georeferenced with UTM projected coordinate system, datum and spheroid as WGS 1984 and zone 43 North. The mapping has been done in 1:50,000 scale.

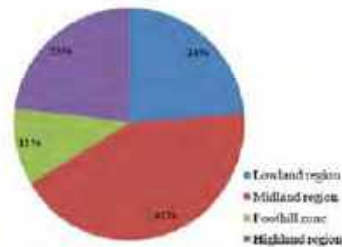


Fig. 2 Areal extent of physiographic regions of Kerala

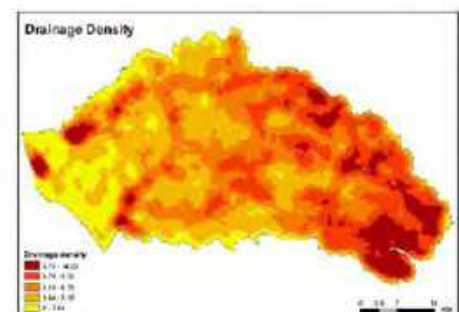


Fig. 7 Map showing Drainage density of the Dakshin-Kaladivur basin

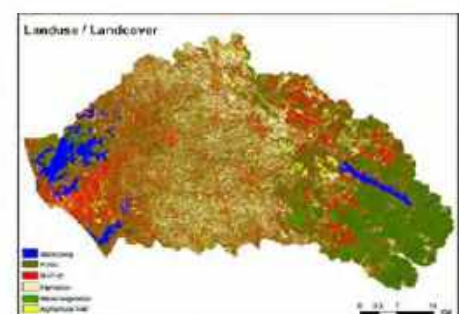
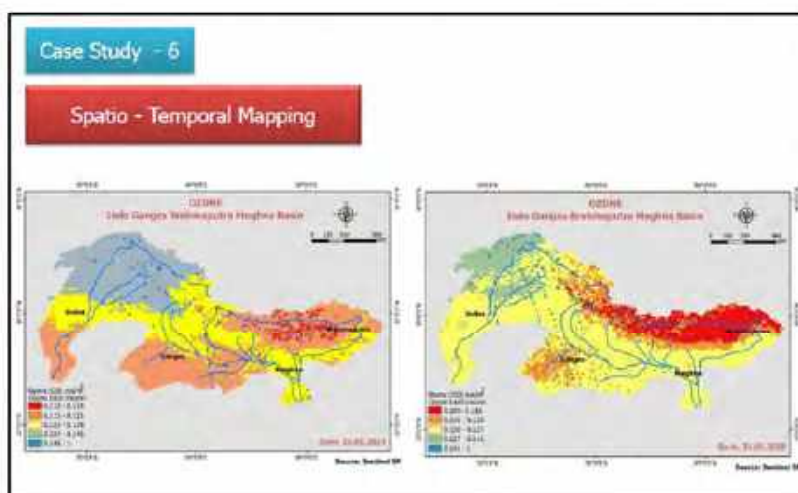


Fig. 8 Map showing Land use / Landcover of the Dakshin-Kaladivur basin

Webinar On Organic Kitchen Garden



Dr. Muthumperumal

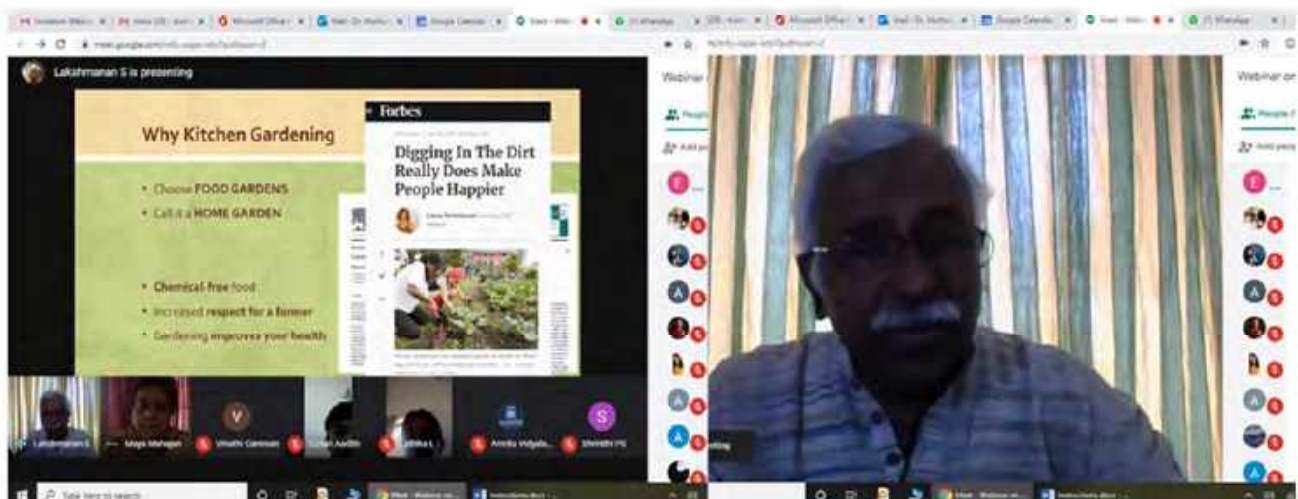
By realizing the fact that promotion of organic kitchen/herbal gardens is an efficient step towards building an environmentally conscious community, ENVIS (Environmental Information System) at Amrita Vishwa Vidyapeetham (AVV), Coimbatore, organised a webinar on 'Organic Kitchen Garden' on 28th July.

Dr Maya Mahajan, Envis coordinator spoke about adverse health and environmental impacts of food contaminated with chemical pesticides and fertilizers and unavailability of organic food at affordable price to common people. She also mentioned about difficulty in accessing vegetable markets due to COVID 19 related lockdowns, and emphasized on growing our own food which is safe and healthy in our own premises,

Around 100 Higher secondary school students from the 12th grade of Amrita Vidyalayam School, Ettimadai participated in the Webinar

Dr Maya Mahajan introduced the Guest Speaker Cdr S. Lakshmanan Iyer (Retd.), the Director of Bio Basics Coimbatore, a firm practicing organic farming and promoting organic-based food materials among the public. He introduced the subject using references of National and International movements for Organic agricultural farming systems, discussed the importance of organic kitchen gardens, and its role in sustainable practices.

Furthermore, he highlighted some key NGOs such as 'Urban leaves India', who are promoting Organic Kitchen gardens and explained some of their models to create and maintain an Organic Kitchen garden / Home gardens with minimal investment. At the end of the session, he interacted with students and responded to their questions. Dr Maya Mahajan concluded the session inspiring and promoting students to practice Organic Kitchen Garden at their home.



Glimpses of the Webinar



Feedback from Participants on Our Webinars

Dear Organisers,

Thank you for organising such a good webinar on Locust invasion- Challenges and Management Strategies. The webinar was very informative and gained a lot of information about the large and aggressive swarms of Locust that have invaded India. We gained much knowledge on the transformations of Locust from solitary to gregarious form and promotion of their rapid movements by the release of Serotonin. The webinar threw some spark in mind regarding the bio control strategies to be adopted. Hope the organisers will conduct more webinars on some other relevant topics too.



Dr. INDU M. NAIR
Assistant Professor
D B College
Alappuzha, Kerala

I am Silpa S Kumar, M. Tech student in Environmental Engineering and Management in the department of Civil Engineering, UKF College of Engineering and Technology, Parippally, Kollam affiliated under APJ Abdul Kalam Technological University, Kerala.

I attended the webinar on the topic 'Advances of geo spatial application in environmental management'. The webinar was very informative. Wonderful session and nicely explained. Thank you organiser's for such a great webinar.

Regards,
Silpa S Kumar
UKF College of Engineering and Technology,
Kollam

It was a very informative session. Moreover, we learnt new things and get to know about different methods to use places in our home usefully.

Anusuya.T
Amrita Vidyalayam,
Ettimadai, Coimbatore.

50+ students from Amrita Vidyalayam have given extremely positive response on our Kitchen Garden Webinar!

Photography Prize Winners



1st Prize

Harikrishnan R.K.



1st Prize

Amir Khan Ahmed



2nd Prize

Kavitha Vijay

Ankush Chowdhury



3rd Prize

Guhan S



3rd Prize

Kasturi Sule

Consolation Prize Winners



Hesha Sikligar



Aravind R



Jithin V

Special Prize for our 12 year old
Young Budding Photographer!!!!



Chetan S.



Poetry by Nature Lovers

MONSOON



Ar. Abhiruchi Arun
@catharsis_by_words
Mumbai

The sudden flash of light.. as if God was clicking a picture...
The loud claps of thunder.. inspiring both fear and awe..
A strange yet intriguing mixture...
The constant pitter patter of rain for hours on end in varying
tempo.. the most soothing rhythm ever...
The birds sing melodiously welcoming the rains as they arrive..
our natural weather forecast tellers so damn clever!!
The entire ambience transforms magically.. crickets chirping a joyous song..
Quenching the thirst of the parched earth.. that's been dry for too long...
Bathing & then draping it with a cool, comfy & airy blanket..
Spreading throughout the soothing fragrance of mud that has just gotten wet..
Greenery creeps in.. creeper by creeper.. stealthily.. swallowing bit by bit
the earth & painting it all green eventually...
Rivers gurgling into life.. & flowing for as far as one can tell..
Little streams & waterfalls born in the stony crevices
that enliven the rocks as well!!
A beautiful refreshing season.. my most favourite.. though how to enjoy it is
up to you..
Either get drenched up to your soul & jump in every puddle.. or maybe a cup
of coffee, a book & a warm blanket would just as well do..!
Such fun to watch colourful umbrellas moving about all around..
If it were up to me I'd most definitely have monsoons as the season all year round!

ZENITH OF PERSEVERENCE

She, an epitome of kindness and beauty
Her family, vast like the boundless sky,
She wished to love and to be loved always,
Little did she know the ultimate truth -
life stories are rarely 'happily ever after'.

Her beauty and tenderness began to fade away,
Her days of laughter and happiness
altered to nights of heaviness and agony.
Her face got tied with thick plastic sheets,
Her nostrils filled up with toxic smoke puffs,
Her hands and legs got cut down to pieces,
Her body scratched with broken glasses,
She could hardly breathe,
she was near death's door almost.

She looked around, Called for help
In so much pain, she cried her eyes out
But nobody ever cared.

When everything was said and done,
Her sunken eyes bled heavily,
Her entire body shivered like the tempest,
And there she is, from the most compassionate mother
to all powerful Goddess -
The Mother Earth she is!!!



Sherin Liya Babu
Ex. MASCOM Student,
Amrita Vishwa Vidyapeetham,
Coimbatore

RUMINATING LOCKDOWN

Knock knock ,(a masked myself peeks) is there anyone outside?
i am just stranded home-wrecked, sitting with no one beside,
i want to go out, but to lockdown rules i must abide
i have a thought i want to share, on nature's healing stride.

No factory work or oils burnt , a cleaner brighter sky
no chitter chatter or honking sound, just nature sweet chirping cry
The wild rejoice their urban jungle, with only their sorrows to die
Nature started healing her herself, maybe i should give it a try

Empty chairs and Empty tables, yet
my selfless smiling friends on my screen,
Forgotten friends are being missed more,
a hesitant green dot near their last seen,
Self realisation hit me hard, hey bro..
where have you so far been,
Realised even with my binge watch bucket list,
I decided to keep my house clean

All those joys and cries cures and deaths,
I have witnessed within my social four walls,
Though this virus in a way has effected us all ,
this was the truest of nature's calls.



Ibrahim Thahir
B.TECH EEE,
Amrita Vishwa Vidyapeetham,
Coimbatore

COIMBATORE

Tribal people get certified in making furniture from invasive weed



THIS STORY IS FROM SEPTEMBER 8, 2019

Centre to document, research & control invasive species

Updated on September 8, 2019, 10:12 AM



TOI

COIMBATORE: The centre for sustainable future at Amrita Vishwa Vidyapeetham here has been selected by the union ministry of environment, forest and climate change (MoEFCC) to set up an environmental information system (Envis) centre on invasive alien species. The centre would collect, document and

Media Coverage

YOURSTORY

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THINK CHANGE INDIA

Meet Maya Mahajan who is transforming harmful forest weeds into eco-friendly furniture

By Think Change India

GLOBAL INNOVATION EXCHANGE

FOR SOCIAL ENTREPRENEURS

OUR IDEA

BROWSE

Updated Mar 26, 2019

GOALBOOK

Conserving forest by making furniture using Lantana an invasive alien species in forest to generate livelihood for tribal

<https://www.amrita.edu/news/andhra-pradesh/conserving-forest-by-making-furniture-using-lantana-an-invasive-alien-species-in-forest-to-generate-livelihood-for-tribal>

Jewels of nature: Tribals learn to make ornaments out of Lantana camara

Updated Mar 26, 2019



COIMBATORE: Nearly 15 tribal people from Singampatti village near Koval Ghat, Coimbatore, underwent a training on Wednesday to make jewellery and small toys out of the wood of Lantana camara, an invasive plant species found in the region.

Most of the tribals were women making their living by collecting and selling amla and honey. This is the third part of the training. "We have already conducted training for them to make furniture and organic farming. In the third part of the training, we teach them to make toys and said Maya Mahajan, associate professor centre for sustainable future, Amrita Vishwa Vidyapeetham. "These products are eco-friendly with as it has natural colours and wax. We have set up a machinery in their village. The villages can use them once they know the art of making them," Maya explained.

indianwomenblog.org

BUSINESS

Maya Mahajan Assembles Her Weed Furniture Business In Sync With Tribal Life

BY NESHA KHANNA
MARCH 07, 2019

What do you think of when you read the words "Sustainable Living"?

For most of us, it means not leaving the water running when brushing our teeth or turning off the lights when not in use. But sustainable living means a lot more than just that. Go to a forest near your city, and you'll see the local tribal communities living the sustainable life. For them, sustainable living means living in peace and equity with the forest around them. For

THE LOGICAL INDIAN

Home > Social Responsibility > How To Make Use Of A...

How To Make Use Of A Forest Killing Weed? Engaging Tribals, This Professor Is Making Eco-Furniture

Sayantani Nath Nath

Update: 2018-10-09 05:42 GMT

Editor: Sayantani Nath Nath



the better india

Shop Stories Indian COVID Soldiers Awards Sustainability Brands in Action Impact Climate 101



How Tribals Are Making Eco-Friendly & Cheap Furniture Using Weed That Otherwise Destroys Forests

In this project, the tribal community is involved in the mechanical control of lantana by manually cutting, and at the same time, they are trained in making low-cost furniture, handicraft, toys and other utility articles using Lantana wood.

the better india

THE TIMES OF INDIA
CITY

City Coimbatore Mumbai Delhi Bengaluru Hyderabad Kolkata Chennai Agartala Aizawl Agartala

Weather Tamil Nadu Elections

NEWS / CITY NEWS / COIMBATORE NEWS / TN TRIBAL PEOPLE GET CERTIFIED IN MAKING FURNITURE FROM INVASIVE SPECIES

THIS STORY IS FROM MARCH 11, 2019

TN tribal people get certified in making furniture from invasive species

Vishek Swaroop | TNN | Mar 15, 2019, 20:39 IST



COIMBATORE: A total of 30 Irula tribal people from Seengapatti, a settlement in Boluvampatti forest range near the city, have completed a course on making furniture using Lantana camara, an invasive species in the region.



© picture-alliance/NurPhoto/V. Bhatnagar

Desert locust

Schistocerca gregaria



Locusts are insects belongs to grasshoppers family, which are most dangerous agricultural pests. A swarm of 40 million locusts can eat as much food as 35,000 humans, according to FAO estimates. Worst locust swarms was seen In Western Part of India during past few months which destroyed 50,000 hectares of cropland in India.

More than half of the 33 districts in Rajasthan were affected by the locusts. The current swarm has destroyed seasonal crops in the states of Rajasthan and Madhya Pradesh. This will lead to lower production than usual and a rise in prices of foodstuff. An agrarian crisis and subsequent food inflation will severely impede India's response to the coronavirus pandemic.

Source: <https://www.dw.com/en/india-locusts/a-53579409>



Ministry of Environment, Forest
& Climate Change



AMRITA
VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY

School of
Engineering

