

BIOINVASION

ENVIS Newsletter on Biological Invasion

Vol. 2 No.1 March 2021



Eichhornia crassipes (Water Hyacinth)



सामंसेव तसमं
Ministry of Environment, Forest
& Climate Change



अमरतायान् लभते ज्ञानम्

AMRITA

VISHWA VIDYAPEETHAM

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Ministry of Environment, Forest and Climate Change's (MoEFCC) Environmental Information System (ENVIS) resource partner at Amrita Vishwa Vidyapeetham 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.

Some of the objectives of the ENVIS Centre 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).
5. To support and promote research, development and innovation in ESIM.
6. To promote national cooperation and liaison with agencies concerned for exchange of environment and biological invasion related information.

Dr. Maya Mahajan

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Cover Photo

Eichhornia Crassipes (Water Hyacinth)

Water Hyacinth (*Eichhornia crassipes*) is a free-floating perennial aquatic plant, native to the South America. It causes dense mats of biomass on the water surface, which reduces dissolved oxygen in the water and the amount of light available to the underground vegetation. This growth causes an imbalance in the aquatic ecosystem and affects the fish population. The plant also destroys natural wetlands and causes flooding by blocking rivers and canals, and is a severe menace in flooded rice fields, where it reduces the yield considerably.

ENVIS Centre

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Impacts of Bio-Invasion by Nile Tilapia (*Oreochromis Niloticus*) In Telangana State

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Introduction:

Now a days, the main environmental concern is Biological invasions. The bio invasions have great impacts on the native flora and fauna and we are not aware of which introduced species will become invasive (Attayde et al., 2011). Invasion is a process done by human activities either accidentally or intentionally outside of its natural habitat (Kottelat and Whitten, 1996). Nile tilapia is a invasive species all over the world. Nile tilapia is a native species of Africa. From the upper Nile River southwards to the equator and west to the Atlantic coast Nile tilapia is distributed naturally (Trewavas, 1983).



Oreochromis niloticus (Source: Fishbase.org)

SCIENTIFIC CLASSIFICATION:

Kingdom	: Animalia
Phylum	: Chordata
Class	: Actinopterygii
Order	: Cichliformes
Family	: Cichlidae
Genus	: Oreochromis
Species	: O. niloticus

In India, Nile tilapia was introduced in 1987 for the purpose of aquaculture. According Singh and Lakra, 2006 a total of more than 7.17% is contributed by Nile tilapia to the inland fish production. In global production of inland fishes, tilapias occupy second place after the carps (Ridha, 2006) and Tilapia is generally known as Aquatic Chicken. Because of its tolerance to the wide

tilapia is a widely cultured species (Tsadik and Bart, 2007). Over the past three decades, the percentage and contribution of Nile tilapia was increased drastically to the capture fisheries production and global aquaculture (De Silva et al., 2004). On the other side, due to the introduction of species like tilapias indigenous species were affected by poor growth rates and age structure (Sreenivasan, 1967; Dwivedi et al., 2016). Local aquatic biodiversity was degraded by appearance increased invasive alien species (Lakra et al., 2008). Local biodiversity (flora and fauna) is highly affected by the population of Nile tilapia, which is competing with other local population for the food and shelter. Ichthyological diversity is greatly affected by Nile tilapia because of changing environmental conditions and lack of predation (Leveque, 2002; Vicente et al., 2011).

Habitat and Biology:

The optimum temperature for Nile tilapia is from 31 to 36 °C. They used in live in shallow waters. Tilapia is highly tolerant to environmental parameters such as salinity, dissolved oxygen and temperature. Nile tilapia can filter feed by entrapping suspended particles, including phytoplankton and bacteria, on mucous in the buccal cavity, and also periphyton mats are the main source of nutrition. At the age of 5-6 months it attains Sexual maturity in ponds. Temperature of water is main environmental factor in tilapia for the spawning (24 °C). Male fish starts the breeding process by digging a crater like spawning nest. This nest is the spawning place for ripe female. Then male fish starts fertilization, after the fertilization female fish carry the eggs into her mouth and in the mouth the eggs are incubated (Balarin and Hatton, 1979). There is a positive relation between fecundity and female fish body mass

Adaptive Characters for Invasion of Nile Tilapia:

Nile tilapias, in particular are highly successful invaders due to their environmental tolerance to water quality parameters such as salinity, dissolved oxygen, temperature and successful reproductive strategies and trophic plasticity (Lowe-McConnell, 1958; Leveque, 2002). This tolerance to environmental variability, along with their high fecundity, rapid growth rates and omnivorous feeding habits further contribute to successful invasions in estuaries as well as fresh water bodies.

Occurrence of Nile tilapia in Telangana:

Telangana state is endowed with vast and varied inland water bodies and diverse aquatic resources viz., tanks, canals, ponds, rivers and reservoirs. In Telangana, tilapias are distributed in all water bodies such as reservoirs, canals, ponds and tanks and *Oreochromis niloticus* is most occurring species of tilapia. Tilapia is the second most abundant species in the state of Telangana after the major carps. Compared to canals, ponds and tanks the growth and abundance of tilapia is more in the reservoir due to availability of food and enough space, also they get sexual maturity earlier in reservoirs. Tilapia is not a culture species in Telangana but they occupy second position in the production because of prolific breeding nature and easy to acclimatize to changing environmental conditions. Recently, a study stated that 36-49 % of the catch was Nile Tilapia variety in Ameenpur Lake.

Impacts of Bio-Invasion:

Each and Every aquatic ecosystem prone to some positive and negative impacts due to bio invasion of alien species.

Positive Impacts by invasive Nile tilapia on Non-native Aquatic Ecosystems:

Nile tilapia greatly reduces the water purification costs by eating aquatic vegetation and

detritus matter and therefore it is used for controlling of aquatic weeds. Since last thirty years Nile tilapia is cultured as commercial aquaculture species. Generally in stagnant waters *Chara* sp. and *Najas marina* are major problem, they could be controlled by introducing tilapia and some aquatic vegetative problems also solved by the invasion of tilapia. Most of the filamentous algae and floating plants are controlled by tilapia such as *Lemna* species and filamentous algae. Malaria causing mosquitos were greatly controlled by tilapia by eating mosquito eggs and larvae in many countries. The contribution of tilapias to global aquaculture production has increased over the past few years with production of 2.6 million tons in 2004 was and continued to rise up to 3.6 million tons in 2008 (FAO, 2010).

Negative Impacts by invasive Nile tilapia on Non-native Aquatic Ecosystems:

In many ways tilapia can cause problems to native bio diversity (Indigenous species). They disrupt the ecological balance and negatively affect the local environment by competing for food and shelter with other species and the intensive production of tilapia leads to Eutrophication of water. They gradually decrease the diversity and density of local plants, which are used for spawning and protection by the local fish species. Tilapia mostly feeds on the eggs of other species which leads to extinction of local species. Not only eating local species but also they spread disease with in the aquatic ecosystems. Along with commercial fisheries, recreational fisheries were also greatly affected by the invasion of Nile tilapia. In ponds and lakes the primary productivity mainly depends on the phytoplankton and zooplankton composition. Production is reduced by invasion of tilapia by grazing upon them. Phytoplankton and zooplankton number, composition and also biomass in tropical lakes and reservoirs can be reduced by Nile tilapia but phytoplankton biomass and size-structure .

influence the magnitude of effects. Singh et al., 2010 stated that local recourses and native species suppressed by the invasion of Nile tilapia

General Management Strategies:

Ecology, morphology, phenology, reproductive biology and physiology are the essential and basic knowledge for effective management of alien species. We can handle the problem of bio invasion by many ways. Strict quarantine, strictly controlled introductions and checking on imports are major ways to stop and suppress the invasion new species from other geographical areas. Moreover, one of the best methods to control is preventing the establishment of alien species. The general public can also participate in alien species prevention by educating themselves about this problem.

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Webinar on “Ecoswaraj: towards rainbow recovery for justice and sustainability”

The *Environmental Information System* (ENVIS) Resource Partner at Amrita Vishwa Vidyapeetham (AVV), hosted a webinar on '*Ecoswaraj: towards rainbow recovery for justice and sustainability.*'

Attended by more than 60 participants, the webinar held on December 1st, 2020 was graced by the presence of eminent Environmental and Social Activist Ashish Kothari, the founder of the NGO Kalpavriksh.

Dr. Magesh G., Programme Officer of ENVIS RP welcomed the participants from various colleges, and Dr. Maya Mahajan (Associate Professor & ENVIS Coordinator, AVV) introduced the chief guest to the audience and said that her students are very curious to know about what is eco-swaraj and rainbow recovery as environmental experts including her often discuss about green and sustainable solutions and requested him to throw more light on rainbow recovery.

Mr. Kothari is a prominent figure in the environmentalism and social activism domain working on development, environment interface, biodiversity policy, and alternatives. His NGO Kalpavriksh deals with environmental and developmental issues and he has been associated with peoples' movements like Narmada Bachao Andolan and Beej Bachao Andolan. Working on a broad range of organisations, Mr. Kothari has been a member of Steering Committees of the World Commission on Protected Areas (WCPA) and IUCN Commission on Environmental, Economic, and Social Policy (CEESP) from 1998 to 2008. He has also been a co-chair of IUCN Inter-commission Strategic Direction on Governance, Equity, and Livelihoods in Relation to Protected Areas (TILCEPA) from 1998 to 2008. Furthermore, Ashish Kothari has also served on the steering group or governing board of the CBD (Convention on Biodiversity) Alliance, the ICCA Consortium, and Greenpeace International.

The poster features a green abstract background on the left. At the top, a dark oval contains the text "Webinar on". Below this, the title "Ecoswaraj : Towards a Rainbow Recovery for Justice and Sustainability" is written in a stylized font. To the right of the title is a graphic of a green leaf with a water droplet containing a globe. Below the title is a circular portrait of Ashish Kothari. To the right of the portrait, the text "Speaker : Ashish Kothari" is followed by "Environmental and Social Activist" and "Kalpavriksh /Vikalp Sangam". To the right of this text is a clock icon with "4.30 to 6.00 PM" and a calendar icon with "1" and "1-12-2020". Below the portrait, a hand icon points to the text "Webinar Link : https://meet.google.com/pcu-eatw-qno". At the bottom, the text "Organised by Environmental Information System Resource Partner on Biological Invasion" is followed by "Amrita Vishwa Vidyapeetham Coimbatore- 641112, Tamil Nadu" and "Website : www.amrita.edu/center/envis". Logos for the Ministry of Environment, Forest & Climate Change, the Environmental Information System, and Amrita are also present.



Mr. Kothari is currently coordinating the *Vikalp Sangam* (Sanskrit for 'Alternatives Confluence') process which provides a forum for organizations and individuals working on development alternatives across India to come together. During his lecture, Mr. Kothari expressed the necessity for society to build on the emerging concept of 'Eco-Swaraj,' referring to radical ecological democracy in light of the rare critical political, economic, and ecological juncture that we are at, due to COVID19



“The current model of development has put a strain on ecological resilience; endangered natural resource-based livelihoods and has produced glaring poverty and economic inequalities. We are rapidly approaching a tipping point as violence against nature, communities and cultures is on the rise. COVID-19 and the related global crisis have provided an excuse for more authoritarian and corporate profits, or opportunity for systemic transformation towards justice, equity and sustainability,” said Mr. Kothari, in his valuable lecture. The Eco-Swaraj initiative should draw lessons from several grassroots initiatives and diverse strands of resistance that have sprung up in South Asia and the rest of the world.

Ashish Kothari recommended the need to embrace a recovery that is not just based on restricted notions of green or red, but is multi-coloured and founded on creating dignified livelihoods, protecting nature, ensuring justice for all, and reviving solidarity. The rainbow recovery, with its strong democratic impulse, seeks to provide space to the most marginalised people in



decision-making. “Embracing radical ecological democracy will require achieving human well-being through empowering all citizens and communities to participate in decision-making. It would also need to ensure socio-economic equity and justice and respect the limits of the earth,” said Mr. Kothari, who then peacefully answered the questions raised by the students during the live interaction and Q&A session.

The strong feedback to the webinar has encouraged the organising committee to host much more webinars of such potential. Kamallesh B J, one of the students who attended the seminar said, “That was a mind-blowing webinar. I would like to personally thank the organising committee for organising this webinar, and Mr. Ashish for his patience while answering all the question.”



KAMALESH B.J
Amrita viswa vidyapeetham,
Coimbatore.



Debolina Banerjee
WWF-India, West Bengal

Invasive Alien species in your locality

I am from West Bengal, so I want to write some words about invasive or alien species of West Bengal. West Bengal is an East Indian state and consists of various enormous mammals, birds, reptiles, plants etc. But there are word limitations so I pick up some invasive species which are very common in my locality and I want to give some positives and negatives of those invasive or alien species.

So the first question is what is Invasive or alien species? The species that migrates into or deliberately or accidentally introduced into our community. Sometimes these species are beneficial but most of the time it is dangerous. It includes flora and fauna also. In the case of invasive plant species- rapid growth, early flowering, high phenotypic plasticity, production of large no of seeds etc. are observed. According to BSI (Botanical Survey of India) 173 alien plant species are found in India (2016). According to ZSI (Zoological Survey of India) 157 alien animal species are found in India (2017).

Kolkata is the capital city of the state of West Bengal and third most populous metropolitan city of India. In this city region not so called green scenery is observed. Some common herbs, shrubs and trees are found. If I consider common invasive plants, then some species are found in my locality or my home premises. Likes- *Calotropis* sp. (family-Asclepiadaceae), in Bengali common name is-Akanda, it is native to Tropical Africa. Overall *Calotropis* sp. throughout the state it is observed. Generally, it's flower used for holy purposes. It also has medicinal values- leaves are used in treatment of paralysis, root powders used as gastric secretion

etc. It is the host for Monarch butterflies. Though the milky extracts from the plant is a poison.



Figure 1. *Calotropis* sp.

Second is *Eichorrnia* sp. (family-Pontederiaceae), in Bengali common name is Kachuripana; it is native to Tropical America. All over aquatic bodies are mostly filled with Kachuripana. It is a very fast spreading plant species and its seeds can remain viable for more than 28 years. So it becomes problematic; as a result, water loss, oxygen losses etc. are observed in water bodies. In tribal regions, it is used as vegetables or medical treatment



Figure 2. *Eichorrnia* sp.

Third is the famous *Lantana camara* L. (family- Verbenaceae), in Bengali common name is Putush; it is native to Tropical America. In all parts of the state in waste ground, *Lantana camara* is reported. It is very dangerous for livestock animals. In some parts, it is used for medicinal purposes. Fourth is *Parthenium* sp. (family- Asteraceae), Bengali name is Jayadrath, it is native to America. Sometimes it is used in allopathic treatments. But ultimately, it's a very allergic plant.



Figure 3. *Lantana camara* L.

If I consider common invasive animals, then small numbers of species are found in my locality or my home premises. In insect's species- *Orthezia insignis* Browne, the common name is Lantana bug; it is native to South and Central America. It is threatened for plants because- it feeds on host plants.

In reptile's section- *Calotes versicolor*, common name is Garden lizard, it is native to South and Southern Asia. In Bengali, it is called “girgiti/ roktochosa”. Overall it is not poisonous but Garden lizard's skin full with poison. Another remarkable invasive species in reptile's section is- *Trachemys scripta* Elegans, common name is Red eared slider, it is native to Mexico regions. Red eared sliders are very poisonous and harmful to other populations of water bodies.



Figure 4. *Trachemys scripta*

In the bird's section- *Acridotheres tristis*, the common name is Myna, it is native to Asia. In Bengali, it is called “Shalik/ Vat Shalik”. In India, it is a symbol of love or prejudice. It is an indicator of habitat changes. In the bird's section, other invasive species are very common- *Passer domesticus*, common name is House sparrow; it is native to Eurasia to North Africa. In Bengali, it is called “Chorui”. These species can cause headache etc.



Figure 5. *Acridotheres tristis*

All invasive species are not harmful, but most of the species are harmful. So in the harmful or poisonous case, control of invasive or alien species are very difficult things because their population size is increasing at a very fast rate. But we can control them by biological, mechanical and chemical processes. In both cases of flora and fauna, we can control them by using herbicides or foliar spray or using other prey or predator species or regular monitoring.

Webinar on Aliens in Indian Aquascapes and Strategies for Management

In light of World Wetlands Day Celebration 2021, the ENVIS Resource Partner on Biological Invasion at Amrita Vishwa Vidyapeetham hosted a webinar on the topic, 'Aliens in Indian Aquascapes and Strategies for Management' on January 20th, 2021.

The webinar engaged students, researchers and academicians aiming to converse about wetland conservation and management of invasive species, and promote awareness of the need to preserve, protect, and restore the world's wetlands, and of the importance of managing biological invasion. Dr. Biju Kumar, Professor and HoD, Aquatic Biology & Fisheries, University of Kerala was the guest keynote speaker. He is also the Member of the Expert

Committee on Invasive Alien Species (IAS) constituted by the National Biodiversity Authority (NBA), Chennai. The webinar witnessed an impressive turnout of sixty-five members comprising Environmental professionals, researchers, and students from several countries like the United Kingdom, Malaysia, Sri Lanka and various states of India viz. Tamil Nadu, Kerala, Karnataka, Maharashtra, Gujarat, Uttar Pradesh, West Bengal, Jharkhand, Bihar, Tripura, and Punjab expressing active participation and interaction.

Dr. Magesh G (Programme Officer of ENVIS RP, Amrita) greeted the participants, and Dr. Maya Mahajan (Associate Professor & ENVIS Coordinator, Amrita) introduced the chief guest to the audience and moderated the event.

Webinar on
Aliens in Indian Aquascapes and
Strategies for Management

Speaker:

Dr. A. Bijukumar
Professor and Head of the Department
Department of Aquatic Biology and Fisheries,
University of Kerala, Thiruvananthapuram

Registration link:
<https://forms.gle/QT4uEnv99hNcEQS66>

20-01-2021
5:00 pm to 6:00 pm

Organised by
ENVIRONMENTAL INFORMATION SYSTEM
RESOURCE PARTNER ON BIOLOGICAL INVASION
Amrita Vishwa Vidyapeetham
Coimbatore-641112, Tamil Nadu
Website: www.amrita.edu/center/envis

Poster for the webinar



She also mentioned that usually more focus is given on Invasive plants in terrestrial ecosystem while any discussion related to biological invasion and expressed that this time on the occasion of Wetlands day centre decided to have discussion focusing on invasive animals especially fishes in aquatic ecosystems.

Dr. Biju Kumar, the keynote speaker explained the alien invasion in the Indian freshwater ecosystem in detail and described the appropriate management practices applicable. He described the different invasive alien species found in Indian freshwater ecosystems. He explained that a significant number of alien species get introduced into the wetlands both intentionally and by accident. The most notable species are Nile/red tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*),

Thai pangus (*Pangasiandon hypophthalmus*), and common carp (*Cyprinus carpio*). These species have evolved as a great threat to aquatic diversity and pose a serious threat to the economy. The webinar ended with the keynote speaker addressing the questions raised by the students who found the event to be of great value. Shuvam Chakraborty, a student from the University of Calcutta commented on the event, "It was a very well organised and very informative session. Seminars like this not only help students like me to gain more knowledge but also provides an extra interest towards the subject."

Shuvam Chakraborty
Ramakrishna Mission Vidyamandira,
University of Calcutta, West Bengal.



National Photography and Article Writing Competitions on Invasive Alien Species in Wetlands

As a Part of World Wetlands Day Celebration , ENVIS RP on Biological Invasion is Conducting a
National Photography and Article Writing Competitions
on Invasive Alien Species in Wetlands

Theme : Invasive Alien Species in Wetlands

Submission Guidelines for Photographs

- The photograph should depict the theme "Invasive Alien Species in Wetlands"
- The photograph must be original taken by the contestant with suitable caption

Link for submitting Photographs: <https://forms.gle/1S6D84U6CimAG4xk6>

Submission Guidelines for Articles

- The file must be in .doc/.docx format in English
- Each submission must have its own Title and details of the author [Name of the Author(s), and the Name of the Institution].
- The maximum word limit for the articles is 1500 words.
- Age limit : 18 and above

Link for submitting article: <https://forms.gle/DEmzuIX57gF92d2SA>

Last date: 02 February 2021

**ENVIRONMENTAL INFORMATION SYSTEM
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Website : www.amrita.edu/center/envis



On account of World Wetlands Day 2021, the ENVIS Resource Partner at Amrita Vishwa Vidyapeetham, Coimbatore, organised a 'National Photography and Article writing Competitions' on the theme 'Invasive Alien Species in Wetlands'. Globally, the aquatic invasive species pose a major ecological and economic threat to rivers, lakes and waterways through the displacement of native species and the alteration of hydrologic cycles, affecting nutrient cycles, altering food web dynamics, introducing diseases and parasites and hybridization with native species. In wetlands, aquatic plants, ornamental and commercially important fishes and some species of shellfishes are identified as the worst invasive organisms. To generate awareness about aquatic invasive species and its management, a national photography and article writing competition was organised by ENVIS center.

More than 40 entries were received from the contestants which were evaluated based on the relevance to the theme. Anvar K (CWRDM, Kozhikode) won first place. Meanwhile, the second and third position was shared between the duo Debomita Banerjee (Jogamaya Devi College) and Sharvesh S (Faculty of Agriculture, Annamalai University, Chidambaram), and Nikhil More (Savitribai Phule Pune University, Pune, Maharashtra.) and Saravanan U (Bishop Heber College- Tiruchirapalli) respectively.

In the article writing competition, around 14 entries were received. D. Dalini (Fisheries College and Research Institute, Thoothukudi) won first place. Hema Karthika R from College of Engineering Guindy - Anna University & Subrato Ghosh (Fishery Extension Officer, Directorate of Fisheries, Government of West Bengal) and Ms Vismaya K Sachithanandhan (Karunya Institute of Technology and Sciences, Coimbatore) bagged second & third place respectively. Thafna K K (MG University Kottayam) received the consolation prize. The prize-winning entries will be published in the ENVIS newsletter on Biological Invasion and the participants will also be awarded an e-certificate.

Congratulation to all the participants and the winners!

National Photography Competitions on Invasive Alien Species in Wetlands - winners



First Prize:



First prize:

Anvar K

Centre for Water Resources
Development
and Management (KSCSTE-CWRDM)
Kozhikode, Kerala

Second Prize:



Second Prize:

Sharvesh s

Faculty of Agriculture,
Annamalai University,
Chidambaram



National Photography Competitions on Invasive Alien Species in Wetlands - winners

Second Prize:



Second Prize:

Debomita Banerjee
Jogamaya Devi College
West Bengal



Third Prize:



Third Prize:

Nikhil More

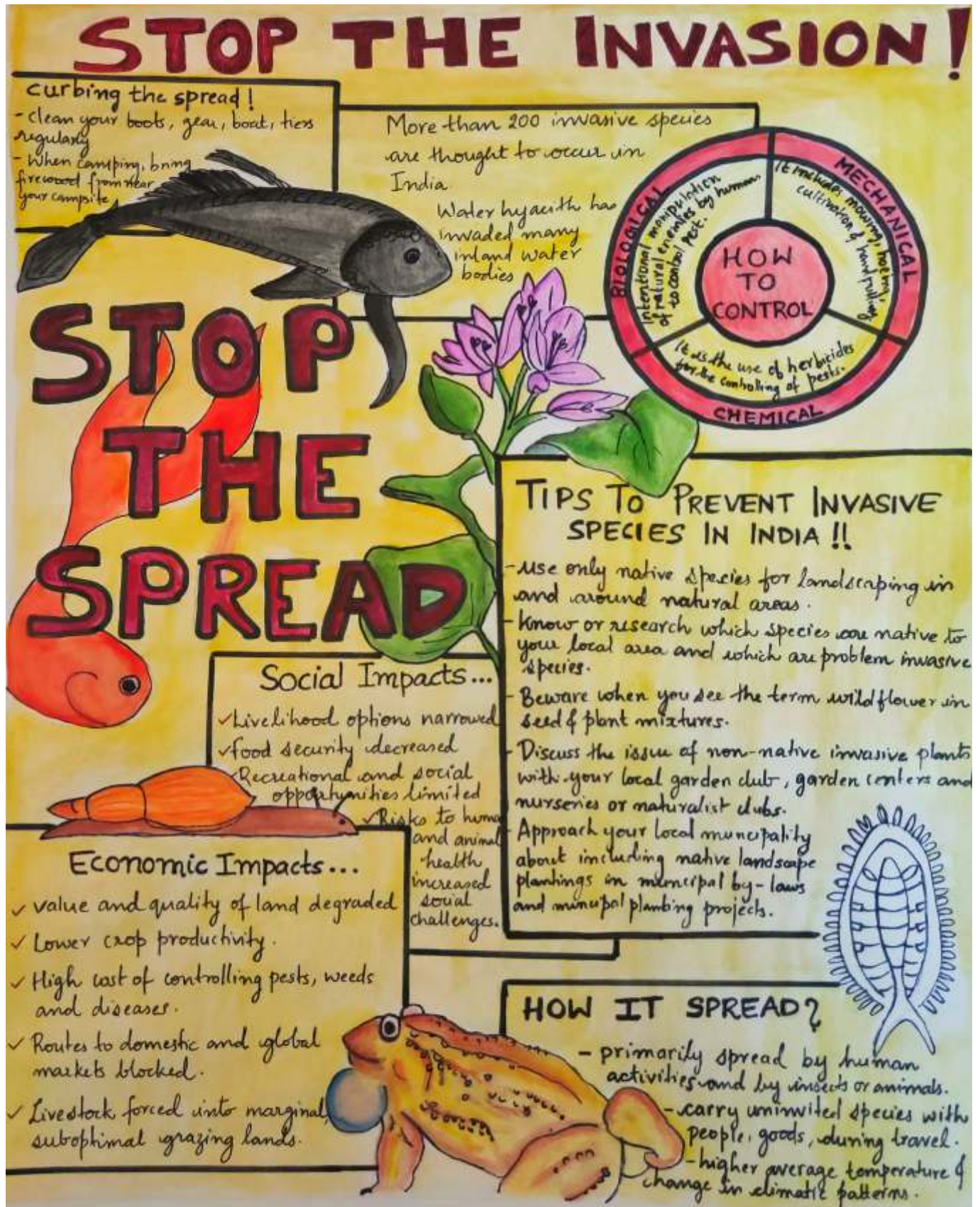
Savitribai Phule
Pune University
Pune, Maharashtra, India



Third Prize:(Back Cover)

Saravanan U

Bishop Heber College
Tiruchirapalli



Aarcha Ram

Amrita School of Arts and Sciences, Kochi, Kerala

National Article Writing Competitions on Invasive Alien Species in Wetlands winners



First Prize:

D. Dalini

Fisheries college and Research institute
Thoothukudi

Second Prize:

Hema Karthika R

College of Engineering Guindy
Anna University



Third Prize:

Vismaya K Sachithanandhan

Karunya Institute of Technology and Sciences
Coimbatore

Third Prize:

Subrato Ghosh

Fishery Extension Officer,
Directorate of Fisheries, Government of West Bengal



Consolation Prize

Thafna K K

MG University
Kottayam



Thafna K K
thafu@gmail.com

African snail (*Lissachatina fulica*) an invasive alien species and its prevention and control strategies in Kochin, Kerala

Invasive Alien Species

An alien species is a species introduced outside its natural past or present distribution; if this species becomes problematic, it is termed an invasive alien species (IAS). IAS are the most common threat to amphibians, reptiles and mammals on the IUCN Red List; they may lead to changes in the structure and composition of ecosystems detrimentally affecting ecosystem services, human economy and wellbeing (IUCN).

They are often introduced as a result of the globalisation of economies through the movement of people and goods, for instance via shipping, consignments of wood products carrying insects, or the transport of ornamental plants to new areas. They can disturb not only the environment or ecology, but also the local economy (Simberloff, 2003). IAS are such a problem that Aichi Biodiversity Target 9 and one clause of UN Sustainable Development Goal 15 – Life on Land specifically address the issue.

The most effective way to stop the negative impacts of IAS is through prevention of spread by regulating the trade or movement of a species. Once an IAS has arrived, early detection, monitoring and eradication can stop the species spreading



The giant African snail (*Lissachatina fulica*)

The giant African land snail *L. fulica* is a fast-growing polyphagous plant pest that has been introduced from its native range in East Africa to many parts of the world as a commercial food source (for humans, fish and livestock) and as a novelty pet. It easily becomes attached to any means of transport or machinery at any developmental stage, is able to go into a state of aestivation in cooler conditions and so is readily transportable over distances. Once escaped it has managed to establish itself and reproduce prodigiously in tropical and some temperate locations. As a result, *L. fulica* has been classified as one of the world's top 100 invasive alien species by The World Conservation Union, IUCN (ISSG, 2003) and also recognised as the second worst invasive alien species in the world by the global invasive species database (Lowe et al., 2000).

L. fulica is a polyphagous pest. Its preferred food is decayed vegetation and animal matter, lichens, algae and fungi. It has extensive negative impact on agriculture and can serve as vector for several parasites, including *Angiostrongylus cantonensis*, a nematode parasite that causes (human) eosinophilic meningitis, an emergent disease (Prociv, 2000). It has been recorded on a large number of plants including most ornamentals, and vegetables and leguminous cover crops may also suffer extensively. The bark of relatively large trees such as citrus, papaya, rubber and cacao is subject to attack. There are reports of *L. fulica* feeding on hundreds of species of plants (Raut and Ghose, 1984; Raut and Barker, 2002). Thakur (1998) found that vegetables of the genus *Brassica* were the most preferred food item from a range of various food plants tested. Apart from economic loss

and human health issues caused by *L. fulica*, they are also a general nuisance to people. Empty shells can act as breeding sites for mosquito larvae of different species (Jayashankar and Reddy, 2010). *L. fulica* can act as a vector of the human disease, eosinophilic meningitis, which is caused by the rat lungworm parasite, *Angiostrongylus cantonensis*.

***Lissachatina fulica* invasion in Kerala**

First introduction outside its native origin was to India in 1847 and northeastern states of India got affected during that period. The introduction of this snail to Kerala, the most Southern state of India was on 1950's and since till now.

Its first introduction happened through a researcher intentionally without knowing the impact caused by the snail but thereafter it has been introduced unintentionally through timber transport from foreign countries. Timber was mainly imported from African countries like Nigeria and from other countries like Burma and Malaysia which all are African snail infested regions. The imported timber is being transported to various timber mills in different districts of Kerala and three places of districts Kasargode, Calicut, and Alappuzha got infested this way. Presence of less predators, hermaphroditic nature, high reproductive rate, skill for hibernation, and generalist feeding nature makes them an invasive species (Thiengo et al, 2008) in Kerala. Giant African snail is known to attack more than 500 plant species, including vegetables, coconut, cocoa, papaya, banana, arecanut, coffee, and even rubber plants. The negative impacts caused by *L. fulica* in Kerala are the agricultural damage followed by cost of controlling the snails and the time spent for the control.

***Lissachatina fulica* invasion in Kochin**

With the onset of monsoon, giant African snails have started appearing in many parts of the Kochin city. Large snails were spotted at Karingachira, West Kochi and central city areas. People used to control the

molluscan population by sprinkling common salt over it. The spraying of larvicides also turned out to be useful in controlling the population to some extent. Kerala Forest Research Institute (KFRI), Thrissur, suggested the use of a concoction of tobacco and copper sulphate. It also suggested not to use any chemicals for the control of snails.

Prevention and control of *Lissachatina fulica*

A vast body of literature has accrued on the various methods of control available for *L. fulica* (Mead, 1961; Raut and Barker, 2002; Fischer and Costa, 2010). The FAO International Plant Quarantine Treatment Manual (FAO, 1981) describes protocols for treatments to eliminate infestations of *L. fulica* on non-plant cargo using hydrogen cyanide and cold treatments (Schotman, 1989). Various insecticides and fungicides were tested against *L. fulica* by Kakoty and Das (1987) who found that only copper sulfate solution produced high mortality rates. The usage of plant-derived molluscicides like *Cedrus deodara* oil, *Allium sativum* bulb powder, and *Nerium indicum* bark in snail control are very effective (Rao and Singh, 2002). In addition, Tobacco Decoction – Copper Sulphate mixture (TDCS) is an effective removal method against *L. fulica*.

Physical control can be efficient by making a strip of 1.5 m wide bare soil around nurseries. Barriers or screens can be constructed using corrugated tin, security wire mesh and ditches dug around fields (Schotman, 1989). Snails can be collected each day and destroyed by crushing or drowning. The public can be involved in such collections by using organized campaigns.

Biological control of *L. fulica* using its natural predators will affect endemic snail population, thus this method was not suitable in Kerala. Besides its natural predators *Sus scrofa*, *Rattus rattus*, *Bandicota indica*, *Herpestes edwardsii* and *Suncus murinus* are the main local predators which help us to eradicate giant African snail.

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Recent news on Biological Invasions

1. Children put leaf beetles to work on invasive weed in Tōtara Reserve, New Zealand: February 15, 2021 (Source: Stuff)

Children from a Manawatū school in Pohangina spent a day with Horizons Regional Council staff helping protect some native plants and insects. They learned about the use of beetles to control the pest plant, tradescantia while helping transfer some of the beetles to Tōtara Reserve in Pohangina Valley.

Horizons runs a weed-control programme at Tōtara Reserve, a designated regional park covering 340 hectares of bush. It is home to native flora and fauna, as well as tradescantia or wandering willie, a ground-covering weed that smothers small native seedlings hindering their growth in native bush blocks.

Horizons community biodiversity advisor Neil Gallagher said traditional weed control methods had proven futile in some plants, including tradescantia. “Bio-control agents like the tradescantia leaf beetle have been introduced as an alternative way to target.

A garden leaf vacuum was used to collect the beetles in large numbers, however, the students were excited to get involved and collect several by hand, placing them in containers for transport. At Tōtara Reserve, the students helped place the beetles in plants on the forest floor, where they can settle into their new home, before getting stuck into the tradescantia



Reference: <https://www.stuff.co.nz/manawatu-standard/news/300230336/children-put-leaf-beetles-to-work-on-invasive-weed-in-ttara-reserve>

2. Invasive Alien Birds May Threaten Himalayan Biodiversity in Coming Decades: January 26, 2021 (Source: The Weather Channel)

Alien birds are spreading across southeast Asia and could reach India—either due to escaping captivity or after being intentionally released, report researchers from the University College London (UCL). In a study published in Nature Ecology & Evolution, researchers show how alien species such as the zebra dove are a threat to India, as the Himalayas are particularly prone to the spread of non-native birds



Native in some of the Southeast Asian countries, the zebra dove (*Geopelia striata*) has spread across the region. Now it has an alien population in Thailand and Laos, among other countries. The study says once a bird has established itself as an alien species in a new region, living alongside native birds, it is most likely to continue spreading to other areas where those same native birds are present. The study improves on the existing methods to predict the spread of alien species. The researchers found that areas such as the Himalayas and parts of sub-Saharan Africa, which so far have not seen many alien species, could be under threat in the coming decades.

Senior author Alex Pigot of the UCL Centre for Biodiversity and Environment Research said: "Alien species—those that have been introduced to new areas outside their native range—are one of the leading causes of global biodiversity loss. Driven by human actions, alien species also represent a growing threat to food security, human health and many economies. Predicting where they will spread next, so that we can find ways to mitigate the damage, is an urgent global challenge."



Reference: <https://weather.com/en-IN/india/environment/news/2021-01-26-invasive-alien-birds-may-threaten-himalayan-biodiversity>

3. Online misinformation has caused an unlikely disaster in the real world: biological invasion: December 30, 2020 (Source: Scroll.in)

Canadian goldenrod, an incredibly harmful weed, has spread worldwide because of the false belief that its honey is a 'superfood'. Biological invasions occur when non-native species spread rapidly, out-competing native species and causing major ecosystem change and damage. Invasive species are a major threat to biodiversity worldwide, threatening the diversity of plants, animals and insects where they spread. History shows that a lack of understanding about a species which leads to unintended consequences is not new. The non-native Nile perch wreaked havoc in Lake Victoria's ecosystem decades after being introduced in the 1950s, most likely with a view to benefit the fishing industry. Japan still suffers a raccoon pest problem after a 1970s children's television cartoon show inspired families to import raccoons as pets. But the ease of spreading incomplete, or false, information via the internet magnifies the risk of far more devastating consequences.

In this study, they showed the impact of online misinformation on biological invasions of Canadian goldenrod (*Solidago canadensis*), an incredibly harmful weed due to its tendency to crowd out other plant species, thereby reducing biodiversity. Goldenrod has a high growth rate, and light, wind-dispersed seeds. It also changes soil properties by releasing chemical substances into the soil which impact on other plants.



Reference: <https://scroll.in/article/982560/online-misinformation-has-caused-an-unlikely-disaster-in-the-real-world-biological-invasion>

4. A new study shows how invasive species change during biological invasion: December 18, 2020 (Source: Phys.org)

A new study published in the scientific journal *Evolutionary Applications*, led by a research team from the Pablo de Olavide University (Seville, Spain), discusses about how species that have been introduced by humans in new places are different

compared to how they are in their native areas. The results show that such differences already occur before the introduction, so that the introduced individuals are not a representative sample of the native population of origin. Historically, many species have been deliberately introduced by humans outside of their native range for fun or purported benefits, and in many cases these species cause problems for local biodiversity, the economy, and human health. Today most introductions are accidental. A large proportion of these accidental introductions are due to the trade in pet animals, which are first captured in natural environments, and then later manage to escape or are released. Although many people do not know it, a substantial portion of these captured animals do not make it to the store, as they die during capture or transport.

However, individuals may not be equally likely to die, for example because some cope better than others with the stress of the new captive environment. "We wondered if there would be systematic differences between the individuals who died and those who survived. If so, the group of survivors would be different from the population of origin," explains Pim Edelaar, leader of the study, who argues that the same situation can also occur with capture. "It may be easier to capture some individuals than others, for example if they are more curious or more attracted to the food in the traps. So that could also cause systematic differences between the original source population and the group that ultimately is introduced into a new site."





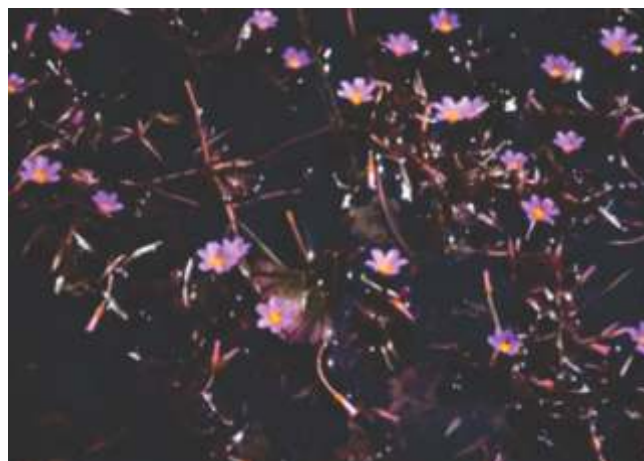
Reference: <https://phys.org/news/2020-12-invasive-species-biological-invasion.html>

5. Kerala's 'pink phenomenon' can choke water bodies and drains, warn scientists: December 15, 2020 (Source: DownTo Earth)

Avalapandi in Kerala's Kozhikode district is in the news due to the widespread growth of an aquatic alien plant which gives the water bodies pink color. The plant behind the 'pink phenomenon' is forked fanwort, which comes from the family of Red Cabomba (*Cabomba furcata*), according to TV Sajeew, senior principal scientist with Kerala Forest Research Institute (KFFRI) at Peechi near Thrissur.

Cabomba is a submerged perennial aquatic plant that grows in stagnant to slow-flowing freshwater. It dominantly belongs to Central and South America. But the aesthetic it has lent to water bodies should not be celebrated, cautioned Sajeew, who visited the village with a team of experts. "The plant will spread in the water bodies across the state, choking them as well as the drainage canals.

It requires a huge amount of oxygen to grow and that could badly affect freshwater biodiversity. The water quality would also be affected," he said. Among the measures to contain the spread of Cabomba include mechanical removal of Cabomba furcata and its drying on land; habitat modification to increase shading (planting trees); tarpaulin shade over Cabomba-infested area, especially where it cannot be mechanically removed; regular weeding on both aquatic and terrestrial habitats based on inputs from monitoring.



Reference: <https://www.downtoearth.org.in/news/wildlife-biodiversity/kerala-s-pink-phenomenon-can-choke-water-bodies-and-drains-warn-scientists-74645>

Green Events

Guest lecture on “we can't do business on a dead planet” at IIM Trichy

Dr Maya Mahajan, ENVIS coordinator, delivered an invited talk at IIM Trichy's flagship annual cultural & business fest - Dhruva on a topic “we can't do business on a dead planet” on 26th February 2021. The program was organised by The social responsibility club of IIM Trichy. She spoke about Sustainable development, egg shell model of sustainable development, happy planet index, global environmental issues and pathway towards sustainability including adopting green technology, sustainable business practices and attitudinal change. The event was a great success and the organisers thanked and appreciated her for her very informative lecture and for inspiring young minds towards adopting sustainability in their personal and professional life.



Maya Mahajan
Associate Professor, Centre for Sustainable Future
Environmental Scientist and Activist

Guest Lecture on
We can't do Business on a dead planet

26th February 2021, 4:00 pm



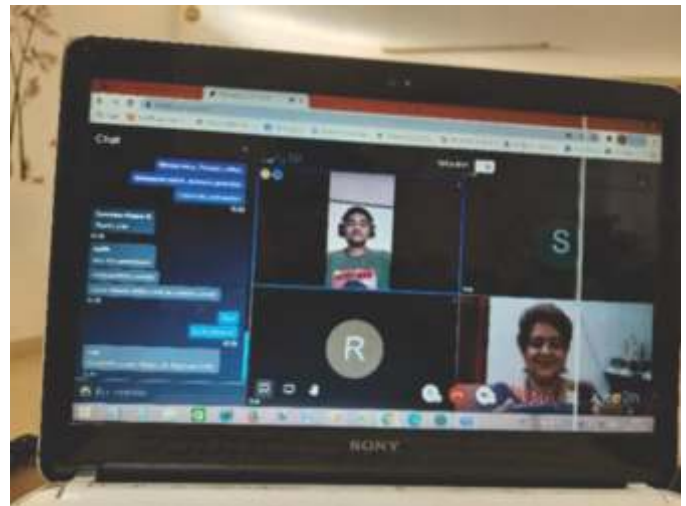
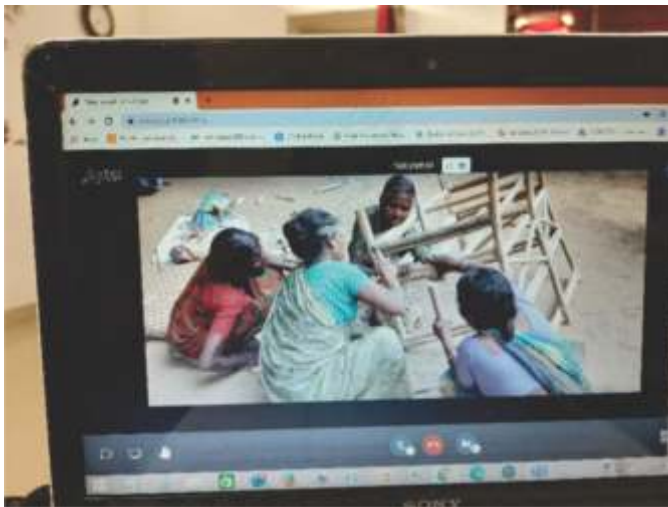
Women's Day Celebrations: “Tribal Women empowerment story in Siruvani”



As part of Women's day celebration 2021, Dr Maya Mahajan, ENVIS coordinator, delivered a Lecture on Women empowerment and shared a story of a group of empowered tribal women in Siruvani Hills, Coimbatore. Event was organised by Coimbatore Urban Biodiversity Group CUB. During her speech she explained how tribal women communities were empowered by transferring technology in Lantana furniture making which also helped in lantana management in the Siruvani Forest and will ultimately lead to biodiversity conservation in the forest. She also spoke about need of water hyacinth management in various lakes in

Coimbatore with peoples participation and requested volunteers to join the ENVIS center in various invasive species management and biodiversity conservation education and action programs.

Expert lecture on Sustainable management of Natural resources for Amrita Nursing college, Kochi



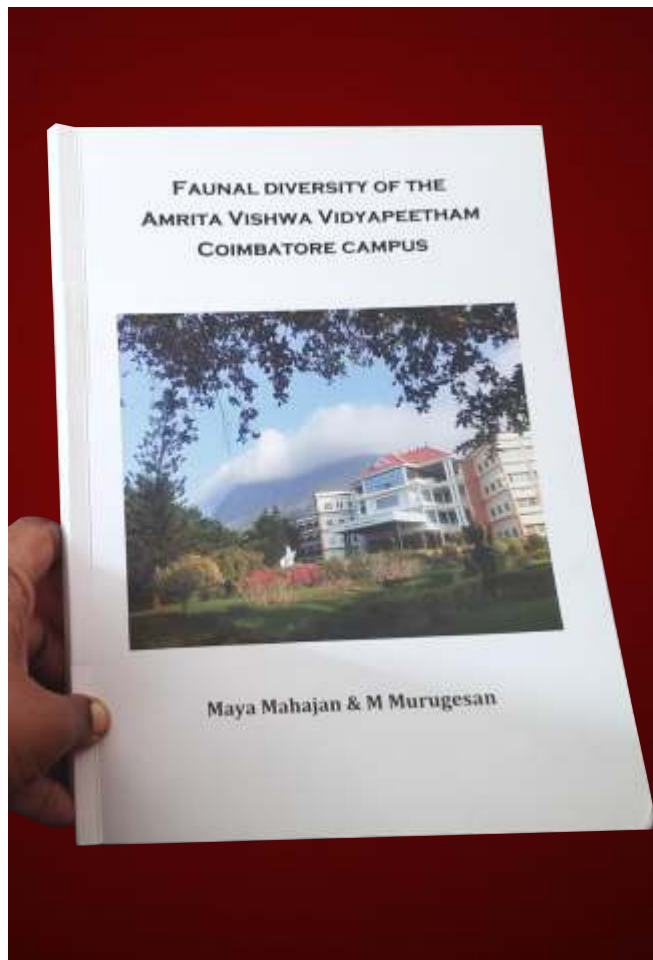
Dr Maya Mahajan, also delivered a presentation as a resource person in a National webinar on “Natural resources Cherish or Perish” on a topic “Nurture nature for Sustainable Future and Sustainable management of Natural resources”. The webinar was held on 25th February 2021 organised by Amrita college of nursing Kochi, Kerala. The webinar was a grand success with enormous participants

Book Publication

Faunal Diversity of Amrita Vishwa Vidyapeetham Campus

A book titled 'Faunal Diversity of Amrita Vishwa Vidyapeetham Campus' was published and printed for wide circulation. 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 book depicts 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. The campus has large number of fruiting and flowering trees and shrubs that provide habitat to the diverse fauna including varieties of insects, butterflies, birds, mammals and reptiles



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Your feedback on this issue, as well as short articles on biological invasion/invasive alien species and poems, artwork, paintings related to biodiversity conservation, waste management, climate change etc. for our upcoming newsletter issues are most welcome.

You can send your entries with your contact details to our email :
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