BIOINVASION

EIACP newsletter on Biological Invasion

Volume 3, No 3, January 2023

Senna spectabilis

Ministry of Environment , Forest & Climate Change

AMRITA VISHWA VIDYAPEETHAM

Senna spectabilis in the news

Pinarayi advocates policy to counter biological invasion

December 03, 2022 10:37 pm | Updated 10:37 pm IST - THIRUVANANTHAPURAM

THE HINDU BUREAU

COMMENTS SHARE READ LATER

Chief Minister Pinarayi Vijayan presenting the book of abstracts released for the national conference on Bioinvasions: Trends, Threats and Management to Additional Chief Secretary V. Venu in Thiruvananthapuram on Saturday

The Hindu Newspaper

Invasive species threatens wildlife habitats of Western Ghats

Rapid, uncontrollable invasion is hitting the carrying capacity of forests in Kerala to feed wildlife

April 24, 2022 06:57 pm | Updated April 25, 2022 03:52 pm IST - KALPETTA

E.M. MANOJ

COMMENTS SHARE READ LATER

Senna sepctabilis thrives in the Wayanad wildlife sanctuary and adjacent tiger reserves in Karnataka and Tamil Nadu. | Photo Credit: Special Arrangement

The Hindu Newspaper

Forest Department worried about spread of Senna spectabilis trees in Mudumalai

These have come in from Kerala and Bandipur; are displacing native species

September 19, 2019 11:38 pm | Updated 11:38 pm IST - UDHAGAMANDALAM

ROHAN PREMKUMAR

COMMENTS SHARE READ LATER

A young, juvenile Senna spectabilis tree growing in the midst of two native trees in the Mudumalai Tiger Reserve

The Mudumalai Tiger Reserve (MTR) may be facing the threat of being overrun by another invasive species of flora, with the *Senna spectabilis* making incursions into the reserve from neighbouring Kerala and Bandipur.

The Hindu Newspaper

Invasive plants to be removed from TN forests: State tells Madras HC

Additional Chief Secretary Supriya Sahu made the submission before a divisional bench of Justices V Bharathidasan and N Satish Kumar.

Published: 01st March 2022 05:43 AM | Last Updated: 01st March 2022 11:28 AM

Removal of invasive plant species from forests is a herculean task, in which no Indian State has managed to succeed so far.

By SV Krishna Chaitanya

Express News Service

CHENNAI: The Tamil Nadu government on Monday told the Madras High Court it would immediately start removing invasive plant species from forest areas, and to begin with, 700

The New Indian Express Newspaper

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About us

Ministry of Environment, forest and Climate Change's (MoEFCC) Environmental Information Awareness Capacity Building and Livelihood Programme (EIACP) 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 EIACP 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 liaise with agencies concerned for exchange of environment and biological invasion related information.

Dr. Maya Mahajan

Senna spectabilis: The progressing invasive threat of Western Ghats

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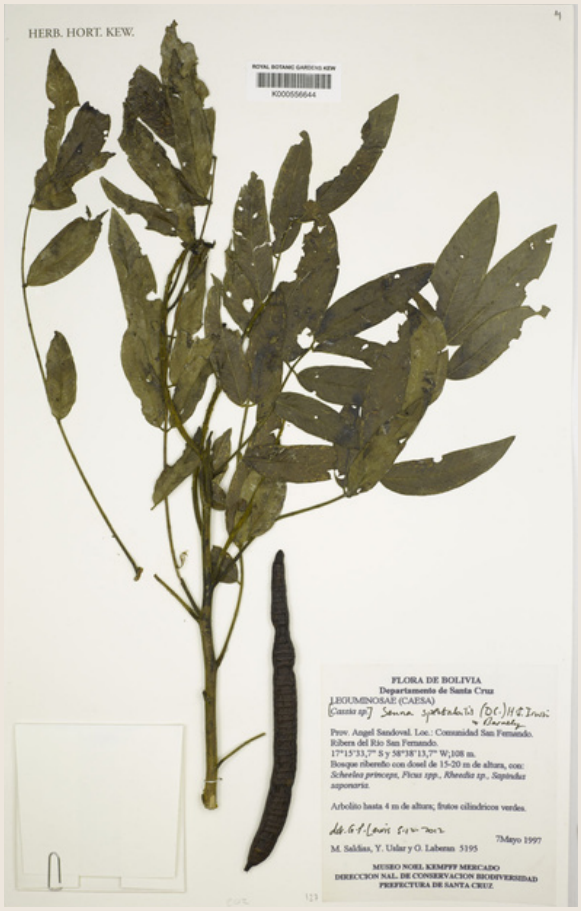
Introduction

Bio-invasion due to exotic and alien species is one of the prevalent complications worldwide. The process disturbs the traditional practices , obstructs the growth of native species, which contributes to extinctions, encumbers and slowdown natural evolutionary development stages which impacts not only the diversified covers of flora and fauna (Seebens et al., 2017; Anoop et al., 2021) but also influences the socio-economic structure of the communities which rely on natural resources from their native biodiversity. In the case of floral species, though the major ration of the species introduced of anthropogenic activities to improve and integrate regional livelihood, the most important mode of transmission is using animal vectors for severe proliferation (Richardson et al., 2000; Gosper et al., 2005). The process of spreading of the invasive species can be destructive as it can deteriorate various peculiar and significant features of native ambience. The passage of spreading through animals can unsettle the symbiotic pathways between the animals and native species, thus, collapses the evolutionary gauge (Farwig and Berens, 2012; Traveset and Richardson, 2014). Encompassing the ways of destruction caused by the invasive alien species, *Senna spectabilis* plays a considerable part worldwide.

General Characteristics

Senna spectabilis, native of many tropical countries including central and southern America, Philippines and Eastern and Southern Africa, pose a serious threat to the native species in India and globally. This multi-rooted plant grow in different sizes from small to medium, possesses some specific features include anti-termite character, resistant to fire and survive extreme flux of soil acidity (Datiles and Acevedo-Rodriguez, 2014). Due to its effective pattern of growth and rate of proliferation, the species is listed by Global compendium of weeds as 'Naturalized weed', 'Garden thugs' and '**Environmental weed**' (Randall, 2012). The savour of the fruits and vegetative features draw attraction of various herbivores (Anoop et al., 2021) which become the potential vectors and careers of the seeds. The possibility of the species to spread strongly worldwide is because they are drought-resistant and can be raised easily (Datiles and Acevedo-Rodriguez, 2014).



Systematic Position

Kingdom	: Plantae
Division	: Tracheophyta
Class	: Magnoliopsida
Order	: Fabales
Family	: Fabaceae
Genus	: Senna
Species	: S. spectabilis

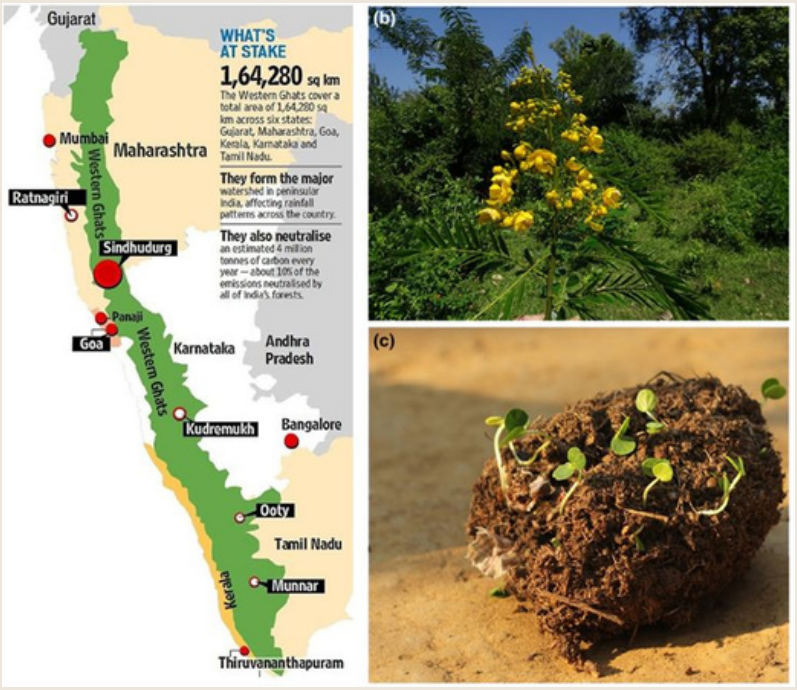
Image source : Internet

Indian Scenario

In India, introduction of *S. spectabilis* was done in Western ghats without any awareness of its potential of becoming an invasive species (Anoop et al., 2021). Lately, on acquiring the insight of its possible invasive behavior and lethal proliferation rate as they nearly established widely, their management strategies and implementation became complicated (Vinayan et al., 2020). As an example, the case of proliferation rate in Wayanad wildlife sanctuary increased to 23% more than their introduced numbers dating back to 40 years (Anoop et al., 2021). The adaptation to active dispersion mechanism is considered to be the reason for this rapid spread. In **Wayanad**, the major vectors identified were **elephants, Indian crested porcupine** and **chitals**, whose fecal matters contained the seeds and sprouted flowers of S. spctabilis (Anoop et al., 2021). In the reserve of Mudhumalai of Nilgiris district, the distribution of the species occupies a massive 1000 hectares.

Impacts

Considering the cases in India, the major threats due to *S. spectabilis* are identified around Niligiris Biosphere Reserve (NBR) and Wayanad wildlife sanctuary. The allelopathic characters carried by the leaves and other features of the species restrict the growth of other native plants when shedded off and starts decomposing. The impacts are also found in the regions and covers of Sathyamangalam, Bandipur and Nagarhole tiger reserves. The change of original posture of the sites impacts and destroys the habitats of majorly populated faunal species such as deers, elephants, tigers and gaurs.



a) Distribution of S.spectabilis
b) Inflorescence of *S.spectabilis*
c) germination of *S.spectabilis*

Image source : Internet

Conclusions

Though the introduction of the species was done to promote ornamental plantations, the effective transmission modes and the allelopathy of *Senna spectabilis* helped them to multiply densely and rapidly and thrive on the native lands. With a great ability to destroy the evolutionary chain and relationship between the native flora and fauna, the distribution of the species stands dangerous in the large scale as in the case of Wayanad and Mudhumalai. The management plans can be a cluster of destroying the species' habitat and converting them into value added products so that the progress can be achieved sustainably which can lead to a promising future and hold the larger hand in attaining the satisfaction of safeguarding the native floral and faunal habitats and culture. Unless the management strategies are sudden and effective, these alien species are capable of engrossing the hotspots of major reserved of Western Ghats.

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Anti - rabies vaccination drive

Members of EIACP team and
Amrita Animal welfare society

Anti-rabies vaccination drive held at Ettimadai

An anti-rabies vaccination drive was conducted for stray dogs and cats recently by the Amrita Animal Welfare Society along with Humane Animal Society (HAS), on the Amrita Vishwa Vidyapeetham premises at Ettimadai in Coimbatore city. At the drive, 27 animals were vaccinated, according to Maya Mahajan, convenor of the initiative. The animals were identified from Ettimadai and neighbouring villages, brought to the premises and administered the ant-rabies injection by medical experts, she said. Further, as the next phase of the drive, the animals would be sterilised, probably in December, she said.

November 4th 2022 marked the first ever vaccination drive conducted on campus. Environmental Information System Resource partner of Amrita Vishwa Vidyapeetham , Coimbatore and Amrita Animal Welfare Society jointly organised the drive.

Through the program, 20 dogs and 7 cats were successfully rescued, treated and vaccinated against rabies with the help of around 60 volunteers under the direction of Veterinarian, Dr. Naveen and patient welfare personnel, Mr. John Peter.

The Hindu Newspaper
dated 5th November

A report on the Anti - rabies vaccination drive

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Rabies is a viral disease that affects the central nervous system of mammals, including humans. It is transmitted through the saliva of infected animals, most commonly through bites or scratches. If left untreated, rabies can be fatal. Vaccination is the most effective way to prevent the spread of rabies and protect both humans and animals from the disease.

The Amrita Animal Welfare Society, AAWS, emerged as a branch of the Amrita Nature Club, with an initiative to protect and look after the animals within the premises of the campus. The idea that started as a group of like-minded people on WhatsApp, has now grown into a force of over 227 students, willing and determined to care and safeguard their animal friends. The works done by the club are usually centered around helping the dogs and cats found in and around the campus. A number of dogs and cats were rescued and many given up for adoption.

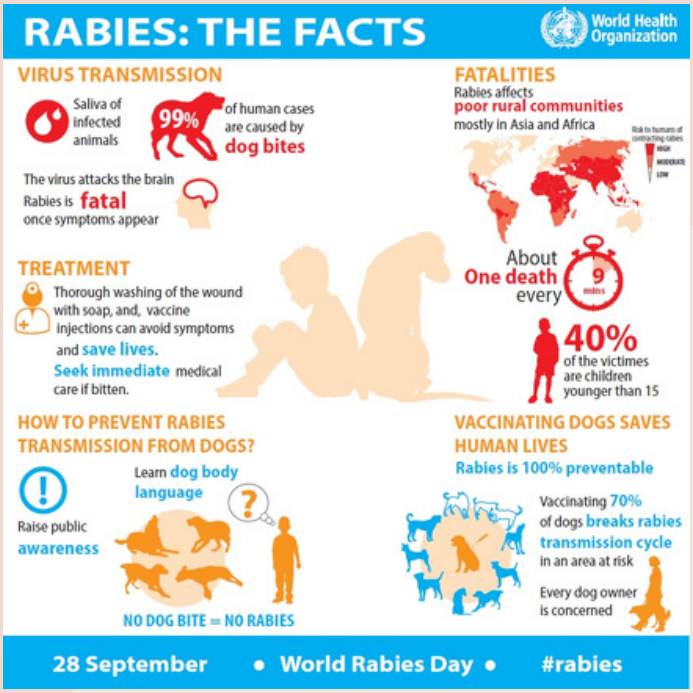
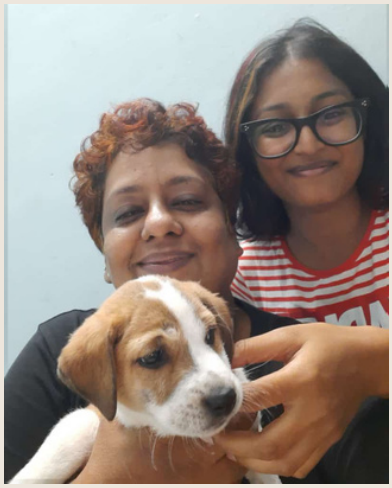


Image source : Internet

On 4 th November, 2022, the Amrita Animal Welfare Society with the help of the Humane Animal Society (HAS) conducted an anti-rabies drive for stray dogs and cats living in and around Amrita Vishwa Vidyapeetham, Coimbatore Campus, India. The drive was conducted, under the guidance of Dr. Maya Mahajan, coordinator of EIACP RP. The drive commenced with a session by Sri Satish Menon who currently serves as the Campus Director for Amrita Vishwa Vidyapeetham, Coimbatore Campus. An avid animal lover himself, he spoke about the importance of treating animals in a humane but responsible manner. Dr. Maya Mahajan spoke about the causes of rabies and importance of anti - rabies vaccination to ensure a safe campus.

The Humane Animal Society, HAS is a non- profit organization, committed to address the welfare of stray animals.The vaccinations were administered by Dr Navaneetha Krishnan S, resident veterinarian for HAS and was assisted by John Peter. The drive would not have been possible without their support and contribution. The drive was led by Sanjan, Eniyan , Chetan, Sai Saketh , Veeresh, Rama and Sushmita.



Photographs by
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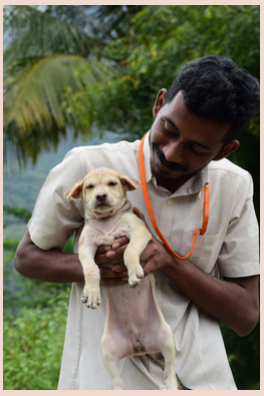
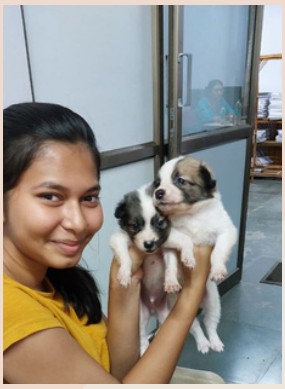
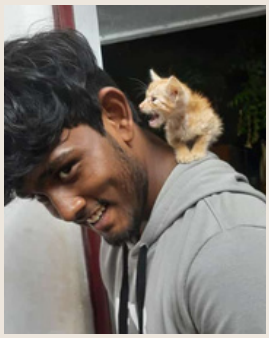
The students initiated a WhatsApp to gather animal lovers and enthusiasts to regularly update their Adda moments with their animal friends. During the initiation phase vaccination drive, Ms. Sanjana initiated a WhatsApp group to gather like minded - biophilics and kept the network active and connected. It has grown to a community of 222 animal lovers from the university campus. The group has committed to improving the well-being of animals.It was an amazing scene to see the animals in campus trusting students fully. During vaccination, the dogs cooperated so well and it was very easy for the doctors to vaccinate them. The members engage in rescue activities and have treated many stray animals.

The vaccination drive was not only beneficial for the animals, but it also provided an opportunity for the university students to get involved in a meaningful way and make a positive impact on their community. They find this activity an amazing stress buster.The students who volunteered their time to assist with the drive learned about the importance of vaccination and animal welfare, and they gained valuable hands-on experience in a healthcare setting.

Overall, the anti-rabies vaccination drive was a great success, and the Amrita Animal Welfare Society and HAS are already planning their next phase of the drive to sterilize the animals. The organizations hope to continue making a difference in the lives of stray animals on the campus and in the broader community.

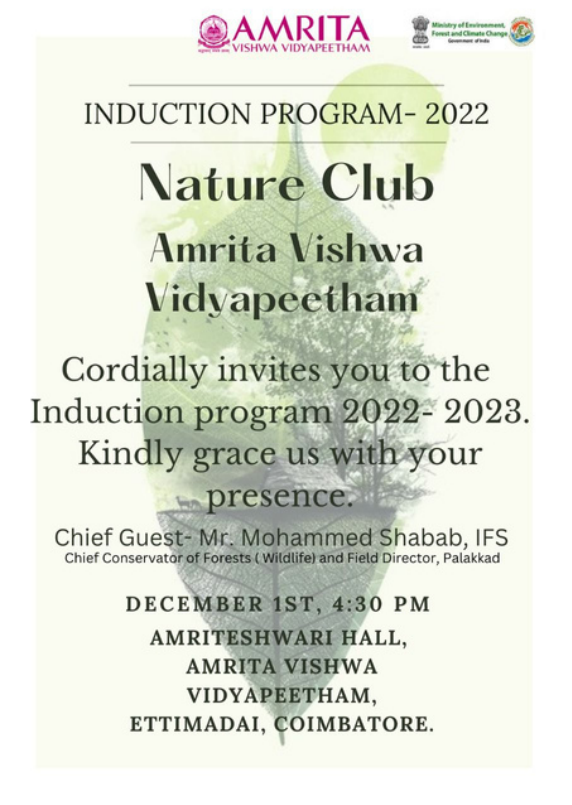





ADDA MOMENTS




Sensitization of Amrita students about nature conservation



""We do not inherit this earth from our ancestors , but borrowed it from our children"

True to this saying, the biophilics on campus have united with the EIACP team of Amrita to embark on a journey to show their love and care for nature.With great enthusiasm , we organised a sensitization program on nature conservation on 1st December at Amriteshwari Hall.

Mr. P Muhammed Shabab , IFS, Chief conservator of forests (Wildlife) and field director Palakkad graced the occasion with his insightful message on nature conservation.
The program was witnessed by our Registrar Dr. Shankaran , Retired Air commodore Mr. Satish Menon, campus director and other students in campus.

The chief guest emphasized on the need for community efforts in conserving nature. He pointed out the income generated by rural communities through the ecosystem goods and services. Mr. Satish Menon, Campus director highlighted the efforts taken at Amrita University for the conservation of nature. And Dr. Shankaran , registrar shared his experiences with nature conservation through his association with EIACP at Amrita University.

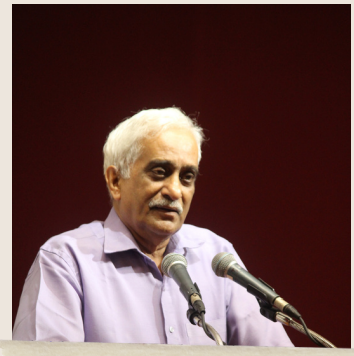
Dr. Maya Mahajan shared the importance of environmental conservation for the sustainable livelihood of future generations. She also highlighted the 21st century environmental crisis that the earth is facing and the need for joint efforts to attain a sustainable living for all.The program was planned and organised by the EIACP team and the core members of Nature club. Sai Saketh and Hrithika Devu Nair coordinated the entire program.

Some glimpses from the program

Mr. P. Muhammed Shabab , IFS addressing the students

Chief guest honored by Mr.Satish Menon

Dr. Maya Mahajan , EIACP coordinator addressing the students



Dr.Shankaran , registrar addressing the students

Nature dance by student volunteers.

Music performance by student volunteers.

Photographs by
Ashrit Mantha
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Glimpses from the 9th Global Forum of UNAOC at Morocco

9th GLOBAL FORUM
United Nations Alliance of Civilizations
Fez, Kingdom of Morocco | 22-23 November 2022

We are happy to share with you that Ms. Sushmita Krishnan , Information Officer, EIACP RP at Amrita Vishwa Vidyapeetham, Coimbatore represented India as a youth delegate at the United Nations Alliance of Civilizations 9th Global Forum at Fez , Morocco from 21st November to 24th November 2022.The UNAOC Global Forums is a high-profile event of UNAOC and a leading platform for promoting intercultural dialogue, understanding and cooperation led by the United Nations General secretary , his excellency , Antonio Guterres .

This year's Forum brought together official delegations representing UNAOC's Group of Friends, political leaders, youth, civil society, academia, and many others from across the globe. The overarching theme of the forum was : "Towards an Alliance of Peace: Living Together as One Humanity." The forum discussed a variety of thought-provoking themes that are of pressing importance in the current global context, ranging from violent extremism, terrorism, online hate speech to the role of religious leaders, women,climate change and youth, education and global citizenship and reinvigorated multi lateralism, among many others. The forum consisted of expert panel sessions, inter - generational dialogue and many other informal discussions.

On the 21st of November, the youth delegates were part of discussions on the overarching themes related to Education, women empowerment, online hate speech, pluralism and many others. Ms. Sushmita spoke about the role of Women as peace builders in achieving environmental sustainability. She spoke about capacity building of women through the Green Skill Development Program on Lantana furniture making in Siruvani and Waynad , which empowered tribal women to become financially independent and contribute to the global goals of Sustainable development. This gathered a huge response from different ministers and agencies to utilize Lantana in furniture making in their respective office spaces.

The last mistake : Mankind vs. Mankind

By Suraj Pratap Singh

Many ancient advanced civilizations have come and gone. Mankind witnesses so many wars. Since, the time immemorial the same kind of mistakes were repeated over and over again. Yet, mankind have not learned any lesson from the past.

“None of us is immortal”

However, still we are proud that we landed on the surface of moon, we deployed robotic probe to the surface of mars in search of life or we created the weapons of mass destruction? We are unsure about our future. However, we do know whatever is happening is not good for the sake of mankind and whosoever is responsible, whether today, whether in the past, or in the coming future. It is not good for the sake of our successor.

“We did globalization for the betterment of mankind not for the reckless exploitation of resources.”

Are, we able to answer it.

Which kind of environment we will give to our successor?

Yes, we will give them an atmosphere, where the water is polluted, the air is polluted and the land is polluted i.e; "Every single unit which support life is polluted".

We need to address the problem i.e; "mankind is fighting against mankind”.

“Our greed for comfortable life style will come at a price which need to be paid by our successor.”

We are heading towards the IMPOSSIBLE reversibility in timeline which will be the last mistake.....

Threats Of Invasive Plant species to coastal flora of Maharashtra.

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The 'western ghat' is one of the 'global biodiversity hotspots', situated near the coastline of Maharashtra. Maharashtra possess 720 km. long coastline which consists of many sandy beaches, estuaries, rocky substratum, lagoons, mangroves, coastal marshes and sand dunes. In which coastal sand dunes represents 18% of the total area. The sand dunes are small hills of sand made by sand which moves landwards due to wave action and wind velocity. This moving sand binds and gets accumulated with roots of grasses or other plant species which are called as sand binders or coastal sand dune plants (CSD).

The coastal sand dune vegetation acts as a frontline bioshield or natural barriers against high tides and surges such as 'Tsunamis'. The plants like grass and creepers are mainly responsible for sand dune formation. In coastal zone of Maharashtra, native sand dune plant species like *Ipomoea pes-caprae*, *Sesuvium portulacastrum, Spinifix littoreus* and many grass species forms roots matt and deeply rooted rhizomes which help to stabilise sand dunes. Currently many invasive plant species are invading the coastal sandy dune areas, which show harmful impact on the performance of sand dune flora. In comparison of native plants, invasive plants shows fast growth, short life cycle, high seed production, high seed germination percentage and ability to survive in new climatic and environmental conditions (Daehler, 2003).

Some invasive species produce allelopathic biochemicals which is toxic to native plant species i.e. the soil is unsuitable for the native plant species. These invasive alien species also shows many harmful effects like destruction of native flora, breakdown of associated food chain, soil erosion and reducing

aesthetic value of coastal environment (Muniappan and Viraktamath, 1993).

Coastal vegetation of Maharashtra is mainly threatened by tourism, trampling, illegal building construction, beach sports and the introduction of new invasive plant species. Only few studies are carried out on invasive plants in coastal environment (Munoz-Valles and Jesus, 2015). The zoning pattern of coastal sand dune vegetation is mainly disturbed due to human activities hence weeds and invasive plants introduced in this coastal zones. A total 173 invasive plants species are found across India including Maharashtra. The most harmful invasive species which includes *Alternanthera philoxeroides, Chromolaena odorata, Cassia uniflora, Lantana camara, Eichornia crassipes, Parthenium hysterophorus* and *Prosopis julliflora* are found in Maharashtra.

The Invasive plant species in Maharashtra and India is came from different regions of world like Western Asia, Europe, Australia, Africa, America, Mexico, Brazil and West Indies. The dominant families of invasive plant species are Asteraceae, Convolvulaceae, Poaceae, Ceasalpiniaceae, Solanaceae, Euphorbiaceae and Amaranthaceae (Reddy et al., 2008).

Spinifix littoreus

Ipomoea pes-caprae

Sesuvium portulacastrum

Image source - internet

In coastal region of Maharashtra, introduction of invasive plant species is mainly through human activities like agriculture, grain transportation and ballast water from ships. The coastal area of Maharashtra comprises Mumbai, Raigad, Ratnagiri and Sindhudurg district. Totally there are 55 coastal sand dune plant species were recorded in which 5 to 8 (10-15 %) are invasive or exotic species found in the coastal areas of Raigad and Sindhudurg district of Maharashtra (Pawar and Telave, 2022). *Chromalaena odorata, Cuscuta campestris, Lantana camara, Opuntia stricta, Alternanthera sessilis, Parthenium hysterophorus, Commelina indehiscens* and *Tridax procumbens* are invasive alien plant species found (Plate 1.) in the site. The highly harmful and fast growing invasive plant species like *Prospis juliflora* and *Senecio bombayensis* are also found in nearby coastal areas which are alarming threats to the coastal ecosystem.

Chromalaena odorata

Cuscuta_campestris

Lantana camara

Opuntia stricta

Alternanthera sessilis

Commelina indehiscens

Tridax procumbens

Prospis juliflora

Senecio bombayensis

Image source - internet

The climbers and creepers like Lantana camara and Cuscuta campestris are climbing and twining around any supports which include native plant, bushes, walls and fences, hence they spread in alarming rate. Cuscuta campestris a parasitic plant are found on host plant Ipomoea pes-caprae (L.) R. Br. one of major sand binder. The C. compestris shows fast growth which weakens the host plant so the host plants growth is stopped and die.

As compared to other terrestrial ecosystems, coastal areas or dunes are unsuitable to plant invasions but in recent times due to low plant- plant competition, open sites for establishment and suitable human activity, the areas are becoming favourable for invasion. Researches mainly aims on controlling population size of invasive species are in the urge of implementation. The legal actions and preventive measures are required against invasion for management and conservation of native species. The plantation programmes of native plants and social awareness regarding invasive plants' negative effect on ecosystem and agriculture fields are important for conservation of important native plant species in coastal environment.

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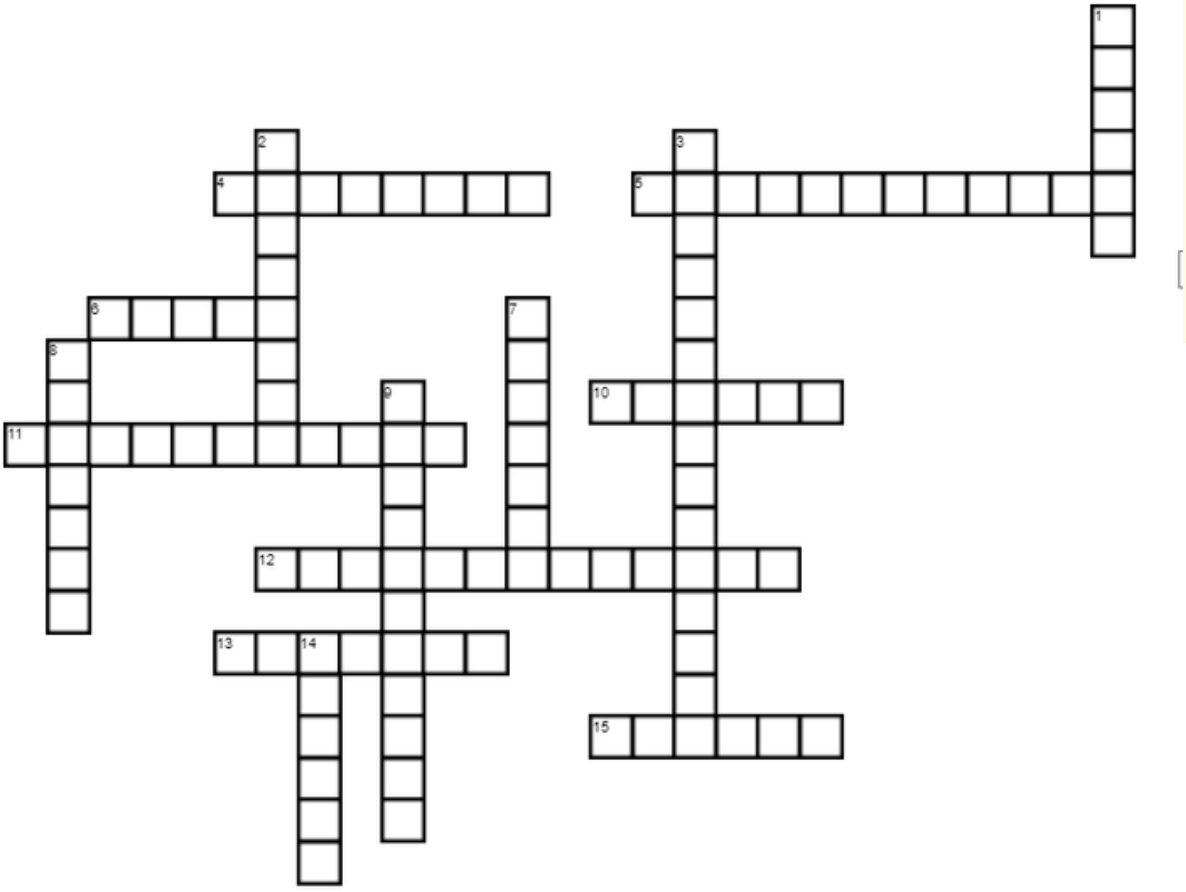
5. Reddy C.S., Bagyanarayana G., Reddy K.N. and V.S. Raju (2008). Invasive Alien flora of India, National Biological Information Infrastructure, US Geological Survey, USA.

Crossword - Invasive species



ACROSS

4 This frog has a very large tympanum
5 An insect pest with pink color powdery coating on its back
6 This type of carp was used for aquatic plant control
10 Crab from China with very hairy claws
11 bird's nests
12 An invasive species introduced from South Africa
13 Brown-headed bird that lays their eggs in other
15 Aquatic invasive rodent with orange teeth

DOWN

1 These freshwater mussels shouldn't be moved
2 Graceful waterbird with "S" shaped neck (two
3 Natural enemy used to control insect pest
7 Invasive creeping grass often seen in lawns
8 These red-eared reptiles can spread disease
9 Spiny Yellow flowered plant
14 words)

Answers will be published in the next issue.

Reflections

By Ranjanee Aron

Sitting in a library,
Going through the pages hidden with stories of evolution
The anthropological scene is shifting and I see your eyes from the book lifting
To meet the oceans perspective on its well being
A little trouble taking but worthy of its creation – mankind, the 'finest' product in its making
Page turn, the rain starts its song against the windowpane
A flower field sneaks in my mind, forming from the perspiration of civilized life
The higher the buildings rise, the deeper I fall into the ground - earth
Magnifying how he writes his mind, so transparently – opaque
Activism to save the marine bay
To live longer or to read more
My mountains, my oceans, my moon, my stars, my sun
Sovereignty, protection, my children
Page turn, hearts merge
The writer and I have become one
The earth and I have become one
Glittering sunshine adds a hymn
To the ballroom where I shall regain my purpose of sound
Taking the writers courage, locking eyes with experience disguised as coldness,
I whisper
"Will you accompany me to the islands of alliance?"

Do Alien Invasive Species Affect Frogs?

Author Information
Madhushri Mudke and Aravind Neelavar Ananthram
SM Sehgal Foundation Center for Biodiversity and Conservation,
Ashoka Trust for Research in Ecology and the Environment (ATREE)

The answer is, yes! Just like many other native fauna, native amphibians (frogs, newts and salamanders) suffer huge losses due to the presence of alien invasive species. Invasive species occupy habitats outside of their home range, hence called alien, and increase the economic and environmental costs. Alien invasive species multiply rapidly in the absence of predators in their new home. They damage crops, use up resources meant for native species, change community structure by altering prey and predator relationships, transfer several pathogens and destruct people's livelihoods by not just impacting agriculture but also by damaging several other ecosystems. Globally, the world spends about $1.2 trillion for managing invasives. Scientists across the world have said that, simple steps towards prevention of spread of invasive species can save trillions of dollars.

Hoplobatrachus tigerinus
Indian Bullfrog

Rhacophorus malabaricus
Malabar gliding frog

Across numerous developed countries from the Global North, studies have shown that alien, non-native fish like trouts e.g. *Oncorynchus mykiss*, bass Micropterus spp., Amur sleeper fish *Perccottus glenii, bluegill Lepomis macrochirus* and mosquitofish *Gambusia affinis* or *G. holbrooki*, impact the presence of native amphibians. Manmade, permanent water bodies house a number of non-native fish. Such fish are often seen around urban and suburban areas.

Apart from beautification and landscaping, non-native fish do not serve any other purposes within urban waterbodies. Some alien fish, however, are also introduced for game fishing, cultivation and for the reduction of mosquito populations, e.g. mosquitofish *Gambusia affinis*.

Alien fish use up resources like space and food that are essential for the survival and reproduction of native and endemic amphibians. Some of the fish are also known to feed on amphibian larvae and tadpoles. Not just due to predation pressure, some amphibian species simply avoid the habitats used by alien species, reducing habitat availability for them. This puts unnecessary pressure on the existing amphibian populations. At times, the number of fish is so high that the fish end up wiping out newly hatched populations of amphibians, thus leaving very few animals to grow up into adults and complete their life cycle. This causes local amphibian population extinction which eventually adds up to the existing amphibian decline.

Amphibian populations have declined by almost 80% in the last four decades. Land use changes like construction and beautification of existing freshwater habitats and the presence of alien invasive species are some of the leading causes of amphibian decline. About 88% of '**Threatened amphibians'** are impacted by habitat changes, like habitat loss and degradation. These declines are far more than other species like birds or mammals. Some of the reasons for such rapid amphibian decline are their sensitivity to change. Given their permeable skin, inability to disperse longer distances, unlike birds and mammals, and specific needs for reproduction - amphibians are at a losing end with just the slightest of disturbances. As urban sprawl and agricultural land use increases, existing dispersal corridors are disrupted and wetlands are degraded. Therefore, comparative analysis between the declines of frogs, birds and mammals show that a total of 21 % of amphibians are categorised as '**Critically Endangered**' and '**Endangered**' while only 5.4 % of mammals and about 10.5 % of birds fall into these categories.

Declining numbers across amphibian populations suggests that amphibians are indeed sensitive to habitat change and alien species. However, not all amphibians are sensitive. Some amphibians themselves are invasive and add to the native amphibian population decline. The American bullfrog *Lithobates catesbeianus*, cane toad *Rhinella marina* and the African clawed frog *Xenopus laevis* often benefit from human made land use and wetland changes. Most of these frogs feed on insects attracted by increased urban lighting and make permanent water bodies their breeding grounds. They also extend their home ranges and invade breeding grounds and spaces with native amphibians.

Research shows that alien frogs reduce the growth and development of native leopard frogs and spotted salamanders in Florida. Alien frogs also feed on the eggs, tadpoles and adults of native frogs. The native Indian bullfrog *Hoplobatrachus tigerinus* is termed as invasive in Andaman archipelago and is known to impact native amphibian diversity by feeding on tadpoles. The African clawed frog is known to spread two deadly pathogens called the Chytrid fungus and Ranavirus in newer habitats that it occupies. Alien frogs also imbalance the community structure by adding in more predators and preying on available insects. Thus, native amphibian fauna suffers with less availability of food, space and breeding grounds, along with the threat of diseases and increased predation from the alien species.

An estimated of 16% of the total amphibians on this planet are threatened by introduced species alone. Habitat restoration and maintenance within urban areas must remove and limit the use of exotic species. Facilitating connectivity within habitats and managing wetlands according to native species' requirements is the key to save millions of dollars and conserve biodiversity.

Word Search - Invasive species

S	O	T	N	E	M	E	G	A	N	A	M	O	A	T	V	I	T	A	M
S	T	C	K	I	K	S	K	I	N	D	I	S	P	E	R	S	A	L	E
E	R	A	B	B	E	C	O	N	T	R	O	L	A	Z	F	G	H	O	E
N	I	S	H	S	G	A	R	D	E	N	S	C	H	I	J	O	L	T	R
E	N	D	C	L	A	P	A	R	C	I	Z	S	U	O	D	L	W	A	U
R	A	I	N	L	R	E	C	A	S	T	N	E	M	G	A	R	F	M	T
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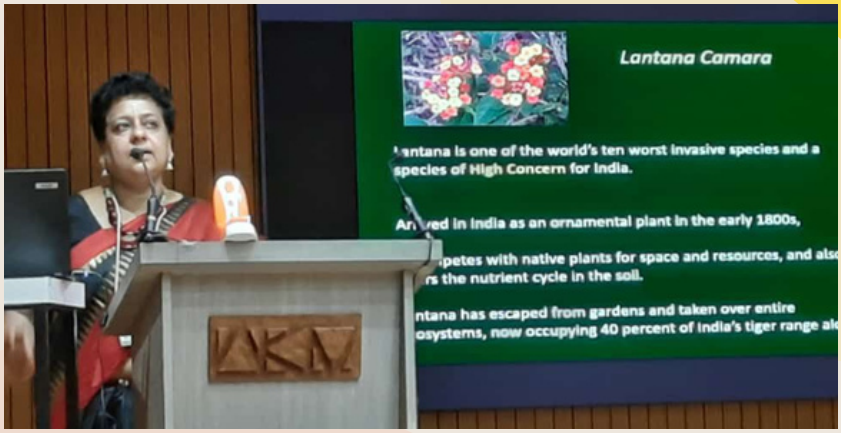
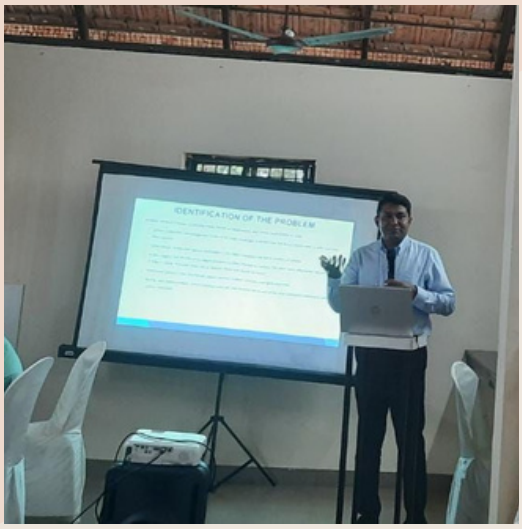
B	A	L	L	A	S	T	W	A	T	E	R	C	T	N	S	C	Z	A	I
I	R	M	D	O	X	E	A	T	S	E	D	O	G	A	E	A	O	L	T
O	W	E	L	B	I	V	U	N	S	D	U	T	A	T	H	T	M	S	R
S	K	A	X	I	J	U	N	T	E	S	T	E	P	C	T	G	E	K	O
E	L	L	E	Q	U	N	W	O	D	H	S	A	W	E	P	N	P	I	H
C	H	E	C	K	C	L	E	A	N	D	R	Y	A	F	O	I	L	E	D
U	T	R	A	N	I	L	W	S	H	U	O	L	S	N	T	H	E	V	I
R	E	M	O	L	R	O	H	A	V	R	J	C	H	I	S	S	U	R	L
I	N	V	A	S	I	V	E	S	P	E	C	I	E	S	K	I	J	A	G
T	C	A	M	P	A	I	G	N	S	R	O	O	F	I	E	F	I	N	S
Y	E	L	E	C	I	T	C	A	R	P	F	O	E	D	O	C	S	D	E

Awareness
Ballast water
Biosecurity
Boat hulls
Campaigns
Check Clean Dry
Code of Practice
Control
Disinfectant
Dispersal
Eradication
Escape
Fishing tackle
Fragments
Gardens
Horticulture
Invasive species
Management
Pets
Rhizome
Seeds
Stop the Spread
Transportation
Washdown

Answers will be published in the next issue.

National Bioinvasion Conference by Kerala State Biodiversity Board

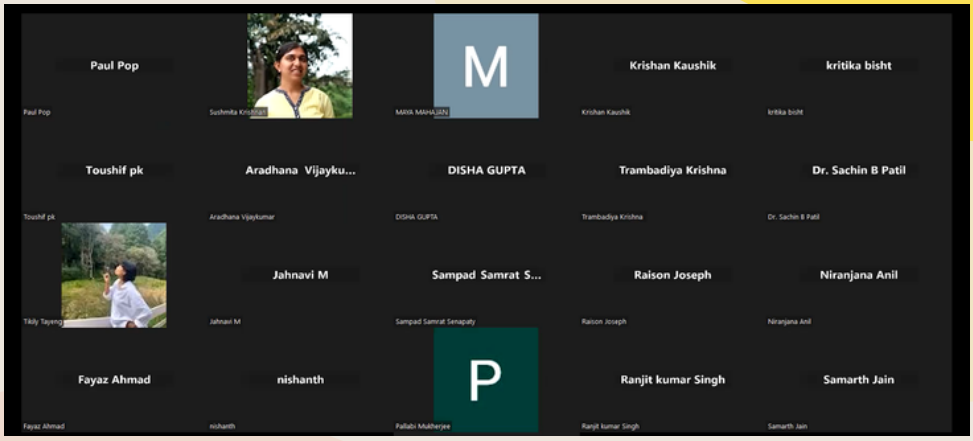




Dr. Maya Mahajan , EIACP Coordinator participated and presented at the National conference on " Bioinvasions trends, threats and management " with the focal themes encompassing Biological invasion in forest ecosystems, invasive species threat in marine and aquatic ecosystems and invasion in agriculture and managed ecosystems. The conference was held at Kerala arts and crafts village , Vellar , Kovalam PO, Thiruvananthapuram. It was organised by the Kerala State Biodiversity Board. Dr. Maya spoke about Lantana management through livelihood support in Tamilnadu.

Ms. Rehna E.T from the Centre for Sustainable Future, Amrita University presented an oral paper titled " Invasiveness of *Tridax procumbens* in the palakkad gap of the western ghats".Mr. Cherian K. Philip from the Centre for Sustainable Future , Amrita University presented an oral paper titled " Study of Lantana furniture enterprise in South India under the theme "status of invasive trade and its impact.".

Soil Day 2022 Celebrations



On the occasion of world soil day (December 5th), we conducted a national level biodiversity quiz for school and college level students on December 10th , 2022. The event was proceeded by Dr. Maya Mahajan , Co - Ordinator of EIACP RP, Amrita University. The event had an excellent response among the student community and similar events were very much welcomed by the participants. The questions were designed to test the understanding of the participants in biodiversity.

Winners of Biodiversity Quiz 2022

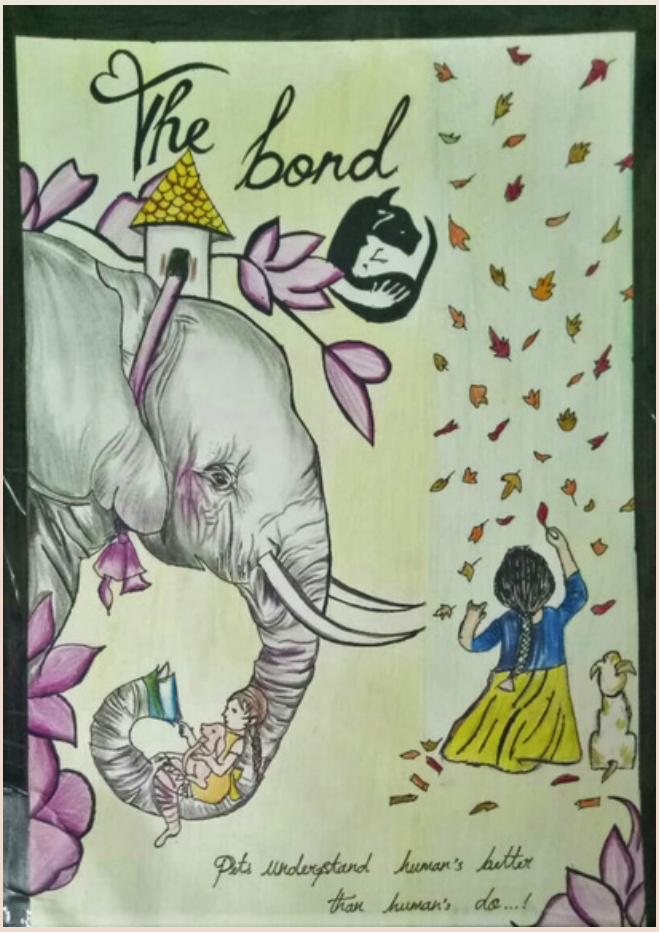
First Prize
Nishanth . S
Research Affiliate
Conservation Initiatives

Second Prize
Toushif PK
Mizoram University

Third Prize
Samarth Jain
Government Model Science College ,
Jabalpur

Fourth Prize
Paul Pop
Government College
Bilaspur

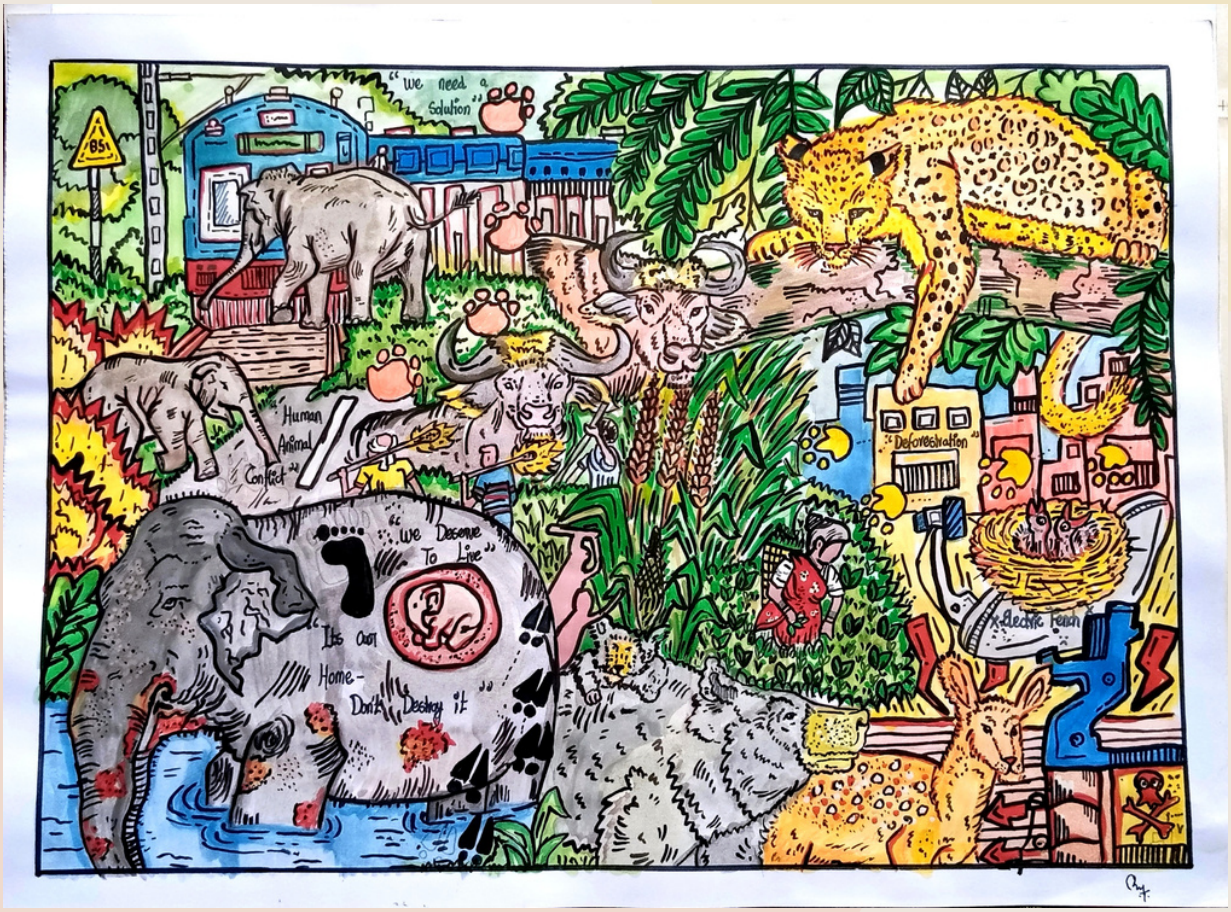
Winners of Poster Contest - Junior category



First Prize
Divyadharshini . S
Seventh Standard
Kikani Global Academy
Coimbatore

Second Prize
Sangamithra. G
Fifth Standard
Akshara Matric School
Madurai

Winners of Poster Contest - Senior category

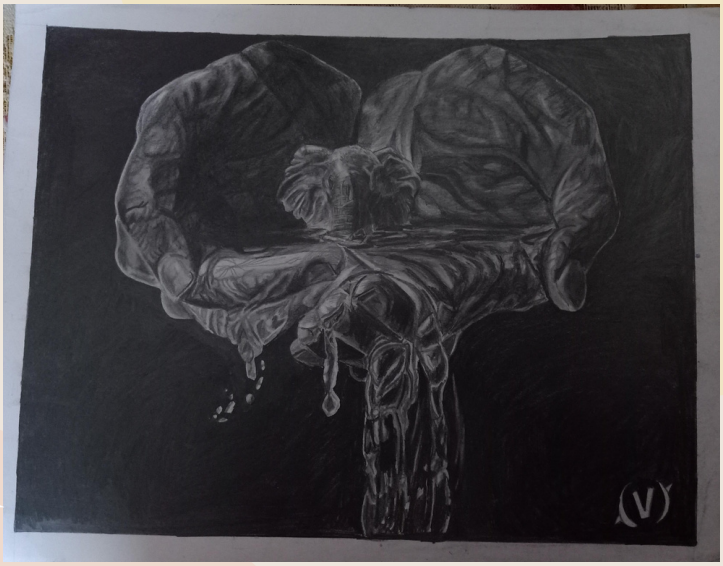


First Prize

Rajkumar.M

ICON Clinical Research India Pvt Ltd , Chennai One IT Park, Chennai

Second Prize
Vaishali Vedwal
Hemwati Nandan Bahuguna
Garhwal University,
Srinagar Garwal
Uttarakhand

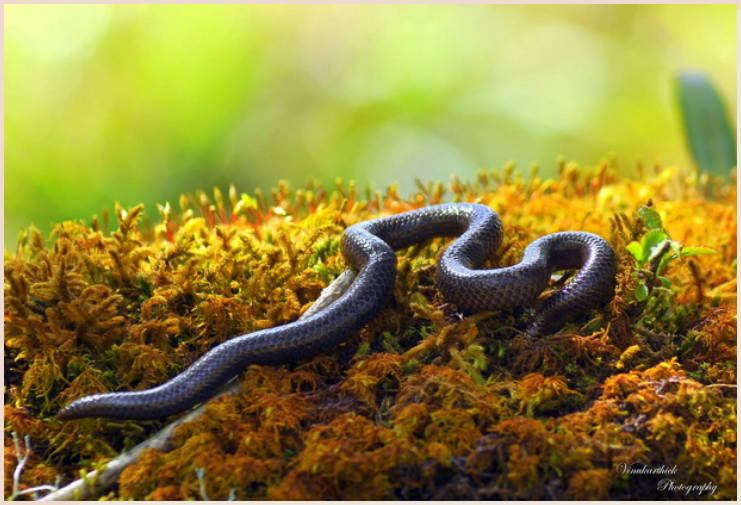


Third Prize
Hanshitha . R
PSG College of arts and
science
Coimbatore

Winners of Photography contest - Junior category

First Prize
Dakshith Nair
Kikani Global Academy
Coimbatore

Winners of Photography contest - Senior category



First Prize
Karthik . S

Plectrurus perrotetii
Nilgiri Burrowing Snake

Winners of Photography contest - Senior category

Second Prize
Nikhil More

Nyctibatrachus humayuni
Bombay Night Frog

Third Prize
Pooja Chaudhary

Saussurea simpsoniana
Fen Kamal

The story of our paw - friend 'Tuffy'

Sanjana , Department of CCE

Adoption stories give you all the reasons to believe in the existence of humanity even at the toughest times of the world's materialistic pleasures.This is a story of man's best friend who was was given new colors to live again joyfully.

"**Love is the only medicine that can heal the wounds of the world**" - **Mata Amritanandamayi**

Tuffy, a joyful dog was adorning the Amrita University campus with her amiable presence and her loving hugs to anyone who approaches to pet her. She was bubbling with energy and would make anyone happy with her enthusiasm.She was a very good friend for every student in campus. Nobody knows from where did she come into campus. She was spotted at the girls hostel for the first time and was later taken care for a week by Dr. Maya. As she was a different breed and was unique, she was often harassed by male dogs in campus. Dr. Maya was disturbed by this and decided to give Tuffy for adoption to find a better home for her. A person from nearby locality was interested to adopt Tuffy. She was believed to have a very good adopter who promised to take good care of her.

Tuffy before adoption

But things didn't favor their promise. Adding to that , she was a mother of two by then and her health was deteriorating after childbirth. The members of the Amrita Animal Welfare Society and EIACP Center at Amrita University led by Dr. Maya Mahajan decided to bring Tuffy back to her favorite home. As she was in very bad state , she was taken to a veterinary hospital for treatment.

Dr. Maya took care of Tuffy like a baby. Tuffy was drained and started puking on the way to hospital. She had severe diarrhoea when she was taken to hospital. Dr.Maya was very kind and compassionate to Tuffy in spite of her puking on her clothes while rushing to the hospital. Tuffy was in very bad shape.With intravenous medications and other treatment procedures, Tuffy had to battle for life in the hospital. The entire expense for the transport and treatment was covered by Dr. Maya. Finally she was brought back to campus with recommended recuperation. As **Mata Amritanandamayi** rightly quoted " **Perceive God in every living being and feed them with that attitude**".

Tuffy during treatment

With the support of Dr. Maya, AAWS members and other animal lovers on campus , we were able to foster Tuffy and her kids on campus. We had gathered support from different people as fostering and reviving Tuffy from her illness was an herculean task. Many students would buy food for Tuffy and her kids. Tuffy enjoys all of their company during evening walks and she has developed a unique bond with every member she associates on campus. Students of AAWS had extra love for her puppies as they were decided to be adopted after fostering. They fondly named them Dolu and Bolu from the famous cartoon series Chota Bheem.

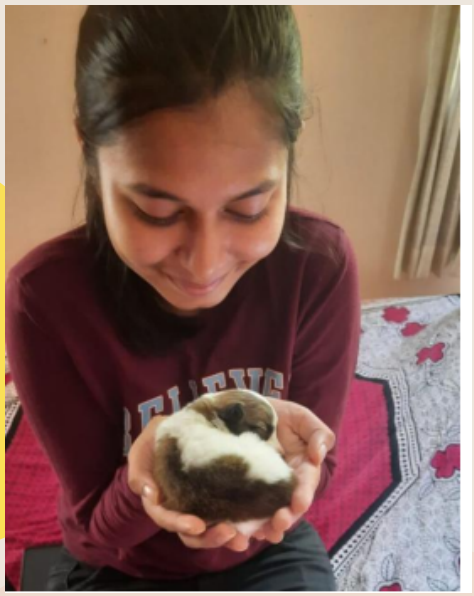


Figure 1 : Dolu with AAWS volunteer Nidhi
Figure 2 : Tuffy with Dolu and Bolu

Hear what AAWS volunteers have to say about Tuffy

Eniyan - It's been an amazing experience being with Tuffy. AAWS taught me to love each and every life form on earth. This club has expanded my love towards animals, especially dogs and cats.

Prakash - AAWS to me is a therapy. Can't be thankful enough to my friend who introduced me to Tuffy and her pups one fine evening. Tuffy was not in an appreciable state when I first saw her that day. It instilled in me a fair share of responsibility to take care of it and nurture it. To see Tuffy get better and the puppies bulking was just bliss. Thanks to AAWS. This will be one of my favorite parts of college life when I look back years later.

Veeresh - What to say?? AAWS has given me immense satisfaction after getting to know that there are so many animal lovers inside Amrita. The empathy each and every person in the club showed to animals gave me happiness .The main support for the students in the club and the energy to the club was Maya ma'am .The amount of love ma'am has towards animals is an inspiration to us, the care she used to give for students in the club and arrangements she used to do for the rescued animals is remarkable.

The people I have met inside the club are just extraordinary when ever there was an animal which is in need of help the response from from each and every coordinator in the club showed the amount of love and empathy they are having towards Living beings .Time spent with these extraordinary people can't be explained in words . The only message from me is let's spread love and empathy towards each and every living being on the mother earth and create a animal friendly society .

Chetan - As an animal lover, being a part of AAWS was really great. It was not only about animals and helping them, but also about showing them care and affection. The vaccination drive which was held and organized by our dear Maya ma'am, helped us a lot to interact and make a bond with them. The way most of the dogs weren't scared of the vaccination drive showed us how much trust and affection they have built upon us. It was a great experience for me. And talking about Tuffy, I really loved taking care of her . It didn't feel like work for me, it felt more like a responsibility. I really enjoyed her company, taking her for walks, and cooking food for her. Finally coming to Bolu and Dolu, I couldn't find anything cuter than them. I would also like to talk about Maya ma'am. All of this wouldn't have been possible without her support. I have seen her sacrifice and risk a lot of things so that the animals in the campus are safe. She used to give us a constant push and used to motivate us a lot. I have never seen any professors be this friendly to students. And also, the support which was given by Uttam and Sushmita was really great. They have been a pillar of support for this club. The talk and chats we used to have, made me feel that I was one of them.I would like to thank each and everyone who is a part of this club and helped it to make it this far.

Nidhi - I met tuffy on my way back to hostel. She was sitting in front of my hostel door and I was so excited to find a new dog around since I've been friendly with all the dogs in campus. Soon she became very close to me and would run to me to pat her when I leave for college or come back. When I heard that tuffy was getting adopted I was so happy for her but also sad that I'll not be able to visit her on my way back to hostel anymore. But somehow the universe knew she was happier with us and Tuffy was back to campus and all of us couldn't be happier to know she came with her two little pups. Taking care of Tuffy and her babies has been a privilege to me. I've felt my peace meeting Tuffy everyday after college, taking her on walks and feeding her. I've made a number of friends who are as interested to take care of Tuffy as I am. Feels so good to be part of such a club with like and friendly minds.

Ms. Prema , who fostered Tuffy in her early days in campus

Tuffy's new home

Left : Prof. Parameshwaran
Right : Mr. Mahesh with Dolu

There are many others who supported us from their capacities. Our program officer Utthamapandian made sure Tuffy was safe around his presence and made every effort to keep things moving smoothly for her. Special appreciation to Mr . Mahesh, general manager for all his support. We are also grateful to **Prof . C Parameshwaran** , Director , CIR for his constant support and encouragement for the activities of AAWS and EIACP. He has guided our efforts and helped us materialize our endeavors for the cause of animals in campus. We appreciate his efforts in arranging for a shelter in University campus to foster Tuffy.

Student volunteers Chetan , Prakash , Eniyan, Nidhi and Veeresh volunteered their time during the nights and on holidays to feed them and spend time with Tuffy, Dolu and Bolu. Despite the dislike that many on campus have for animals, there are loving people who helped us amplify the goodness in our efforts and radiated multi fold love for animals. Ms . Prema , a support staff in campus fostered Tuffy during her initial stages , which Tuffy still recognizes her with love. Breaking many odds, we brought back Tuffy back to old enthusiastic form and identified really loving families for Dolu and Bolu who have accepted them as a family member.

In a campus that stands tall with the divine guidance of **Mata Amritanandamayi**, a spiritual leader with indomitable courage, we take the satisfaction of walking by her words - “ **As you perform good actions selflessly, true love will blossom , which will purify our emotional mind**”.

BIOINVASION

Instructions to contributors

We welcome original research and popular articles, reviews, reports, research highlights, notes, news, snippets, etc related to the thematic areas of EIACP Resource partner of publication in EIACP newsletter on Bio-invasion.

The next issue will focus on the theme "Wetlands".

The articles and other relevant information should be neatly typed in double space not exceeding five pages. The figures, graphs/drawings should be of good quality and clarity. Photographs should be of minimum 300 dpi resolution. References should be limited and cited in the text by name and year.

Email your articles in MS-word format to bioinvasion.envis@gmail.com

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In case of feedback , write to **envis.bioinvasion@gmail.com**

Follow our Instagram page to get all updates on upcoming events.

AMRITA_ENVIS_RP

प्रकृतिः रक्षति रक्षिता
Nature Protects if She is Protected

सत्यमेव जयते

AMRITA
VISHWA VIDYAPEETHAM

WORKING TOWARDS A SUSTAINABLE ENVIRONMENT
ENVIS INDIA