ZOO'S PRINT

Communicating Science for Conservation

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Cover photo: Woodmason's Earth Snake *Uropeltis woodmasoni*. © G. Rajesh Kumar Jain.

RHATC 2022-23

Nicobar needs us.

Approximately 8.5 lakh trees in pristine rain forests will be cleared in the Nicobar Islands to make way for a 'developmental' project. It is home to 648 species of flora and 330 species of fauna, including rare and endemic ones like the Nicobar wild pig, Nicobar tree shrew, the Great Nicobar crested serpent eagle, Nicobar paradise flycatcher and many others.

Cost of the Nicobar project

$9.2 billion

$9.2 billion equals INR 72,000 crores
$1.6 trillion equals INR 128 lakh crores

Natural wealth wiped out

$1.6 trillion*

*The estimated worth of one tree is about $1,932,500 if left alone for 50 years. This number excludes the value from fruits, lumber and other services.

Source: Singapore Zoological Gardens, The Value of a Tree, based on Update Forestry

What you can do to help

- Read about the latest developments on the project
- Be vocal about your concerns on social media and other channels
- Volunteer with organisations fighting to reverse the decision

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Advanced Training in Conservation

Concept by the RHATC Team and Illustration by Lakshmi Nair, RHATC Fellows 2022-23, Zoo Outreach Organisation, Coimbatore, TN, India.

ZOO Poster# 61 Nov 2022

Read about other environmental issues at zoosprint.zooreach.org

DON'T KILL THE GOLDEN GOOSE !!!!

The Nicobar Project will end up destroying the habitats of Vast diversity of FLORA AND FAUNA

Concept by Melito Pinto and Illustration by Pooja Patil, RHATC Fellows 2022-23, Zoo Outreach Organisation, Coimbatore, TN, India.

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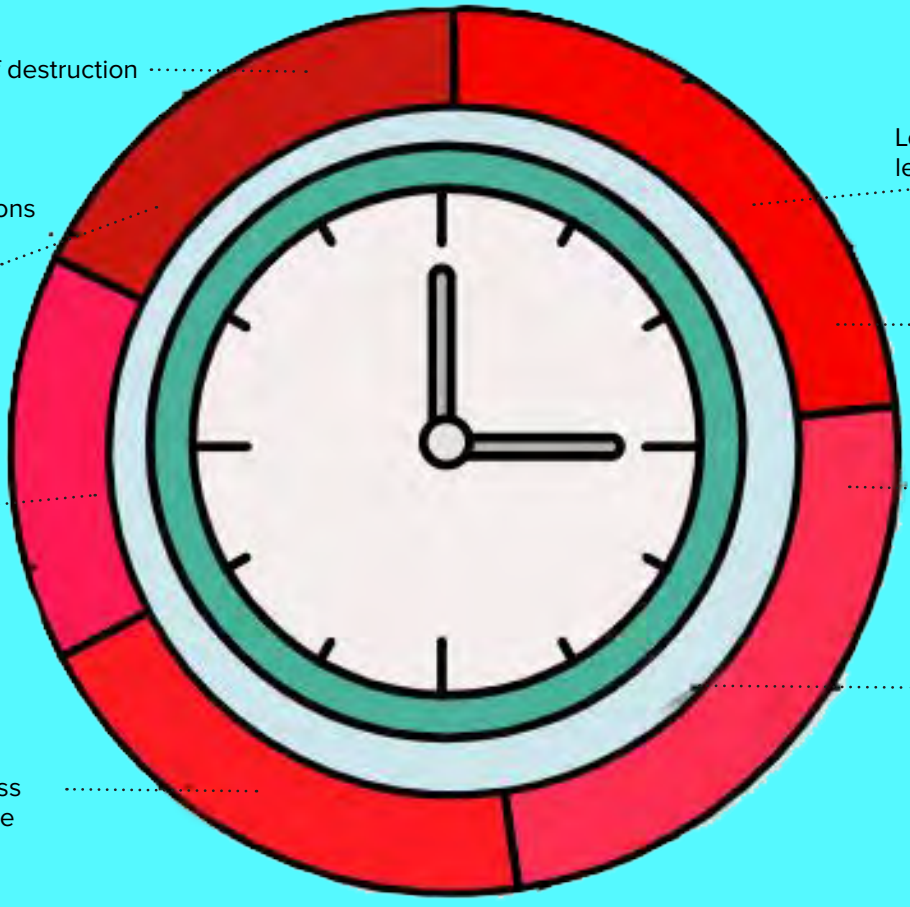
RHATC 2022-23

Math doesn't match for Great Nicobar Island Project

Approximately $118 million of compensatory afforestation ≠ $1.6 trillion deforestation

As stated by Professor T. M. Das, trees are worth around $193250, including its worth of oxygen generation, control of air pollution and soil erosion, home to animals, and recycling of water. The Holistic Development of Great Nicobar Island Project will cut around 8.5 lakh trees. The compensatory afforestation allotted for the project does not even equal the amount of degradation the project will cause on the island. Along with that, the project will also spell trouble to its several wildlife and tribes.



$118 MILLION = ~RS. 970 CRORE

$1.6 TRILLION = ~RS. 128 LAKH CRORE

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Concept by Tandrali Baruah,
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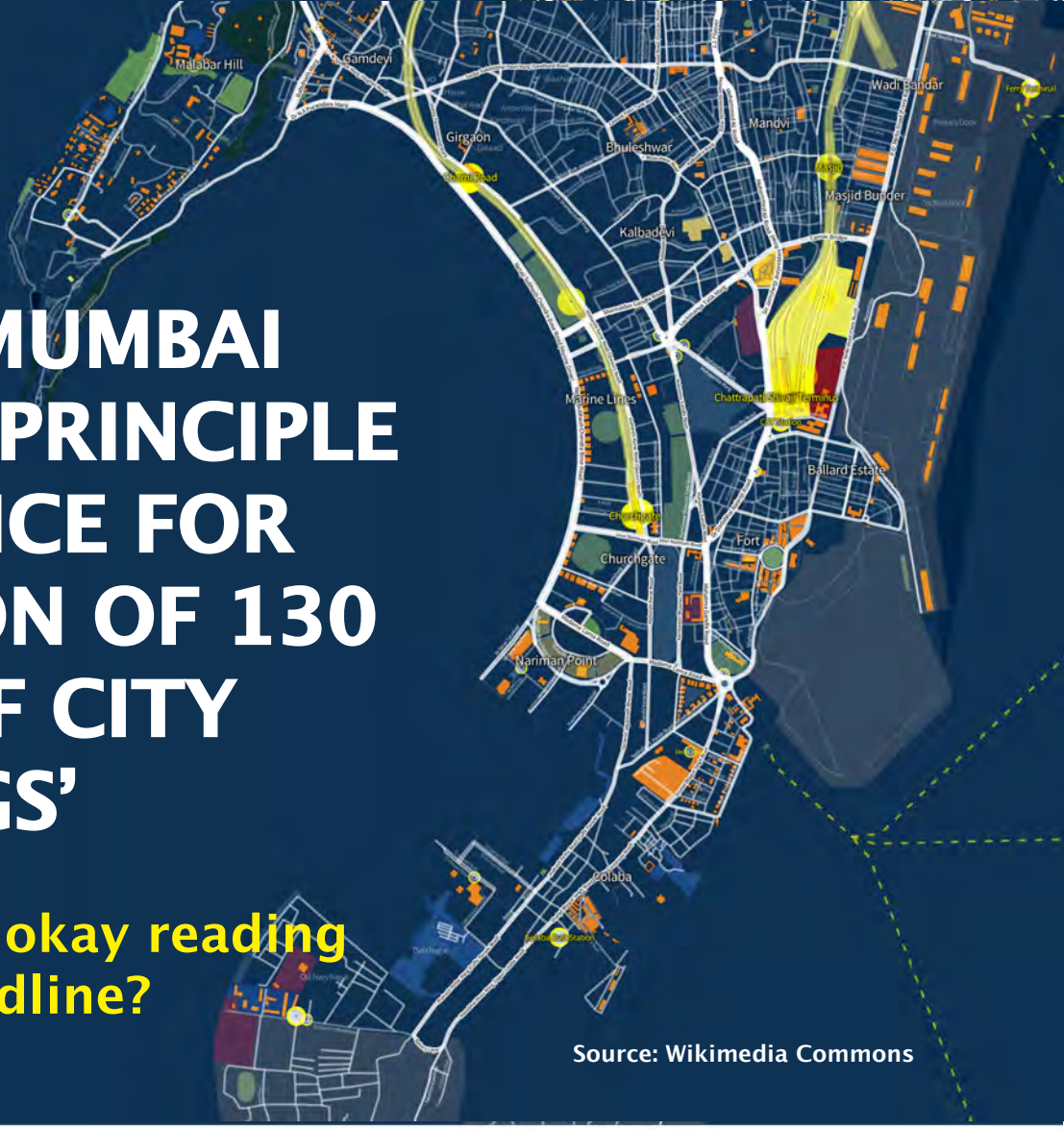
‘SOUTH MUMBAI GETS IN-PRINCIPLE CLEARANCE FOR DIVERSION OF 130 SQ KM OF CITY BUILDINGS’



Source: Wikimedia Commons

Would you be okay reading this news headline?

About 648 species of flora and 330 species of fauna, including rare and endemic ones like the Nicobar wild pig, Nicobar tree shrew, the Great Nicobar crested serpent eagle, the Nicobar megapode and many others will lose their habitats with the upcoming developmental project at the Great Nicobar Island.

Would you be okay if this happened to your habitat?

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Concept and Illustration by:
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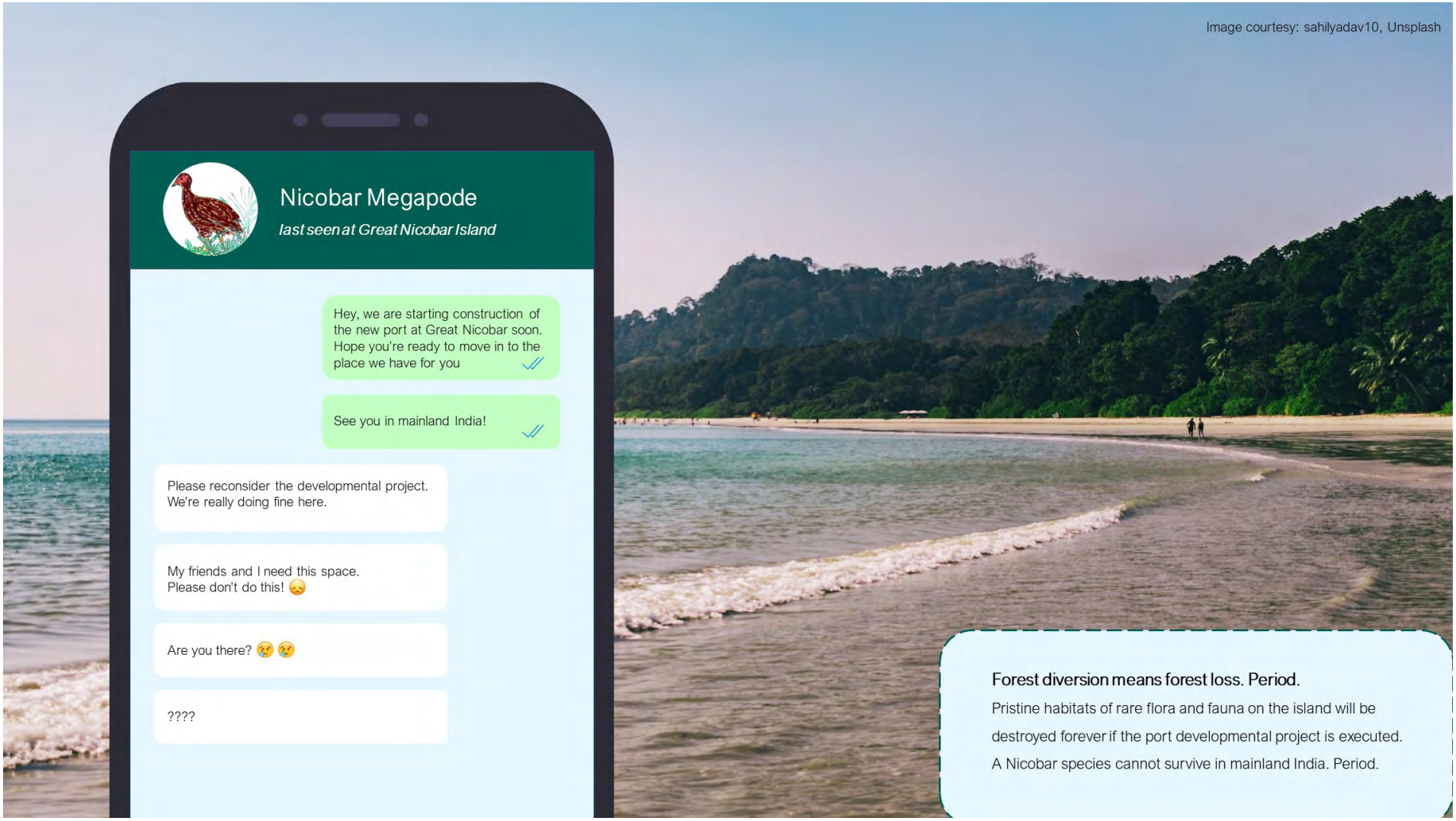

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Concept by: Kritika P
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RHATC 2022-23

RHATC Report

WHY ARE THEY DESTROYING OUR HOME??? PLEASE HELP US!

* NICOBAR LONG TAILED MACAQUE (Macaca fascicularis umbrosa - VU)
* NICOBAR TREESHREW (Tupaia nicobarica - EN)
* NICOBAR CRICKET FROG (Minervarya nicobariensis - EN)
* NICOBAR PIGEON (Caloenas nicobarica - NT)

*ONLY FOUND IN THE NICOBARS

JCB

JCB

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ZOOREACH ZOO OUTREACH ORGANIZATION

Ram Hattikudur Advanced Training in Conservation

Illustration and concept by Akansha Mishra and Rajib Saha, RHATC Fellows 2022-23, Zoo Outreach Organisation, Coimbatore, TN, India.

ISLANDS OF INDIA NOW ISLANDS OF OPPORTUNITY

Déjà vu?

EIA ignored aspects of the sustenance of the Shompens and the Nicobari Tribal population

Holistic Development of Great Nicobar Island

Lush forests and coastal regions within the confines of a UNESCO Biosphere Reserve will be used to construct International transshipment terminal, an international airport, a power plant, and a township area.

National Board for Wildlife Denotifies Galathea Bay major nesting site for leatherback turtles and Megapode* Wildlife Sanctuary in Great Nicobar Island.

AVATAR coming to an island near you

*Endemic species of GNI

Concept by Soham Vinita Shamkant, RHATC Fellow 2022-23, Zoo Outreach Organisation, Coimbatore, TN, India.

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Bugs ALL
#257
21 November 2022
Newsletter of the
Invertebrate Conservation & Information Network of South Asia (ICINSA)

Distribution record of Cricula Silkmoth in Nilgiris, India

Cricula trifenestrata Helfer, 1837 is a wild lepidopteron sericigenous moth known for its lustrous golden cocoon. *C. trifenestrata* is a silk-producing wild insect in India and produces an open-ended 'net-like' cocoon of beautiful golden yellow colour. The silk is rich in luster and is used for making spun silk. *C. trifenestrata* is one of the most destructive pests of mango and destroys 13–51% of its leaves (Ahmad & Alam 1994). It also infests cinnamon, cardamom, cashew, and plantation crops (Ahmad & Ahmad 1991; Das et al. 1999; Sujata & Anand 2003; Yadav & Kumar 2003; Pal & Medda 2006). *C. trifenestarata* is widely distributed in south Asian countries. *C. trifenestrata* is reported to be predominant in India, Andaman, Myanmar, Vietnam, Cambodia, Malaysia, Singapore, Thailand, Bangladesh, Java, and the Philippines countries (Tikader et al. 2014). This note represents the distribution record of *C. trifenestarata* in Nilgiris, Tamil Nadu, India.

***Cricula trifenestrata*. © Anbazhagan Abinesh.**

On 02 May 2022 at 0222 h, we observed three individuals of *C. trifenestrata* during the herpetofauna nocturnal survey in Gudalur area (11.4889 N, 76.3339 E; 1,014 m) Nilgiris, Tamil Nadu, India. We used iNaturalist, which is a citizen-based species distribution mapping website-based application to obtain the distribution records of *C. trifenestrata* as well as past literatures in India (Tikader et al. 2014; Hridya et al. 2021). In total, 100 records were observed in 17 states in India. High numbers of records were observed in Kerala (N = 25 observations) followed by Assam (N = 13), Karnataka (N = 10), Tamil Nadu (N = 8), and West Bengal (N = 7). On the other hand, a low number of

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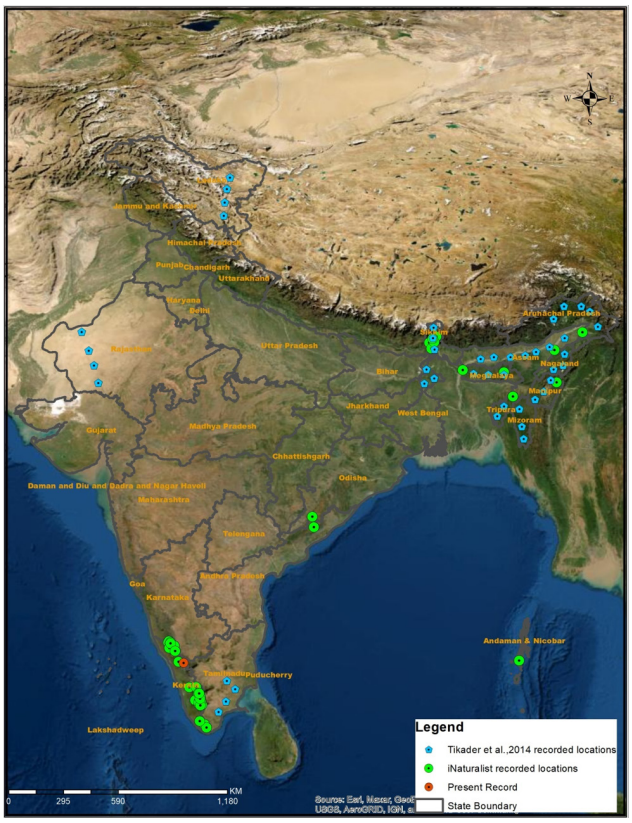
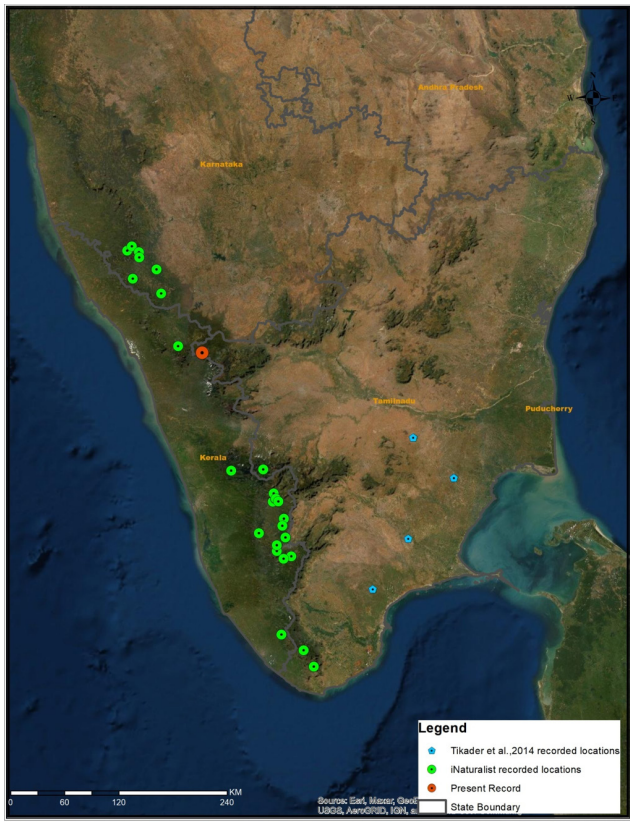


***Cricula trifenestrata* distribution in India.**

records were observed in Andaman & Nicobar Islands, Meghalaya, Andhra Pradesh, and Odisha, each one record respectively. Elevation wise, the species showed a significant variation in distribution. The lowest elevation record was 1 m and the highest elevation record was 5,658 m. The average elevation record was 980.09 m in India. In the southern Indian region, *C. trifenestrata* was found majoritively distributed in the Western Ghats region most of the records observed in Kerala (N = 25 observations) followed by Karnataka (N = 10), and Tamil Nadu (N = 8).

In Tamil Nadu, five out of eight records were observed only after the south of the Palghat gap of the Western Ghats region. The average elevation record of *C. trifenestrata* in the Tamil Nadu region was 572.05 m. Singh (1992) reported that *C. trifenestrata* was recorded at an altitude of 1,097 m in some parts of Tamil Nadu. In the southern Indian region *C. trifenestrata* is mostly recorded in the hilly terrain region. Moreover, out of 100 records, most of the records (N = 75) were observed in the hilly terrain regions in India. This study confirms that the distribution of *C. trifenestrata* is mostly in the hilly terrain regions in India with above 900 m elevation. The present record showed *C. trifenestrata* was also distributed



***Cricula trifenestrata* distribution in Western Ghats, southern India.**

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above the Palghat gap of the Western Ghats regions of Tamil Nadu. This observation shed light on moth diversity in Nilgiris. Further studies are highly warranted to understand the proper distribution pattern of this species in the Tamil Nadu region as well as the Nilgiris.

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#228
21 November 2022

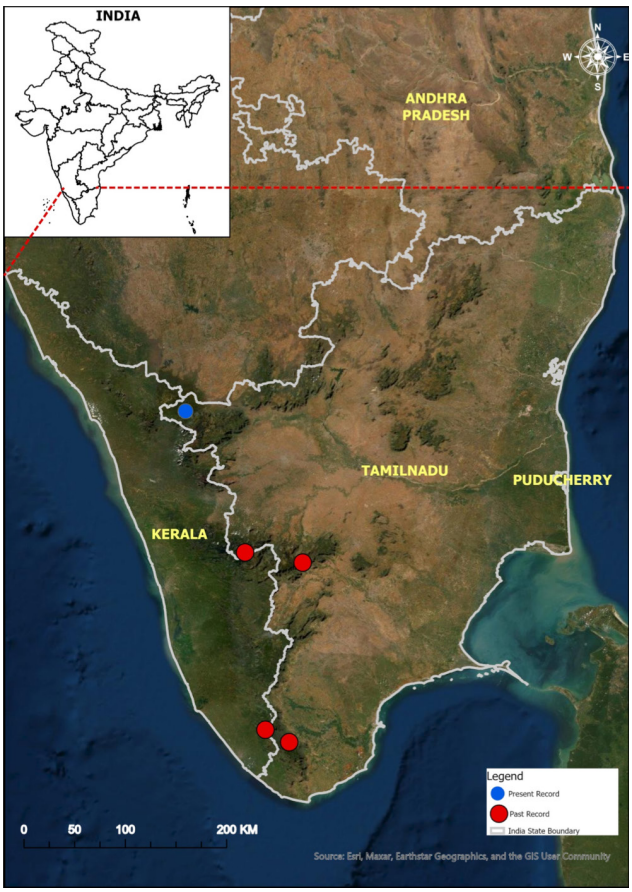
Woodmason's Earth Snake: photographic evidence in Nilgiris, India

Uropeltis woodmasoni, commonly known as Woodmason's Earth Snake is a species of snake in the family Uropeltidae. It is endemic to the Western Ghats of India and it has been recorded in the Anaimalai, Palani, Meghamalai, Nilgiri, and Ashambu Hills. This fossorial species inhabits moist soils and was primarily reported to be found in montane shola forests. Known from the Palani hills of India, in the Anaimalai-Palani hill complexes, south of the Palghat Gap, c. 1860–2100 m (Wall 1923; Wallach et al. 2014; Ganesh 2015).

This note represented the occurrence of Woodmason's Earth Snake *Uropeltis woodmasoni* in Nilgiris with photographic evidence.

Woodmason's Earth Snake *Uropeltis woodmasoni* in Nilgiris, Tamil Nadu, India. © G. Rajesh Kumar Jain.

On 24 May 2022 at 1030 h, we recorded the Woodmason's Earth Snake in the human habitation surrounded by tea estate from Gudalur areas (11.54917 N & 76.41446 E, elevation 1,125 m) of Nilgiris, Tamil Nadu, India. We photographed the snake species for identification purpose and did not collect the snake. Later, based on the physical characteristics of the snake, such as dorsum



Distribution records of Woodmason's Earth Snake *Uropeltis woodmasoni* in southern India.

blackish, with transverse series of small round yellow spots. A lateral series of large yellow spots and ventrum blackish are confirmed to Woodmason's Earth Snake. The total length of the snake was 26.5 cm (SVL 26 cm & TL 0.5 cm).

Woodmason's Earth Snake is a very common snake species in Palani Hills, Tamil Nadu (Rajendran 1985; Smith 1943; Ganesh 2015). Rather than Palani hills, Woodmason's Earth Snake was reported in Anaimalai Hills, Coimbatore, Tamil Nadu (Smith 1943), and Travancore Hills, Thiruvananthapuram district, Kerala (Wall 1923). There is some unauthenticated information that shows Woodmason's Earth Snake distribution in Nilgiris, Tamil Nadu. The present record showed the authenticated photographic evidence of Woodmason's Earth Snake in Nilgiris region. Further studies are warranted to understand the distribution of the Woodmason's Earth Snake in Nilgiris, Tamil Nadu, India.

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First record of Short-tailed Shearwater and first photographic record of White-Cheeked Patridge in Bhutan

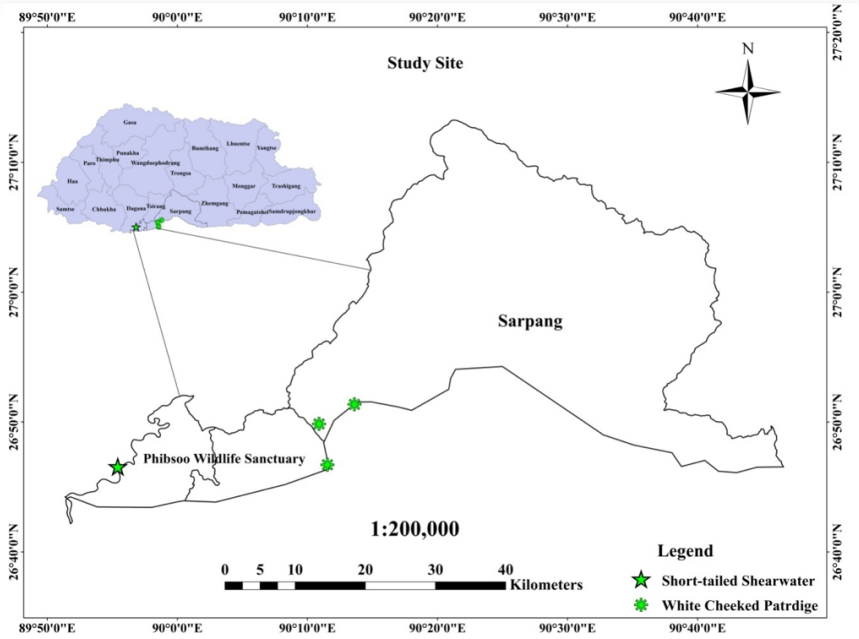
Bhutan is one of the significant parts of the Eastern Himalaya Endemic Bird Area (Bishop 1999; Gyeltshen et al. 2020), and currently, 23 Important Bird Areas (IBA) are recognized in the country (Norbu et al. 2021). Birds of Bhutan and the eastern Himalaya (Grimmett et al. 2019), which is the most recent study of birds in the region, covers 814 species of which 753 species are recorded in Bhutan (Tshuthrim & Wangchuk 2021).

Short-tailed Shearwater on Sunkosh River. © Pema Dorji.

White-cheeked Partridge with distinct cheek pattern. © Tashi Phuntsho.

Of the 98 Shearwaters in the world (Birdlife International 2021), Short-tailed Shearwater *Ardenna tenuirostris* (Procellariidae) formerly known as *Puffinus tenuirostris* is one of the top and most abundant predators in the Pacific Ocean (Nishizawa et al. 2017). It migrates from southeastern Australia and Tasmania to spend its non-breeding seasons in the northern Pacific (Nishizawa et al. 2017). The bird spends May–August in the northern Pacific off Asia and in the Bering Sea and returns to south through the central Pacific to nest off southern Australia in September, laying eggs in late November (Gillson 2008).

Short-tailed Shearwater is known to occur in Pakistan and Sri Lanka (Grimmett et al. 1998; Rasmussen & Anderton 2012), Bangladesh (Thompson et al. 2013), West Bengal (Giri et al. 2013), Arabian Sea, Kerala (Praveen et al. 2015) and India (Shah et al. 2018), but not been reported from Bhutan (Ludlow & Kinnear 1937; Clements 1992; Ali et al. 1996; Bishop 2009;



Location of new sightings.

Male and Female Partridge with reddish-orange legs. © Namgay Dorji.

Inskipp et al. 1999; Grimmett et al. 1998; Grimmett et al. 2019; Gyeltshen et al. 2020; Norbu et al. 2021; Tshuthrim & Wangchuk 2021). Here, we report the record of this species for the first time in Bhutan.

A single Short-tailed Shearwater was observed swimming on Sunkosh River (26.7547^0 N, 89.9094^0 E) of Bhutan on 20 January 2021 at elevation of 205 m. The bird was characterized by pale grey under wing coverts, shorter bill and deeper forehead, grayish feet extending in-flight beyond a short-rounded tail, and was reported as a vagrant to Pakistan and Sri Lanka. The observation was made in the multiple use zone of PWS with cover of vegetation such as *Duabanga grandiflora*, *Terminalia* species, and *Tetrameles nudiflora*. Flood & Fisher (2019) defined its characteristics with greater maneuverability, faster flight, quicker wing-beats; shorter and narrower wings, shorter front-end projection, a lighter and more compact body, presence of dark hood, steep forehead, shorter neck and small size differentiating it from Sooty shearwater and Balearic Shearwater. Our record corresponds to the observation with presence of darker hood, short thick neck, and short bill.

The species record is very significant that the species' range extends from India to Bhutan. Outside Bhutan, the species is known by names like Tasmanian mutton bird, Yolla and moon bird. It breeds in Australia and migrates every year to north Pacific Ocean and reach Arctic Ocean. It also winters the north of Japan, near Aleutian Island (USA) being trans-equatorial migrant (Praveen et al. 2015). Thompson et al. 2013 also reported from Bangladesh. In India, it has been recorded thrice (Giri et al. 2013;

Praveen et al. 2015; Shah et al. 2018). Short-tailed Shearwater *Ardenna tenuirostris* has extremely large range and does not approach the thresholds for vulnerable range size criteria and also vulnerable population size criteria. Therefore, it is evaluated as Least Concern in International Union of Conservation and Nature (IUCN) Red List category.

White-cheeked Partridge (WCP) *Arborophila atrogularis* (Family Phasianida) is recorded from Singye Gewog (26.8561N, 90.2269E), Sarpang District, Bhutan at an elevation of 323 m observed in late winter on 25 March 2020. The sightings were further validated with sound record in Phibsoo (26.7776N, 90.1924E) at elevation of 232 m and in Singye top (top 26.8309N, 90.1816E) at elevation of 552 m. The species record not only provides the morphometric but also the first pictorial record from Bhutan. Outside Bhutan, it is resident in eastern Himalaya, northeastern India and Bangladesh (Grimmett et al. 1998, 2019), Myanmar, and China (Birdlife International 2022). WCP is known to inhabit dense undergrowth in broadleaved primary and secondary evergreen forest, and sometimes adjacent scrub, bamboo, grassland, and cultivation, most frequently below 750m in India, but usually at 610–1,220 m in southeastern Asia (Grewal et al. 2016; Birdlife International 2022). Two dead White-cheeked Partridge were observed from a scrub undergrowth of *Chromolaena odorata*, *Psilanthus bengalensis*, and regeneration of *Schima wallichii*.

Morphological measurements and photographs of the birds were taken by the first and fourth authors soon after the observation. Two medium-sized gray-brown partridge with beak length of 240–245 mm, white-cheeked, distinctive head, neck pattern and wing span of 135–135.5 mm, tail length of 40–40.5 mm and reddish-orange legs with tail length 40 mm. The species during measurement were dead which might have resulted in morphological shrinkages as reported by Winker (1996). The species weighed 277.53–278 g without much difference among the two species. Eleven months after the birds were found, the species was confirmed as White-cheeked Partridge *Arborophila atrogularis* by Dr. Sherub, Ugyen Wangchuk Institute for Conservation and Environmental Research, Bumthang, Department of Forest and Park Service.

White-cheeked partridge *Arborophil aatrogularis* has been reported as decreasing population trend with moderately small, scarcer and declining population. Therefore, it has been evaluated as Near Threatened in IUCN Red list category (Birdlife international 2022). Bhutan might need to conserve and protect the species by adding it to Schedule I as protected species and give high conservation importance. Furthermore, surveys on its distribution, status and habitat information and its breeding status are direly needed.

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Occurrence of Purple Cochoa from Darjeeling town of West Bengal, India

Purple Cochoa *Cochoa purprea* (Hodgson, 1836) is a stocky, generally lethargic and unobtrusive thrush with dull purplish-grey body, distinct lilac-blue crown, lilac tail with black tip which is closely related to the more frequently encountered Green Cochoa *Cochoa viridis* (Inskipp et al. 2011). It is apparently a summer visitor to the Himalayas from May to October, or else strongly nomadic (Collar 2020) and found from Uttarakhand of India to Bhutan (at least with Sikkim) and southern Assam hills (Khasi hills and Nagaland) to west Arunachal Pradesh at 915–3,000 m. It was also recorded in southeastern Bangladesh (Collar 2020), but it becomes more difficult to find to the farther west of West Bengal. Probably the seasonal movement of Cochoa to lower altitudes depends on tracking fruit resources (Lahiri & Sonowal 2020). Despite these data found in literature, it is not enough to conclude its residential status or seasonal movement pattern. However, the eBird data from

On above was the immature *C. purpurea*. Below (marked with a circle) was the mature one clicked by smartphone on the first day. © Asim Giri.

199 records shows that it is found from September to May in India from 50–3,000 m. It prefers dense, moist broadleaved evergreen forests and humid undergrowth in ravines through pine forests. Their main diets are berries, insects and molluscs. At the Namdapha National Park of northeastern India, it was recorded feeding on wild fruits (Viswanathan & Naniwadekar 2014).

On 15 September 2021, while I was on my way to the work station inside Padmaja

Location where *C. purpurea* was photographed, marked with the yellow pin ©Google Earth Pro.

Naidu Himalayan Zoological Park (27.0587N, 88.2546E) Darjeeling, West Bengal, I saw a mature *P. purpurea* lazily foraging inside dense foliage near the trail. Fortunately, I was able to take a photograph on my smartphone. Again, on the next day, I was able to photograph an immature male bird at the same spot but was unable to find either of them after that day. There are very few records from Darjeeling, and the first one was by Jerdon (1863), who managed to collect only a specimen from above 2,420 m. Other nearby records were from the adjacent Kalimpong District (which was previously under Darjeeling District) of West Bengal on the eBird platform. Despite these evidences, there was not a single photographic record from Darjeeling District. As visitors are not allowed there, this becomes an undisturbed small forest patch home for more than hundreds of birds and other fauna, including this Cochoa.

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Captive breeding of Black-crowned Night Heron at Sardar Patel Zoological Park, India

Black-crowned Night Heron *Nycticorax nycticorax* is a widely distributed species throughout the Indian subcontinent (Ali 2012; Grimmett et al. 2011). It is primarily nocturnal and crepuscular except when feeding young ones (Grimmett et al. 2011). It is found in ponds, inland waters, tidal creeks, and mangrove swamps. The nesting season is between April and September in northern India, whereas December to February in the south (Ali 2012). The Black-crowned Night Heron is a natural colonial nesting bird that lays 4–5 pale sea-green eggs. The male and female share incubation, and the eggs are laid between 23 and 26 days. After 42 to 49 days, the chick flies away (Kabir et al. 2019).

Black-crowned Night Herons are frequently seen in Gujarat's wetlands and are listed in Schedule IV of the Wildlife (Protection) Act of 1972. During breeding, Pelecaniformes water birds

Twenty-day chicks in the nest and after 46 days, the juveniles are out of the nest. © Ravi Patel.

gather their nests in spatially and temporally defined nesting colonies, sometimes heronries or egretries (Ali 2012). Examples of how these birds have adapted to newer nesting environments include Reef Heron *Egretta gularis* and White Ibis *Threskiornis melanocephalus* nesting in zoo aviaries (Devkar et al. 2005, 2006). Inadequate protection for at-risk species may hasten the regional loss of biodiversity (Terborgh & Winter 1980).

Here, we report the nesting of the Black-crowned Night Heron in an aviary of the Sardar Patel Zoological Park, Kevadiya, Gujarat. Since Gujarat has not reported any instances of these species being bred in captivity, the knowledge gathered here may ultimately be crucial for managing this species and creating a programme for conservation breeding.

The Indian aviary of Sardar Patel Zoological Park (SPZP) is located in the Narmada District, Gujarat, India. The SPZP has the largest geodesic dome aviary in India, with a 150x50x15m and 6962.5 m^2 area. The aviary has a water body of 44x35x1.5m. The aviary has 32 birds that are frugivorous, carnivorous, graminivorous, piscivorous, and omnivorous. Indian aviary has 10 individuals of Black-crowned Night Heron, out of which two individuals were seen collecting nesting material and set on the tree branch. Later, we started taking the observations during the daytime through 10x50 Nikon Aculon binoculars. We also kept some dry nesting material on the ground as there is a limited source inside captive conditions. The pair started making a nest on the dry Neem tree *Azadirachta indica*, situated behind the Golden Bamboo *Phyllostachys aurea* for better hiding from other birds. We avoided observing at night as most species got disturbed and had accidental issues. We also make sure that sufficient food is available for the nesting pair.

We observed two individual Black-crowned Night Heron copulating, and three eggs were laid at the two-day interval in the first week of February 2021. The incubation of eggs was done by both parents alternatively. We took every management and care about bird diet, nesting area habitat, atmosphere, and disturbance. During the incubation period, sufficient food and proper shelter were provided to the pair. At the end of February 2021, after 27 days, all eggs were hatched. One of the parents is always present in the nest, while the other provides the food. After the chicks were born, the veterinary doctor took a detailed observation of the chicks and made sure that the parents were feeding the young ones. We chopped the fishes and prawns into smaller pieces to provide for the young ones. The sound of a chick begging for food may only indicate that a nest is no longer in stage one. After 46 days, we saw chicks rarely off the nest platform; they all settled on the tree branch.

After 62 days, the three juveniles completely took flight and started feeding with adults with all other species on the feeding platform. Five different platforms were there - large fish for pelicans and storks, small fish and prawn for egrets, herons and ibis, seeds plate for graminivorous, fruit platforms for parakeets, starlings and peafowl, muddy pond for ducks,

goose, and flamingos. The heron feeding platform was around 174m away from the nest. The small freshwater fish and prawns kept on the feeding platforms were *Ctenopharyngodon idella*, *Labeo calbasu*, *Cirrhinus mrigala*, and *Macrobrachium rosenbergii*. They were seen roosting on the nesting tree. After breeding, the group joined with other herons and got habituated to the captive aviary environment.

Herons sexually mature by two years (Davis 1993) and have only one brood per season (Nickell 1966). In tropical areas, the heron family undergoes breeding at any time (Nagelkerken et al. 2008), and here we report captive breeding in the post-winter months. This survey reveals how they reproduce in captivity and creates valuable baseline data for further thorough research. Thanks to the captive breeding program, we gained essential knowledge about the reproductive biology of these ecologically significant waders that contribute to the biodiversity of Indian wetlands. Enhancing the captive breeding programme requires careful planning, including acquiring wild birds to prevent inbreeding depression and maintain healthy lines of captive birds and developing reintroduction procedures like releasing young birds into groups in the wild.

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Infanticide perpetrated by a free ranging adult male Tiger – a case report

Tigers have served as an effective umbrella species in conserving many forms of biodiversity in the Indian subcontinent. Tiger demography is characterized by both high productivity and high mortality. Its body is adapted for stalking and ambushing prey up to five times its own size and the jaw muscles and long canines enable a strong bite necessary to kill and crush bones (Karanth 2003). Tigers are solitary animals that aggressively defend their home range by marking, charging, roaring, and growling (all contribute to defense). Unlike other animals, tigers must travel much further to obtain nutrients. Because of this they are much more aggressive and are prone to attack much more quickly than other cats (Ostrowski 2012).

Infanticide includes starvation, forest fire, floods, diseases, other predator attacks, human persecution, and death of a tigress (all these directly affect cub population). Infanticide perpetrated by male animals is common considering the physiological characteristic of females and social organization in cats. Infanticide is a key factor shaping the socio spatial ecology of tigers and also highlights the importance of functional components of population when managing large carnivores, particularly for invasive activities that artificially elevate adult male turnover (Barlow et al. 2009).

Approximately, a year-old male tiger cub was presented with a history of weakness, hide bound, knuckling and epistaxis. It was immobilized on the field with a standard dose of xylazine and ketamine at 0800 h. Detailed examination revealed numerous scratches and bite wounds over face, body, and limbs with a compound fracture on forehead. The cub was treated with standard dose of antibiotic, anti-inflammatory, anti-histamine, intra-venous fluids, and supportives. On the same night, a cage death reported and complete post mortem procedure was carried out to identify the cause of death and to support the infanticide.

Scratch wounds and bite marks on various parts of the body showed conclusive evidence of attack on cub. Previous history of animal sighting and mating season clearly supported infanticide perpetrated by immigrating adult male tiger. Ramnagar forest division and adjoining Corbett Tiger Reserve, India have recorded high density tiger population, high reproductive rate, low survival and or shorter home range resulting in more frequent encounters.

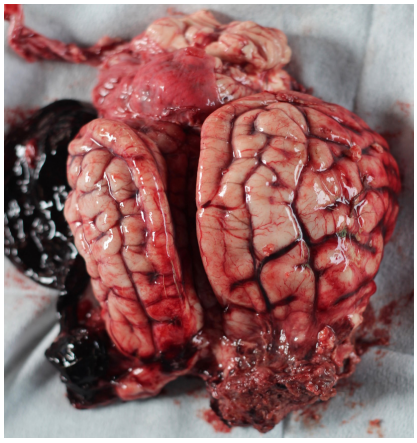
Eva et al. (2006) documented that based on the sexually selected infanticide (SSI) hypothesis, infanticide can be an adaptive mating strategy for males, but rarely documented in non-social mammals and should not benefit females, so one would expect females to evolve mating counter strategies in order to protect their

Knuckling position.

Bite mark in forehead.

Bite mark in knee.

Break in skull.



Massive blood clot in brain.

Piece of broken skull bone.

infants from infanticidal males. Suggesting that infanticide is an adaptive male mating strategy in this non-social carnivore, infanticide shortens the time to the mother's next estrus and putative perpetrator is not the father of the killed infants.

Fest-Bianchet & Apollonio (2013) stated that loss of resident males increases cub mortality substantially through infanticide and temporarily limits the supply of individuals available for replacing residents who die.

The large fluctuation in number of young tigers was due to infanticide that occurred when adult males acquired new territories. With male land tenure typically being only about 2.8 years, infanticide and subsequent synchrony of litter births by resident females may be common and account for much of the observed oscillations in local abundance. Randeep et al (2014) reported female tiger death from a battle with a male while defending her cubs to avoid infanticide. Removal of adult territorial males leads to increased immigration of new males and further leads to reduced survival of cubs and population.

Management strategies to secure the remaining tiger populations can be evaluated by assessing changes in tiger numbers, increasing or stabilized numbers indicate success, whereas decreasing populations may help identify threats and highlight the need for intervention (Parmigiani & Vom Saal 1994).

Camera trapping, radio telemetry, and secondary sign surveys all have been used to estimate tiger abundances at various sites but most studies have been limited rather than tracking change over time (Johnsingh & Negi 2003; Karanth 1995).

Smith & McDougal (1991) reported monitoring programs that identify the breeding sector of a population that have considerably higher power to detect change than comparable efforts tracking total abundance.

Small-scale monitoring programs may have low power to detect trends, and if trends are detected they may not be useful to evaluate the effectiveness of conservation efforts. We recommend that tiger monitoring programmes be designed to differentiate between the breeding and nonbreeding sections of the population. Identifying the residents will increase power to detect change and improve inferences regarding population status and long-term viability (Chapron et al. 2008).

However, detailed demographic population studies on the breeding female and or immigrating male tiger along with effective monitoring and surveillance may control infanticide in the future.

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Commercialisation of an American colonizer

India is a land rich with biodiversity. Her forests, shrublands, grasslands, wetlands, desserts, freshwater, coastal, and marine ecosystems along with the life she harbours, makes her one of the 17 megadiverse countries in the world. But sadly, 40% of the floral species growing in India are alien species and 25% of the non-native species are invasive (Convention on Biological Diversity 2005).

Lantana camara. © Supriya Samanta.

Among all these invasives one of the most common invasive, seen in our backyard is *Lantana camara*, has escaped and is invading 40% of India's tiger range today (Mungi et al. 2020). The total forest cover of the country is 712,249 sq.km. of which *Lantana* has likely invaded 303,607 sq.km. (Mungi et al. 2020).

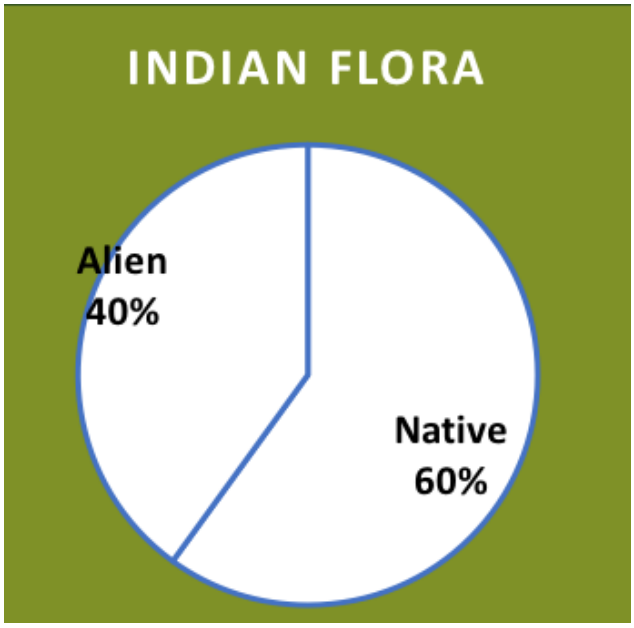
Being a very resistant and adaptable plant, eradication of *Lantana* has been a big challenge to conservationists for a long period of time now. Fruit eating birds like bulbul have been found feeding on the fruits and then dispersing the seeds in Rajaji National Park, and thus paving its path into the ecological cycle (Mungi et al. 2020). In some parts of the country *Lantana* saplings are been sold as ornamental plants to attract butterflies.

In many parts of the country incentives are being given to tribal people and communities for uprooting *Lantana* plants and making products out of them to earn money by selling them (Priya Davidar, Shweta Madgulkar, Trisa Bhattacharjee pers. comm.). This not only helps in solving the problem from its base but, at the same time it also helps the communities to get a 'better' life. But the question is, is it really a sustainable and conservation friendly option to do so? In the longer run is it a practical option to continue with? Is it right to make people dependant on an invasive for their livelihood?

At the first batch of the Ram Hattikudur Advanced Training in Conservation by Zoo Outreach Organisation in 2021-22, this question was posed to the fellows to debate on. Some of the responses that came up are mentioned below.

The spread is not equal all across, being a major threat in some places, while a budding threat in other. Thus, if the incentives are to be given and

***Lantana camara* eradication as a livelihood option**	***Lantana camara* eradication not as a livelihood option**
Help in economic upliftment of the people and thus giving them a better quality of life.	Making people dependent on an invasive plant, they may start harvesting.
Using *Lantana* as fuelwood and reducing the load on other forest trees.	There will be more dispersion of seeds if not looked after properly.
Teaching people to make *Lantana* brickettes, furniture, packaging, cremation, and use it as an alternate. This will give people incentive and also help them gain skills and have small scale business	A lot of investment will go into this and will involve several other industries like chemical, storage, transportation which in turn will increase the pollution. Also, a lot of investment goes into training the people, and we are yet to know if it will be successful in the market.
This is the only sustainable option as both wildlife and livelihoods are benefited	*Lantana* is not the only invasive species out there, should we start commercialising all the invasives then?



Present status of floral diversity in India

commercialization becomes successful then people will start harvesting the weed in parts of the country. *Lantana* has its strongest base in Shivalik hills, central India, and southern Western Ghats (Mungi et al. 2020). Being a rich base for the weed, people in parts of southern Western Ghats are still cutting the plant instead of uprooting it, along with the fact that bigger plants are only being cut (Priya Davidar pers. comm., 2021), in a way harvesting it. But *Lantana* stems are not hard enough and thus if used to make furniture it may not stay for long. If the commercialization is not successful enough, it will be a big waste of time, money, labour, and raw materials.

Livelihood is an emotion, rather it is much more scientific to make people aware about the harmful effects of *Lantana* and explain them why they should remove it from their nearby places. This would be a far more scientific approach. Also, *Lantana* is harmful for animal health; if fed on, it causes diarrhoea, liver failure, and even death of animals (Mungi et al. 2020). Workers clearing *Lantana* have complained of respiratory irritation (The State of Queensland (Children's Health Queensland) 2022). *Lantana* pollen is the most common IgE (Immunoglobulin E) sensitivity inducing pollen known (Ghoshal et al. 2016). Usually, symptoms are delayed, including nausea, vomiting, diarrhoea, laboured breathing, dilated pupils, lethargy, weakness, dermatitis, and as much as death in a few situations (The State of Queensland (Children's Health Queensland) 2022). Thus, if people are involved in making products out of *Lantana*, it may subsequently affect them, their kids, and the old people in the house, who are not directly involved but are around. Also, the waste and the remains, that include leaves and branches which if not

thrown properly, may be consumed by domestic animals. During our trip to Mudumalai, we have seen Elephants actively avoiding *Lantana* plants and rather opting for native plants to feed on.

Lantana products are not environment friendly. They involve setting up of various industries including, transport, packaging, chemical, and storage. This adds to the environment pollutions. Also, the unused parts need to be burnt which causes more pollution. Rather it can be given to people as fuelwood or for burning the dead, which in turn can reduce the pressure on timber plants. At the same time, making products using *Lantana* will need a lot of man power and resources, for training the people how to make it, uproot it, commercialise it, and also for creating market visibility. Also, people involved need to be kept a check on so that they don't start harvesting it. Rather this resource can be spent on hand in hand restoration work along with uprooting. Invasive plants usually, are seen to lose their strength once there is a shade or a canopy cover above them (Divya Mudappa pers. comm.). Thus, planting fast growing native species of plants along with removal of *Lantana* will make the eradication process much faster and more efficient. This has been successful in Valparai. Also, restoration as a livelihood is environment friendly and sustainable.

There are many arguments on both sides, and no one yet knows a better solution to come up with. A lot of work and research is needed to know the best possible way to deal with this. But, *Lantana camara* is not the only invasive knocking our doors, there are many more. So, are we going to do the same for all of them and wait to see that it turns out to be a great success or a bigger threat? Thus, we need to think fast and act faster, as there are plants around us many of which are native and require conservation efforts for their survival.

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