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# prithivya

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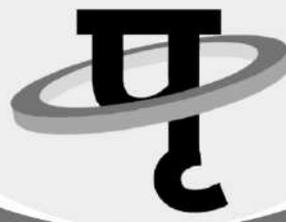
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Read about  
Rapid assessment of  
orchids in Kerala



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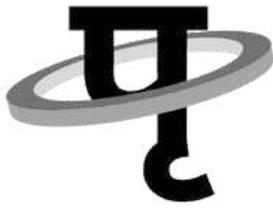




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# TABLE OF CONTENTS

## Prithivya

A tri-annual Newsletter of WCB Research  
Foundation and WCB Research Lab

Volume 2 | Issue 2 (August, 2022)



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### *Field observations*

1-3 *Bilateral anophthalmia in juvenile common Sand Boa (Eryx conicus)*

*Shah et al.*

4-6 *Report of auto-sexual behaviour in a captive Sloth bear (Melursus ursinus) at Sardar Patel Zoological Park, Gujarat - India*

*Patel et al.*

### *Short Articles*

7-9 *Celebration of the World Bear Day 2022 at Ratanmahal Sloth bear sanctuary*

*Desai et al.*

10-17 *A rapid assessment of orchid flora in Anakkulam range, Mankulam Forest Division, Idukki in the Western Ghats of Kerala, India*

*Sebastian et al.*

### *Research Paper*

18-23 *Monotonous diet composition of Indian Eagle Owl, (Bubo bengalensis)*

*Patel et al.*

### *Review Articles*

24-33 *A short review depicting major threats to Vultures in India*

*Pandey S*

34-37 *Environmentalism in ancient Indian scriptures – a short review*

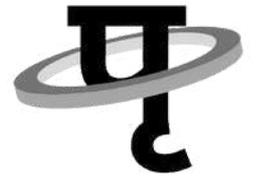
*Joshi M*

### *Assorted news*

*Achievements*

*Announcements*

# EDITORIAL NOTE



॥ माभूमनिष्ट्याइवेन्द्रत्वदरणाइवावनानिनप्रजहितान्यद्रिवोदुरोषासोअमन्महि॥

*Rigved 8.1.13*

We, as a scientific community, are heaving a sigh of relief as the dark clouds of Covid 19 pandemic are slowly lifting. The life is returning to near normal, rather to a New normal where the people are realizing the connection between the human health and environmental health. Though we were much excited to read about a fall in pollution levels and an increased visibility of nature with louder bird calls due to the reduction in anthropogenic activity during the pandemic, currently we are at the edge of a cliff where the earth's yearly resources are already used up on 28th June 2022, infamously known as the Earth's Overshoot Day, in terms of utilization of natural resources. Countries across the world are devising newer strategies to recover the economic losses. Some of the positive steps taken by EU countries to ensure that the environment comes first are, innovative urban planning ideas with smart houses and increased urban green spaces. Governments are encouraging investments in renewables and helping to decarbonise their economies by offering incentives to enterprises adopting Green technologies. The above quote from Rigved, underlines the immense importance of healthy forests in our lives, however, we are ignoring the wisdom shared by our forefathers. Disturbing reports of more than half of protected areas in Africa being forced to halt or reduce field patrols and anti-poaching operations as well as rolling back activities related to conservation education and outreach, are making headlines. A quarter of protected areas in Asia also reported cost cutting and shelving many of the conservation projects. The cutting down of resources allocated for environmental activities and relaxing or scraping of environmental goals and laws for boosting the economy at the cost of ecology would be disastrous. Such decisions would bring on long term repercussions in country's efforts for reducing the carbon footprints.

Though India features in the list of five countries that have been successful in complying with the Paris agreement of engaging in activities that would reduce the rise in global temperature by less than 2 degrees, it is still the 3rd largest global emitter of greenhouse gases. As we boast about our demographic dividend, a pragmatic leadership with an ecological and economical foresight, can make us the torch bearers in setting and achieving newer sustainable development goals, that necessary to co-exist with nature in this new-normal era. The heartening news of recognition and addition of 11 new Ramsar sites from India, is the encouragement needed, for protecting biodiversity of many more such Indian wetlands.

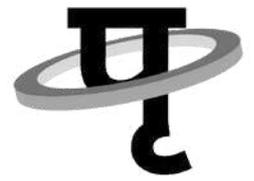


**Dr. Sagarika Damle**

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## DIRECTOR'S COLUMN

Presenting this issue of “Prithivya”, our official newsletter publishing scientific and semi-scientific articles in the field of conservation biology. I am thankful to all the contributors for contributing their scholarly articles and happy to appreciate your work in the respective fields. The foundation is completing its two years in this September with a very progressive journey and helping the young researchers through various programs. Our research and conservation activities are well recognized and appreciated by various national and international organizations.

Conservation is often referred as the act of protecting our natural resources for current and future generations. Establishing the protected areas and implementing the laws may not only helps conserve natural landscapes and resources, but also, involvement of local community and local institutions is equally important. Science based conservation practices implemented through community has always been successful in species and habitat recovery. At WCB Research Foundation, we always try to integrate the scientific research and local knowledge that help in conservation and also enhance the involvement of local youth in such practices.

I am thankful to our supporters and collaborators who are constantly inspiring us in organizing conservation and research programs including research projects and internships. We are planning several activities in the coming years to address the issues of environment and conservation. National Conference on Climate, Community and Conservation is one of the initiatives in partnership with Navrachna University, Vadodara. This conference will provide a platform to the researchers of the country to share their research.

Through “Prithivya”, we try to highlight such conservation practices and use of scientific research in such practices. I urge the researchers to share their knowledge, experience and their scientific research through the medium of “Prithivya”. I also request to strengthen the conservation organizations of your areas by your support and appreciation. Let us observe and celebrate the National Wildlife Week (October 2 to 9) through spreading awareness and disseminating scientific knowledge about wildlife in the community. I wish you will like to read this issue of “Prithivya” and do not forget to write us your feedbacks and suggestions.



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## Bilateral anophthalmia in juvenile common Sand Boa (*Eryx conicus*)

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Common Sand Boas (*Eryx conicus*) are stout-bodied, medium-sized snakes with strongly keeled scales (Das, 2002). It varies from its yellowish-white to dark brown colour with irregular blotches of reddish-brown to black forming an uneven chain down the back due to which this snake is often misidentified as baby python by local people. The average length of Common sand boa is 50cm which may reach up to 1m (mostly female) (Whitaker R, 2006). Common sand boa occurs throughout the Indian subcontinent except in the islands of Andaman Nicobar (Whitaker and Captain, 2004). These snakes occupy habitats ranges from sandy soil, rat burrows to brick piles and rocky areas. They are considered as strong burrowers in loose sand or silty soil (Sharma 2007).

In August 2021, we received a snake rescue call from the city of Rajkot, Gujarat, India (22° 15' 30.405" N, 70° 49' 2.7228"

E). Upon examination, it was identified as a juvenile common sand boa (*E.conicus*) and the snake was found dead (Fig. 1). During body examination, it was also observed that this juvenile boa was missing it's both the eyes since birth. During the careful investigation, we did not find any evidence of injury and the eye sockets were also absent. To the best of our



Figure. 1. Juvenile Common Sand Boa (*Eryx conicus*)



knowledge, this may be the first report of Bilateral Anophthalmia in Common sand boa in Gujarat, India (Fig. 2-4). As the snake was already dead, we kept it in a nearby natural habitat for decomposition.



*Figure. 2 Bilateral Anophthalmia in Common Sand Boa (Eryx conicus)*

Anophthalmia, which can be either unilateral or bilateral, is defined as the congenital total absence of ocular tissue resulting from the failure of the primary vesicle to develop or from a complete regression of the optic vesicle (Millichamp et al. 1983). These deformities have been attributed to infections, exposure to chemicals, UV radiations, mutations, or developmental errors (e.g. Khan and Law, 2005; Bell, Spotila, and Congdon, 2006). Genetic factors may also play an important role in such abnormalities in reptiles (Velo-Antón, Becker, and Cordero-Rivera, 2011). Although, we did not know the reason behind anophthalmia whether it is genetic or environmental.

### **Acknowledgments**

We would like to thank Mr. Jaydeep Maheta for his timely support, suggestion, and guidance in identifying this abnormality and preparing this manuscript.

### **Ethical statement by Authors:**

*The authors hereby confirm that the work described here was carried out under the supervision of the forest department and no any harm to the animal was caused as the work was carried out on the dead specimen found from Rajkot city. All the authors are agree with*



*the above statement and take full responsibility for any further consequences occur in the future.*

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## Report of auto-sexual behaviour in a captive Sloth bear (*Melursus ursinus*) at Sardar Patel Zoological Park, Gujarat - India

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Sloth bear (*Melursus ursinus*) are endemic to Indian subcontinent and widely distributed in the India. At least 85% of the present sloth bear population occurs in India. Although sloth bear still found scattered across much of its former range, their actual distribution is now highly fragmented and confined mainly to five distinct regions, namely northern, north-eastern, central, south-eastern, and south-western. Sloth bear subsists primarily on termites, ants, and fruits. Fruits may comprise 70–90% of the diet during the fruiting season, whereas termites and other insects may comprise >80% of the diet the rest of the year (Dharaiya et al., 2016).

The adult pair of Sloth bear (*M. ursinus*) is kept at Sardar Patel Zoological Park, Gujarat state India. In an enclosure of 100m<sup>2</sup> areas of kraal, there are total 4 shelter houses. The animals are released into enclosure from 7:00am to 6:00pm six days a week and they keep in the kraal for one day. In captivity, sloth bear are provided with the diet 60% of mix fruits and vegetables, 20% boiled rice, 10% boiled eggs and 10% yellow meal worm (*T. molitor*) along with honey. In the present behavioural study, we observing sloth bear on regular basis and we reported a unique behaviour performed by male sloth bear.

The behavioral study on captive sloth bears was carried out from January 2022 to till on continuous basis. Observations were carried out on one pair of adult sloth bears (1 male and 1 female) displayed in Sardar Patel Zoological Park. Observations were made on daily basis during in the morning from 7:30am to 10:30am and in the evening from 4pm to 6pm.

The bears are mostly active in the mid-afternoon (4:00pm) to the late morning (11:00am) and found performing mainly two types of behavior: Active behavior (e.g. foraging, locomotion, climbing, digging, rolling, playing etc.) and Passive behavior (e.g. seating, roosting and maintenance).

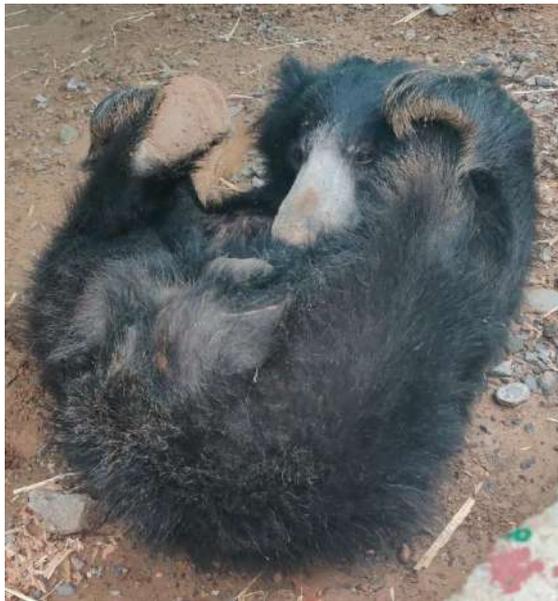
On June 13<sup>th</sup>, 2022 a pair sloth bear released in the kraal from shelter house. At 11:00am a female foraging on the ground of kraal and at the same time male was seating on the ground in luge position balancing by hind limbs; after sometime male wrapped its penis by fore limb



(Fig. 1) and ejaculate semen. After ejaculation it has tried to suck the semen by licking the penis (Fig. 2). Generally, this type of behavior we have observed in our zoo in exotic primates, like Tufted Capuchin (*Cebus apella*) and Squirrel Monkey (*Saimiri sciureus*); however, it was observed for the first time in sloth bear and it is not reported earlier from any Indian zoos.



**Figure. 1:** *M. ursinus* wrap its penis by fore limb.



**Figure. 2:** *M. ursinus* trying to suck semen by licking its own penis.

This observation suggests that sloth bears might display such behaviour of auto-sex or masturbation in wild but due to its secretive nature, it may not be reported. This observation can open the new areas to study sexual behaviour of sloth bear in captivity. Veeraselvam et al., 2013 and Pastorino et al., 2017 studied the behaviour of sloth bears in captivity at Arignar Anna Zoological Park, Chennai and Zoological Society of London respectively and noted several activities like foraging, locomotion, climbing, digging, rolling, playing, seating, roosting and maintenance; however, auto-sexual behaviour was not observed.

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## Celebration of the World Bear Day 2022 at Ratanmahal Sloth bear Sanctuary

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The World Bear Day is celebrated on 23 March each year, to recognize and encourage the conservation of the various bear species found in the world. Bear Day is celebrated to raise awareness among people about the various bears, their habits and habitats. The Wildlife and Conservation Biology (WCB) Research Foundation and Vadodara Wildlife division jointly organized the World Bear Day celebration at Ratanmahal sloth bear sanctuary in 2022. In the study area “AatmavatSarvabhuteshu” a project is currently being conducted to increase community understanding of sloth bears and improve opportunities for coexistence (Mesaria et al, 2021). This project main aim is to “explain and transfer scientific ideas to the local scientific ideas and practices with the local community, and to create and spread science-based, culturally sensitive education to school children and adults through outreach programs meant to sensitize people to the plight of the sloth bear (*Melursus ursinus*). The hope is that this message will in still more positivity and ideas of how to live with sloth bears.

In this celebration 20 volunteers from various places were encouraged to participate and conduct a sloth bear awareness drive among the children living around the sloth bear habitat. The aim of this activity was to educate the local communities and develop an effective understanding of the ecological value of their surrounding flora and fauna, as well as a sloth bear-specific education to help mediate the overlap in habitat use between locals and bears, to increase the local knowledge about sloth bears, and to decrease the instances of human-sloth bear conflict.



*Figure 1: Children curiously reading a comic leaflet about the story of the Sloth bear and its related threats*

As part of the celebration WCB Research Foundation educated 223 students from 1<sup>st</sup> to 12<sup>th</sup> grade and 45 teachers from six schools in the six villages located in the close proximity of the bear habitat in the Ratanmahal sloth bear sanctuary were also trained. All the schools were visited by our volunteers and engaged children with (1) activity booklets to spread awareness about the sloth bear, (2) recommendations on safe living in the sloth bear habitat through a detailed presentation with brief talk on sloth bear, followed by a documentary film and animation film on the same topic and (3) distributing bear education materials as a take-home message. Activity booklets and comic leaflets previously prepared by Mesaria et al. (2022) were distributed among the kids. An elaborated presentation on dos and don'ts in the sloth bear habitat was also provided as material. Education material, including sloth bear pocket booklets, posters regarding sloth bear, leopard and hyena, dos and don'ts when encountering a bear, food calendar of sloth bears and map of sloth bear habitat in Gujarat and India in local language, was very well received by the kids as well as their teachers.

### **Acknowledgements:**

We would like to thank the Gujarat forest department, the Serenity Trust-Ahmedabad, Bear Trust International- USA, the Allwetter Zoo (Germany) and the Governing council of WCB Research Foundation for financial and technical assistance. We are grateful to principals and teachers of all the participating schools for allowing us to organize this program and related activities. We also would like to thank all the volunteers who travelled from different places and made this celebration successful.

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## **A rapid assessment of orchid flora in Anakkulam range, Mankulam Forest Division, Idukki in the Western Ghats of Kerala, India**

**Sebastian J.<sup>1\*</sup>, Ramakrishnan T. A.<sup>2</sup> and Raju R.<sup>3</sup>**

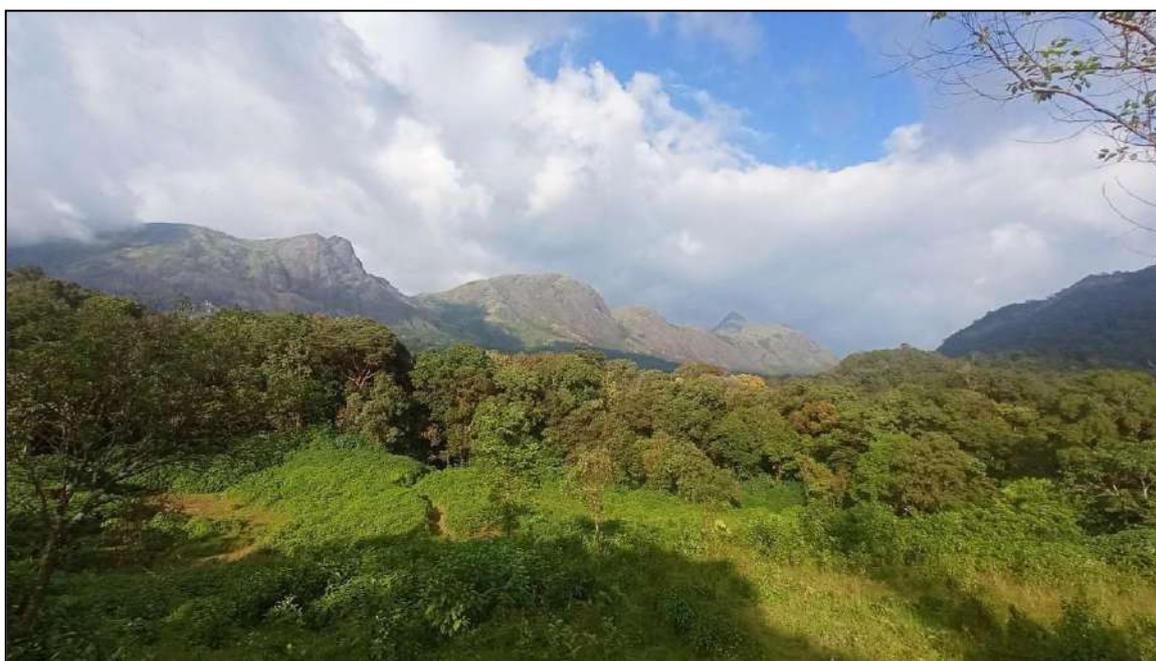
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Orchid diversity in the state of Kerala is very unique and the highest in the country after the north-eastern states (Singh et al. 2019). The number of orchids in the state is around 265 species with high endemism (Jalal & Jayanthi 2012; Sasidharan 2013). Increasing habitat diversity with increasing area can predict orchid diversity in the tropics (Keppel et al 2016). Interestingly, the dominant forest type in the state is the evergreen forest. Evergreen habitats exhibit a diverse array of climatic and habitat conditions within, providing micro-environmental conditions thereby, favoring the diversity and abundance of orchids (Sebastian 2020). In India, ecological studies on orchids are only a handful leaving a huge gap in orchid science. Interestingly, global research on orchids warns us that a large number of orchids from the tropics are going to be majorly threatened due to changes in habitat and climate. Hence, it is high time orchid science in the country initiated seasonal observations and spatial and temporal long-term ecological studies from all biogeographical zones. The current study



*Figure 1. Montane evergreen forests in Anakkulam range, Mankulam Forest Division*



was part of a rapid biodiversity assessment carried out by the forest department. The orchid flora recorded from the rapid biodiversity assessment in the Anakkulam range is discussed in this article.



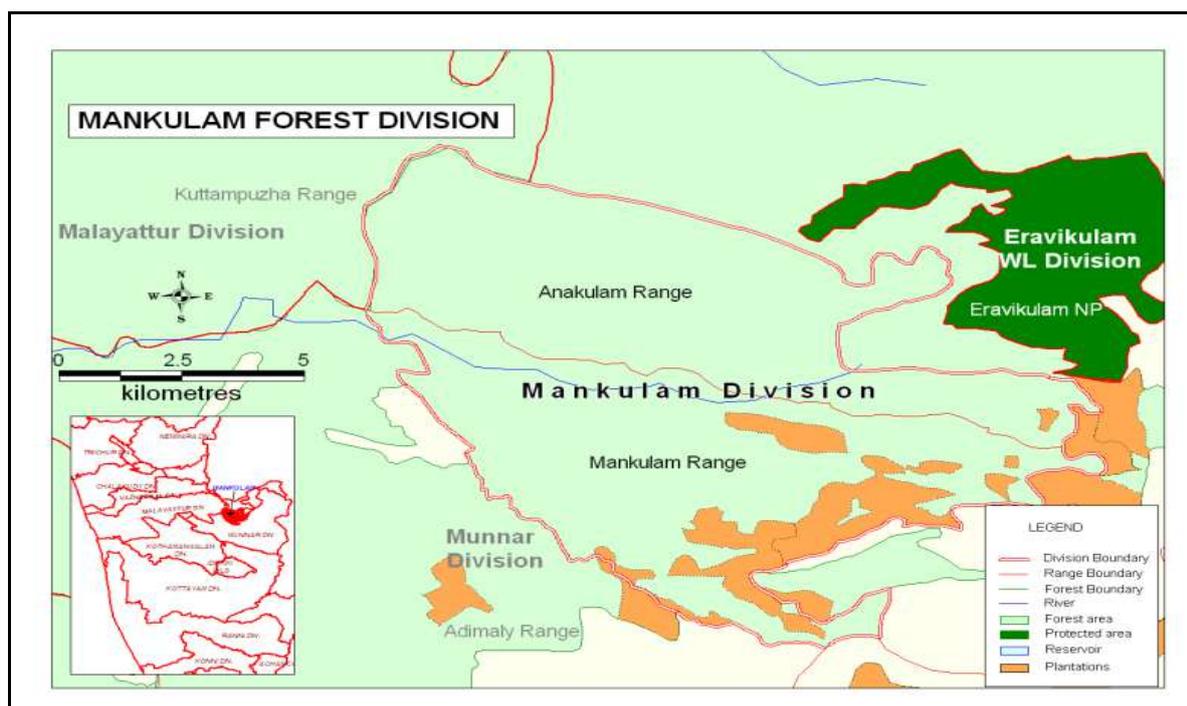
*Figure 2. Some orchids recorded from the Anakkulam range, Mankulam Forest Division, Idukki district, Kerala*

### **Field observations:**

As part of a rapid floral assessment, the authors visited the Anakkulam range of the Mankulam forest division for the forest department on the 11th and 12th of December 2021. Mankulam forest division is a territorial forest division in Kerala located in the high ranges of the Anamalai Hills in the Western Ghats. Anamalai hills surround Anamudi, the highest peak in south India. These hills are mostly protected with the largest contiguous montane shola grasslands and serve as a conservatory for endemic flora and fauna, that includes flagship species like Nilgiri tahr (*Nilgiritragus hylocrius*), Neelakurinji (*Strobilanthes kunthiana*) etc. The Mankulam division shares borders with Eravikulam national park in the northeast, the Munnar forest division in the southwest, and the Malayattur forest division in the northwest (Image 1). The total area under the Mankulam forest division is 90.05 sq km, of which 52 sq km falls in the Mankulam range and 38sq km in the Anakkulam range. ‘Anakkulam’ range is named after the regular sighting of a herd of elephants by the ponds in the area. The division



has perennial rivers such as the Karinthiyar river and Menachery river flowing through the range. There are several peaks such as Parvathimala, Bhagavathypara, Oosi mala, and the highest peak in the division is known as Sanku mala. The elevational gradient of the Anakkulam range is from 900MSL to 1600 MSL. The range experiences an average rainfall of 2700mm in a year and the temperature here varies between 5° C in winter to 30° C in summer. The forest type in the lower ranges is montane evergreen forests and it slowly transitions into shola forests in the higher ranges.



**Figure 1.** Map of Mankulam Forest division (Source: Kerala forests and wildlife department).

Transect walk was followed for 12km to record the vegetation in the range. These transects are established by the forest department for survey and monitoring. The transect length was roughly around 1km and the width was 5m. A total number of 33 orchids have been recorded from 12 transects. Of which 25 are epiphytic and 8 are terrestrial orchids. Interestingly, of them, 14 are endemic to the Western Ghats. The orchids surveyed from the Anakkulam range are given in Table 1.

**Table 1. Orchids observed in Anakkulam range, Mankulam forest division**

Sl no.	Species	Endemic**	Epiphytic/ Terrestrial	Status of Conservation **
1	<i>Anoectochilus elatus</i> Lindley	✓	T	EN
2	<i>Bulbophyllum aureum</i> (Hook. f.) J.J. Smith	✓	E	EN
3	<i>Bulbophyllum careyanum</i> (Hook.) Spreng.	-	E	
4	<i>Bulbophyllum sp *</i>	-	E	
5	<i>Bulbophyllum sp 2*</i>	-	E	
6	<i>Bulbophyllum sterile</i> (Lam.) Suresh	-	E	
7	<i>Calanthe sylvatica</i> (Thouars) Lindl.	-	T	
8	<i>Cheirostylis flabellata</i> (A.Rich.) Wight	-	T	
9	<i>Coelogyne nervosa</i> A. Rich.	✓	E	EN
10	<i>Conchidium braccatum</i> (Lidl.) Ormerod	-	E	
11	<i>Dendrobium herbaceum</i> Lindl.	-	E	
12	<i>Dendrobium jerdonianum</i> Wight	✓	E	EN
13	<i>Dendrobium heterocarpum</i> Wall. ex Lindl.	-	E	
14	<i>Dendrobium macrostachyum</i> Lindl.	-	E	
15	<i>Didymoplexis pallens</i> Griff.	-	T	
16	<i>Disperis neilgherrensis</i> Wight	✓	T	CR
17	<i>Eria mysorensis</i> Lindley	✓	E	EN



18	<i>Eria nana</i> A. Rich.	✓	E	EN
19	<i>Eria pauciflora</i> Wight	✓	E	
20	<i>Eria polystachya</i> A. Rich.	✓	E	
21	<i>Eria pseudoclavicaulis</i> Blatter	✓	E	
22	<i>Gastrochilus flabelliformis</i> (Blatter & McCann) Saldanha	✓	E	EN
23	<i>Liparis elliptica</i> Wight	-	E	
24	<i>Liparis viridiflora</i> (Blume.) Lindl.	-	E	
25	<i>Malaxis sp*</i>	-	T	
26	<i>Oberonia brunoniana</i> Wight	✓	E	
27	<i>Papilionanthe subulata</i> (Willd.) Garay	-	E	
28	<i>Pholidota imbricata</i> (Roxb.) Lindl.	-	E	
29	<i>Seidenfia crenulata</i> (Ridley) Szlachetko	✓	E	CR
30	<i>Sirhookera lanceolata</i> (Wight) Kuntze	-	E	
31	<i>Spiranthes sinensis</i> (Pers.) Ames	✓	T	
32	<i>Trichoglottis tenera</i> Lindl. (Rchb.) f.	-	E	
33	<i>Zeuxine gracilis</i> (Breda) Blume.	-	T	

Abbreviations used: E- Epiphytic, T- Terrestrial \*species not confirmed due to lack of phenological developments; \*\*Endemic orchids, Status of conservation- Kumar et al. 2001

Interestingly, most of the recorded orchids are habitat-specific (Sebastian 2020) and are rare in the Western Ghats (Kumar et al 2001). It may be noted that the population and ecological aspects of these species are not yet known. *Didymoplexis pallens* was the only orchid



recorded as mycoheterotrophic, which grows in leaf litters and completely depends on fungi for survival (Jalal & Jayanti 2013). The presence of mycoheterotrophic orchids indicates the availability of undisturbed primary forests. Based on the Conservation Assessment and Management Plan Workshop (Kumar et al. 2001), the Anakkulam range has 9 species of orchids that need immediate conservation interventions. The presence of these orchids advocates the availability of specific (micro)habitat and (micro)climatic conditions montane evergreen forests provides to orchids (Sebastian 2020) and therefore invites scientific attention. Orchids such as *Dendrobium macrostachyum*, *Liparis sp*, *Bulbophyllum sterile*, *Malaxis sp*, and *Pholidota imbricata* are seen as generalists i.e., distributed across habitats. Species such as *Anectochilus elatus*, *Liparis elliptica*, *Oberonia brunoniana* were in flowering. Also, it may be noted that some genera of orchids could not be identified without flowers leaving uncertainties in relation to exact taxa. So rapid assessments or short-term studies may not always yield the required data on species and their ecology. Ecological understanding of endemic orchids in the Western Ghats is almost nonexistent. The presence of 14 endemic orchids (42%) suggests the high endemic floral elements in the region, Anamalai Hills in the Western Ghats.

Orchids are known to be indicators of specific habitat and climatic conditions. The lack of taxonomic and ecological studies in India makes our orchids hitherto unknown to practicing conservationists. Therefore, it is very important to immediately initiate large-scale spatial and temporal studies to understand the ecological aspects of orchids against seasons or changes in climate, especially in regions of importance such as areas of endemism and in the high ranges of the Western Ghats. Otherwise, the lack of understanding may lead us to witness orchids succumb to potential threats possessed by changes in climate and habitat.



From left: A. *Liparis elliptica* Wight, B. *Bulbophyllum* sp. , C. *Oberonia* sp., D. *Anectochilus elatus* Lindl. in flowering



Clockwise:

- A. *Anectochilus elatus* Lindl.
- B. *Disperis neilgherrensis* Wight
- C. *Seidenfadeniella filiformis* (Rchb.f.) Christenson & Ormerod
- D. *Eria braccata* Lindl.

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## Monotonous diet composition of Indian Eagle Owl (*Bubo bengalensis*)

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### Abstract:

The study on food habits of the Indian Eagle Owl, (*Bubo bengalensis*) by analysing their regurgitated pellets. The diet composition of Indian Eagle Owl was studied at Junagadh out scouts Gujarat, India (21°33'59"N, 70°37'25"E). Samples were collected from nesting site of Indian Eagle Owl and analysis of 58 regurgitated pellets yielded 89 prey items. The results of the present study indicated that Indian Eagle Owl are opportunistic nocturnal predators for controlling of rodent and especially totally depended on one species Indian Gerbil (*Tatera indica*) as monotonous diet. They used stones for digestion or unknown reason. They are survived with monotonous diet and breed successfully. This article is one of the warm evidence for Owls are as bio-control agents because they control rodent population which are harmful for agriculture.

**Key Words:** Pellet, Indian Eagle Owl, Monotonous, Stone, Diet

### Introduction:

Owls (Aves: Strigiformes) play an important role in ecosystem by maintenance of natural balance since they are at the apex of trophic levels in aquatic and terrestrial ecosystems (Sergio, 2008). They are commonly found near human inhabitation, agriculture fields and in forest zones. Owls are also known for their important role in bio-control agents and eats number of harmful insects and pests like small mammals' species like rodents and insectivores (Paunikar et al., 2015). The Genus *Bubo* comprises some of the world's largest species of owls. Most if not all of which are tertiary consumers and an excellent indicator of ecosystems they reside. The Indian Eagle Owl (*Bubo bengalensis*) is also known as the Indian Great Horned Owl, Bengal Eagle Owl, Rock Horned Owl and Rock Eagle Owl, and till recently they considered as a subspecies of *Bubo bubo* (Patki et al., 2014). The Eagle Owl is the largest owl in the world (1500-3500g) with a wide distribution range across Europe, Asia and North Africa (Sandor and Ionescu, 2009). The Pharaoh Eagle Owl in Azraq N. R. feeds on a wide range of available prey species and depends mainly on mammals to ensure its food requirements (Shehab and Ciach, 2008).

Owls feed on small mammals such as squirrels, bats, rats, mice, etc. Owl pellets are accumulations of the undigested portions of prey which are regurgitated and ejected through mouth in compact forms. They regurgitate undigested food material from the mouth in the form of oval and greenish coloured are known as pellets. Pellets contain many things like



broken parts of skulls, mandibles, vertebrae, pectoral and pelvic girdles, limb bones (Talmale and Pradhan, 2009). Owl pellet analysis serves mainly two primary purposes. Foremost, pellet analysis serves as non-destructive means of diet determination. Obtained diet information can include prey species eaten, preferences of prey species and estimates of contributions of biomass of prey. Owl pellet analysis also is a useful method for gaining additional insight into communities and distribution of small mammal. Driver (1949) reported that teeth and teeth sockets are very significant characters for identification of small mammals. They give some clues from their shape, size and arrangement.

In India, several studies have been carried out on the food habits of different species of owls by Neelanarayan & Kanakasabai (2004), Pande (2004), Ramanujam (2006), Zade (2011) and Nerlekar (2014).

### Materials and Methodology:

During the study food habit of Indian Eagle Owl (*Bubo bengalensis*) were observed by collecting and analysing their regurgitated pellets from their roosting and nesting sites (Figure 1). Samples were collected from Junagadh out-scout, Gujarat, India. (21°33'59"N, 70°37'25"E). The fresh pellets were collected randomly in different periods and packed in polythene bags carefully along with labelling before transferred to the laboratory. Total 58 Pellets were collected, bagged and kept in an oven at 70° for 24 h for incubation and in order



**Figure 1: Pellets arranged size wise (Photograph by Ravi Patel)**

to kill infesting insects and then stored. Length of the pellet material was measured by using Vernier caliper (Patki et al., 2014). Different food remnants like bones were cleaned under a dissecting microscope from. The diet composition of Indian Eagle owl was studied by the examination of materials found in the



pellets. The skull, cranial bones and the mandible bones were useful for identify the small mammals upto the species level (Paunikar et al., 2015). Mammalian prey items (skulls and mandibles) were identified up to species level following the key by Talmale & Pradhan (2009)

### Result and Discussion:

In present study 58 pellets of Indian Eagle Owl (*Bubo bengalensis*) were collected and incubated at 70°C for 24 hours. We found monotonous diet of Indian Gerbil (*Tatera indica*) by Indian Eagle Owl. Among 58 regurgitated pellets of the Indian Eagle Owl, 9 pellets were large sized. The measurements of large sized pellets were  $12.5 \pm 1.5$  cm in length,  $3.2 \pm 0.7$  cm in width and 18-gram weight. The 31 pellets are average, size of pellets was  $7.8 \pm 2.1$  length,  $3.2 \pm 0.5$  width and 9-12 grams; While 18 pellets were small sized. The measurements of small sized pellets were  $4.3 \pm 1.8$  cm in length,  $2.9 \pm 0.4$  cm width and 5–7-gram weight.

The regurgitated pellet consisted of hair, fur, small parts of vertebrate bones. Vertebrate bones found in the Indian Eagle Owl pellet, formed the basis of identification of small mammals.



**Figure 2: examination of One large sized pellet with three skeletons and stones (Photograph by Ravi Patel)**



**Figure 3: Undigested bones of 58 pellets: 1. Skull 2. Scapula 3. Radius & Ulna 4. Femur 5. Tibia & Fibula 6. Ribs 7. Vertebrae 8. Unidentified ©Ravi Patel**

According to Pande and Dahanukar (2011) the Indian Eagle Owl is a dietary generalist, which corresponds with published literature, their study showed that the abundance and total biomass of different groups of prey in diet where in the rodents were the most preferred prey followed by birds and bats. They also observed that insect prey was very high. Birds and Reptiles have been listed as prey items in diet of the Indian eagle owl. The Pharaoh Eagle Owl's diet contained a wide variety of prey items that comprised mainly of small mammals (Benamor et al., 2021).



In present study we examined total 58 regurgitated pellets of Indian Eagle owl. We found that their diet is totally depended on Rodents and especially they eat Indian Gerbil. So, it is monotonous diet preferred by Indian Eagle Owl. There were 1-2 whole skeleton found while examine the large sized regurgitated pellets of Indian Eagle Owl. While examination of large sized regurgitated pellet, we found 3 skeletons and small stones from it. It is one of the abnormal and rare things that Indian Eagle Owl used stones for digestion or unknown reason. (Figure 2). Throughout the collection of regurgitated pellets near the nesting site we observed that there was female hatching the eggs and two owlets were successfully grew (Figure 4).

### Conclusion:

From the present study it is observed that Indian Eagle owl (*Bubo bengalensis*) can be considered as biological pest controller in agricultural habitat because Indian Eagle owl is a dietary generalist relying mostly on the rodents for their food. Being at the apex of trophic levels in terrestrial and aquatic ecosystems, the owls play an important role in maintaining natural balance and also help biologically in controlling harmful insect pests' as well as small mammalian pests like rodents and insectivores (Pande & Dahanukar, 2011a, 2011b).



**Figure 4: Nesting site of Indian Eagle Owl with two owlets. (Photograph by Gaurang Bagda)**

In the present investigation, the feeding habits of the Indian Eagle Owl were studied by analysing their regurgitated pellets. After identification of bones of body parts found in the pellets that revealed only one species Indian Gerbil (*Tatera indica*). Indian Eagle owl totally



depended on this monotonous diet. So, according to this observation and analysis Indian Eagle Owls can survive with monotonous diet of Indian Gerbil (*Tatera indica*) and breeding is also successful with this diet (Fig. 4).

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## A short review on depicting major threats to Vultures in India

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### Introduction:

The health and well-being of communities depend greatly on the benefits rendered by natural ecosystem, which in turn rely on biodiversity (Bennett et al. 2015). The current unexpected extinction of species, on the other hand, jeopardises the foundations of ecosystem perseverance and associated services (Cardinale et al. 2012). Diurnal and nocturnal raptors are regularly used as ecological indicators due to their important roles in food web links (Buechley et al. 2019). Vultures serve an active role in the ecosystem by scavenging on animal carcasses (Ali & Ripley, 1968). They predominantly feed on rotting flesh and tear meat from carcasses before it decays, preventing the spread of disease that affects other mammals, including humans (Iqbal et al. 2011).



*Image 1: A flock of White-rumped Vulture - Nature's remarkable scavenger. (Source: Down to Earth.org.in)*

There are nine vulture species in India, five of which are members of the genus *Gyps* (Prakash 1999). Residents include the Oriental White-rumped Vulture (OWRV) *Gyps bengalensis*, Long-billed Vulture (LBV) *Gyps indicus*, and Slender-billed Vulture (SBV) *Gyps tenuirostris*, while the other two, Eurasian Griffon *Gyps fulvus* and Himalayan Griffon



*Gyps himalayensis*, are primarily migratory species (Prakash et al. 2003). The three resident *Gyps* spp. in India have been identified as critically endangered by the IUCN. The red-headed vulture *Sarcogyps calvus*, also known as the Asian King Vulture, is a critically endangered species. The Egyptian vulture *Neophron percnopterus* is Endangered, while *Aegypius monachus* is Near Threatened. Due to food scarcity and habitat loss, vultures have dropped significantly in many parts of their former ranges (Pain et al. 2003). Since the early 1990s, the Indian subcontinent has seen a catastrophic decline in three *Gyps* species: White-rumped vulture (*Gyps bengalensis*), Indian vulture (*Gyps indicus*), and Slender-billed vulture (*Gyps tenuirostris*) (Prakash 1999; Prakash et al. 2003). (Bird Life International 2001). With the exception of the White-Rumped and Indian vulture, which are not found in the Trans-Himalaya and the Andaman and Nicobar Islands, all vulture species are found in nearly all geographical zones of the Indian subcontinent (Ali & Ripley, 1983). Vulture populations are most common in areas with permanent bodies of water, livestock and wildlife populations, and carcass disposal playing fields (Channgani 2010). They have also been spotted near safe nesting and roosting trees and cliffs, particularly in protected and undeveloped areas (Channgani 2005).

The most vultures are found in thorn forests, followed by dry deciduous, moist deciduous, and riverine forests (Samson 2016). Egyptian Vultures can be found in non-forested areas such as semi-arid and Gangetic eco-zones, where they feed on small animals, debris, or garbage dumps, as well as human and animal carcasses, ungulate faeces, and vegetable matter (Prakash & Nanjappa 1988; Jha, 2015). Vultures are nature's most efficient scavengers, consuming an adult cow carcass in minutes. Ali and Ripley (1983). Vultures are a unique functional guild among vertebrates, contributing significantly to ecosystem balance (Buechley & Sekercioglu 2016). Nonetheless, they are one of the most endangered species (Buechley & Sekercioglu 2016; O'Bryan et al. 2018). By efficiently consuming carrion, vultures help to control the spread of disease and facultative scavenger species that can cause human injury or death (Ogada et al. 2012). Vultures are also involved in waste disposal and nutrient cycling (e.g., Gangoso et al. 2013; Mole'on et al. 2014). Replacing these services could result in significant costs as well as increased greenhouse gas emissions, such as from carcass incineration (Morales-Reyes et al. 2017; O'Bryan et al. 2018).



## Review of Literature:

Publish or Perish Software was used to search for relevant research papers about Vulture Conservation and Threats to Vultures in India. The search was done from 1965 to 2020, for a period of 55 years. The Keywords used were “Vultures”, “Threats to Vultures”, “Gyps”, “Diclofenac contamination”, “poisoning”. Out of the filtered 200 research papers, 45 papers were selected. The filtering was done using Prisma Method (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

## Results:

Due to a lack of food and habitat destruction, vulture populations have declined from their former range (Pain et al. 2003). Their population in India was estimated to be around 40 million in the 1980s, and the decline observed by BNHS at Keoladeo National Park in the late 1990s was concerning. Gyps vultures are in danger of extinction due to the use of diclofenac in domesticated animals in India, Pakistan, and Nepal.

As a result, 95 percent of the vulture population has already declined, leaving only 60,000 vultures. In contrast to diclofenac use, the BNHS initiated a programme in 2003, and the Indian government decided in 2006 to restrict diclofenac manufacture, marketing, and use (Ganguly & Mukhopadhyay, 2013). Vulture populations are declining due to a number of factors. Human persecution and diclofenac poisoning, on the other hand, are among the causes of almost all vulture population declines (Ogada et al. 2012). The threats are discussed briefly below:

**Diclofenac contamination:** The primary cause of vulture population decline is diclofenac, a nonsteroidal anti-inflammatory drug (NSAID) (Green et al. 2004; Shultz et al. 2004; Oaks et al. 2006). Vultures are exposed to diclofenac after feeding on the carcasses of dead farm animals. In vultures, it causes kidney failure and death (Oaks et al. 2006). Diclofenac was responsible for 99 percent of Oriental, White-backed, Slender-billed, and Long-billed vulture mortality in Assam (Hussain 2015).

**Habitat Loss:** Vulture populations are declining as a result of habitat loss, food scarcity, and electrocution. Cutting down trees for agriculture, urbanisation, and firewood degrades habitat and threatens vulture nesting sites. Fire and grazing are also reducing safe roosting and nesting sites for vultures. The decrease in safer nesting sites reduces breeding success and raises the death rate (Purohit & Saran 2013).

**Interference from traffic and other animals:** Vulture breeding grounds, particularly those of *Gyps bengalensis*, are frequently found near roads. Vultures may feed on roads, making



them vulnerable to accidents caused by human activity and traffic. Another Cause that has been identified is the interaction of other animals with vultures and their nestlings, such as monkeys (Thakur & Narang 2012).

**Infectious diseases:** Post-mortem and histopathological examinations of 28 carcasses of *Gyps bengalensis* and *Gyps indicus* collected from across India revealed evidence supporting the infectious disease hypothesis. According to post-mortem examinations, many vultures had visceral or renal gout (Oaks et al. 2006).

**Low Food Availability:** Dead animals are the primary food source for many vulture species. Previously, animal carcasses were dumped in the open; however, this exercise is no longer practised in order to prevent disease transmission from the carcasses. As a result, a gradual decrease in food availability for vultures has been observed, which is a major threat to vultures and a contributing factor to the vulture population loss. Food availability has also decreased as a result of habitat loss and rapid urbanisation (Hussain 2015).

**Environmental Contaminants:** Contaminants are indeed a main cause of mortality in raptor and vulture communities. Insecticides and pesticides pollute the environment, and their accumulation in waterbodies serves as a potential source of contamination. Because of bio-magnification, these birds may incur significant losses (Hussain 2015).

Vultures are threatened by toxicants and other nutritional contaminants, direct persecution, collision with infrastructure and electrical hazards, disturbance, and habitat loss and fragmentation (Buechley & Sekercioglu 2016). Other threats include electrocution of birds on overhead power lines, which causes unnatural mortality (unpublished data from the Eskom-EWT Strategic Partnership's Central Incident Book).

The population of resident *Gyps* vultures on the Indian subcontinent plummeted during the 1990s. This was first reported in the media in 1996-97, and it was later documented by the Bombay Natural History Society (BNHS).

Between 1991 and 1993, the BNHS used a road transect method to conduct nationwide raptor surveys in many parts of India (Samant et al. 1995). The survey was repeated in 2000, and the results were shocking. OWRV and LBV populations decreased by more than 92 percent between 1991-1993 and 2000. (Prakash et al. 2003; 2005). Repeat surveys (in 2002 and 2003) revealed that between 2000 and 2003, the average annual decline rates for OWRV were 48% and 22% for LBV. Green and colleagues (2004). SBV and LBV were considered and counted as one species until the 2002 count, when SBV was discovered to account for less than 2% of the total of LBV and SBV (Green et al. 2004).



### Discussions:

Vulture population declines and rapid urbanization are temporally linked events for vast human-use landscapes in South Asia and Africa (Botha et al. 2017; United Nations Department of Economic and Social Affairs- Population Division 2019).

Most of the literatures cited in this article were highlighting the issue of population decline of Vultures due to rapid urbanization and changes in land use pattern. The heavy uncontrolled utility of available natural resources by humans over the years has led to the decline in the overall habitat condition with a boom of environmental toxicants in the abiotic components resulting in an unbalanced ecosystem and this has ruptured the complex food web. The unsustainable practices along with the modernized commercial technological developments has forced the natural environmental factors to deteriorate which ultimately is responsible for affecting the entire biodiversity and species like Vultures.

In the Past Vultures were used to be commonly seen roaring high in the sky, but they are nowhere to be seen in the present. The limited available food and habitat resources in the urbanized landscape with increased linear infrastructure is the major cause for decline of Vultures in India. Industrial revolution in our country and urban development has affected the breeding ecology of Vultures by destroying their nesting sites for infrastructural development.

After identify them, I'm trying to count the total individual of Sociable Lapwing with help of binoculars and I observed total 18 individuals of them; They were primarily resting with little movement, although a few individuals were feeding occasionally. While observing the surrounding Habitat of the Sociable lapwing, I found 4 individuals of Red-wattledlapwing which are also foraging with the flock of Sociable lapwings; and 9 individuals of Cream-coloured courser *Cursorius cursor* and 8 individuals of Indian courser *Cursoriuscoromandelicus* are also observed nearby flock of sociable lapwings.

On January 25, 2021 while surveying near by the Shervowetland (Kachchh,Gujarat), At 1357 h, I observed 3 birds in flight. And I also heard the short call "kyek" by one individual during flight (Image 2).On February 02, 2021, at 1040 h, I observed a flock of 24 individuals in flight at different location(490 meters away from the earlier sighting at Bhirandiyara village).Later on February 06, 2021, at 0950 h again while surveying near plains of Bhirandiyara village, I found only 1 individual foraging in the plains with the folks of Greater short-toed larks *Calandrellabrachydactyla*(Image 3).



Collisions with and electrocution from energy infrastructure, human disturbance, habitat degradation, and a decrease in food availability are all significant threats to vultures (Botha et al. 2017)

Birds devote significant time and energy to nest building and maintenance (Hansell 2000), so it is surprising that nesting biology has been overlooked as a research focus in comparison to other aspects of their breeding biology (Deeming & Reynolds 2015a) Biodiversity conservation in urbanizing landscapes thus necessitates multidisciplinary research (Nagendra et al. 2014).

Conservation of an efficient dynamic raptor like Vultures need high prioritization and ground-level approach with immense utilization of skills and both short-term and long-term planning.

### **Conclusion:**

Vultures considered to be the supreme scavengers facing the risk of extinction. In order to restore our country's glory, we must make significant efforts at the local and national levels to provide suitable habitats for the species to adapt and exist as it did in the past. We need to provide suitable landscapes and habitat conditions for the raptors, for being able to co-exist with Humans. Proper steps have to be taken at the ground level to preserve the species habitat and its co-existence with Humans. Below are a few threat mitigation strategies that need to be reinforced for a

### **Conservation Implications for Vulture Conservation at Ground:**

- i. Removing the primary cause of vulture mortality, diclofenac
- ii. Preventing diclofenac human formulation leakage into the veterinary sector
- iii. Monitoring vulture conservation and recovery sites
- iv. Establishing and expanding a vulture care and breeding centre
- v. Preventing further mortality
- vi. Raising awareness, particularly among veterinary formulation users.
- vii. Tracking the implementation of the Action Plan.
- viii. Ongoing assessment of ground conditions and local issues.

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## Environmentalism in ancient Indian scriptures – a short review

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### **Introduction:**

The concerns of environmental awareness and protection of the environment from adverse anthropogenic factors has reached a point of global significance. But, the origins of these concerns can be traced to times of antiquity in the Indian context. The concepts of environment and environmental conservation are known to differ from time to time as they are dependent on the conditions prevalent during those time spans. But the awareness about the environment in ancient residents of the Indian Subcontinent is evident from the literature analysis of *Vedic* texts and *Samhitas* available from those time periods. The current review sheds light on the references to environmental awareness and environmental protection as observed in these scriptures using a few reference examples.

The ancient word for Environment, '*Paryavarana*' is a mix of two words namely '*Pari/Paritah*' which means omnipresent and '*Avarana*' is cover. Hence, *Vedic* understanding of environment shows the inclusion or the sum of everything around us as an environment. The notions of proper sanitation and sense of the environmental protection can also be observed from historical and pre-historical excavations and literature studies. The emphasis on rainfall and hydrological cycles which has been elaborated in numerous *Suktas* of *Vedic* literature such as *Indrasukta*, *Varun Sukta*, *Parjanya Suktas* and thus in all four *Vedas*, is evidence of an environmentally aware civilization. Further, all of the *Vedas* are observed to recognize the importance of seasonal cycles and the relation of these cycles to changing climatic conditions due to anthropogenic activities. These references indicate the extreme level of environmental awareness of the populace of that time (Nigam & Chandra, 2022; Sarmah, 2015; Padhy, Dash, & Mohapatra, 2006).

Among the *Vedas*, numerous references also mention the critical role played by plant ecology with respect to maintenance of ecological balance of nature (Sarmah, 2015). With reference to a tree, a hymn from *Vrikshayurveda* explains that, 'दशपुत्र सम द्रुमः...' i.e., 'planting a tree is equal to having ten virtuous sons', thus fortifying the hypothesis that, *Vedic* Period civilization was aware of the role of plants. The medicinal and environmental importance of



numerous plants such as *Aswattha* (*Ficus religiosa*), *Vatavriksha* (*Ficus benghalensis*), *Bilva* (*Aegle marmelos*), *Bakul* (*Mimusops elengi*), *Rudraksha* (*Elaeocarpus angustifolius*) etc. have been asserted at various locations in the *Vedas* and *Puranas* of India (Sarmah, 2015) (Atharvaveda 5/4/3) (Rigveda 10/97/2). Through hymns from *Rigveda Khanda 8* (Part 8), it can also be observed that the habitants of the *Vedic* era were aware that mountains are the causal factor for rain and air currents, hence also mention the importance of saving mountains and forests (Sarmah, 2015).

Even the *Puranas* of Ancient India provide various such examples. *Matya Purana* refers to a festival called as *Vrikshotsav* (A festival of nature wherein tree plantation is carried out) (Bharadwaj, 2021). Across *Vedas* and *Puranas*, various such festivals and occasions can be observed which have been undertaken to spread awareness and protect the trees and environment as a whole. Few such examples include *Navahimpatotsava* from *Nilamata Purana*, the festival for first snow which emphasizes the role of mountains in the origin of rivers, *Damanaka Tritiya Vrata* from *Agni Purana* to emphasize the tremendous medicinal importance of *Damanaka* Plant (*Artemisia pallens*). Also, *Agni Purana* speaks of *Ashokashtami*, a festival to portray the myriad medicinal properties of *Saracaasoca*. One of the most important such festivals is *Aranyashanthi* which symbolizes the bountiful forest, nature and signifies fertility, resources and prosperity of Nature (Bharadwaj, 2021).

About water, the *Chandogya Upanishad* describes water as the source of life and healthy living in all organisms and further also describes the stages in the hydrological cycle elaborately. The importance of maintaining purity of all forms of water and prevention of pollution has been emphasized. The *Padma Purana* condemns water pollution to such an extent that it claims that, the one who pollutes has no space in heaven (Shatapatha Brahman 1.9.3.7) (Rigveda 10.87.6) (Rigveda 1.23.20) (Padmapurana, Bhimi 96.7.8) (Tiwari, 2010). Thus, implying that, the concept of pollution and its ill effects were also well known to the populace.

### **Conclusion:**

From the above citing, it can be observed that, the *Vedic* populace was aware of the importance of environment and also of maintaining balance in the abiotic and biotic factors of the ecosystem. It can also be noted that the *Vedic* vision to live in synchrony with environmental factors and other biotic components of the environment was not simply an objective approach but includes a far wider, subjective and comprehensive understanding of



the transactions between humans and the environment. The sages and extant population of those times, grasped the need of pure or unpolluted water, air and surroundings as the roots of healthy and prosperous life and hence revered these environmental factors as deities.

Yajurveda 36.24, mentions the desire of the *Vedic* population to live a hundred years and believes that this can be achieved by a pollution free, clean and peaceful environment (Sarmah, 2015). In current India, various environment based legislative laws and acts are in place such as the forest act of 1972, water act of 1974, air act of 1981, environment protection act of 1986. But a verse of the *Sukla Yajurved* speaks thus:

द्यूःशान्तिरन्तरीक्षन्, शान्तिपृथिवी, शान्तिरापः, शान्तिरोषधयःवनस्पतयः,

शान्तिविस्वदेवह्, शान्तिब्रह्म, शान्तिःसर्वशान्तिःशान्तिरेवशान्तिःसामाशन्तिरेधि II

Stating that, (Let there be) Peace be upon the heavens and peace be upon the sky, peace be upon the earth and peace be upon the waters, peace be upon the herbs and plants, peace be upon the *Visvadevah*, peace be upon Brahma, and peace be upon all, peace be upon all, peace be upon thee!

This further emphasizes the all-encompassing approach to environmentalism during *Vedic* times wherein people were made aware of the importance of sustainability and a comprehensive approach to prevent pollution and protect the environment. By making the population aware and by treating the environment as a part of all human existence, protection would also be perceived as the moral duty of all humans of the society without the implementation of stringent law based systems.

The current study is but a glimpse into the vastness of knowledge held in the traditional scriptures of Ancient India. This knowledge from *Vedic Sciences* and available literatures can be used to upgrade our current understanding of environmental interactions and be used to initiate better awareness about the need of environmental protection.

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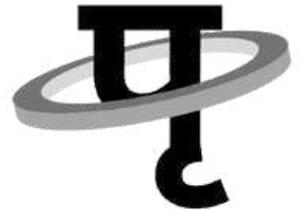
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# Achievements of WCB Members



## Dr. Rohitkumar M. Patel Awarded by the Education Minister (state) Hon. Dr. Kuberbhai Dindor, Government of Gujarat



Dr Rohit Patel has studied and documented the diversity of grass species in the Dahod district. The primary focused area for exploration was Rampura Reserve Grassland. He recorded the highest 112 Grass species from Rampura Reserve Grassland and 129 Grass species from the Dahod district. In Forest working Plan of 2008, only 37 grass species were listed. Dr. Rohit has also zoned the entire Rampura Grassland based on the dominant grass species to identify the area for protection and improvement. The total land area of the Rampura Grassland was divided into seven major categories. He has prepared a coupe wise fact sheet which depicts its present situation. As a finding of his research, he discussed various threats and suggested specific management and improvement options to the forest department of Gujarat.

## Support and Encouragement provided to Mr. Shailesh Desai by IDEA Wild Foundation, USA for his research on Wolf in Gujarat



Mr. Shailesh Desai is currently working as PhD Scholar at the Department of Life Science, Bhakta Kavi Narsinh Mehta University, Junagadh, Gujarat. Currently he is studying landscape ecology of Indian Grey Wolf in Bhal region of Gujarat. As a part of ongoing field work, the IDEA WILD FOUNDATION of USA has supported his work by providing field instruments.

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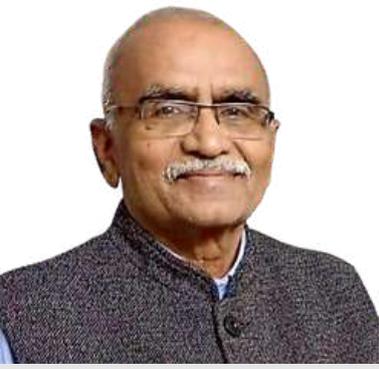
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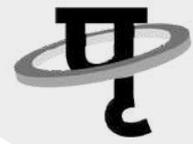


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**Title:** Try to keep short and concise

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**Discussion:** Summarize the main findings of the study (but do not repeat results), explain and comment the results in relation to previous research. Discuss limitations of the study and potential needs in future research.

**Conclusion:** Optional. It should contain 10-15 sentences, concisely stating the main outcomes of the study.

**References:** Strictly follow the APA style of referencing. References should be arranged alphabetically by first author. Following are some examples for references.



### **Unpublished sources**

“(Harkirat Sangha, in litt., e-mail/letter dated 02 January 2013)”; if oral, “(Rajah Jayapal, verbally, dated 15 December 2013)”.

### **Journal articles**

Naoroji, R., & Sangha, H. S., 2011. Threats to habitat and wildlife in Changthang and Rupshu areas of Ladakh: a case study at Hanle. *Prithiviya* 7 (1): 2–6.

### **Books**

Futehally, Z. (ed.) 2006. *India through its birds*. 1st ed. Bangalore, India: Dronequill Publishers Pvt. Ltd. Pp. 1–214.

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