

Building evidence for conservation globally

# Journal of Threatened Taxa

10.11609/jott.2026.18.3.28455-28606  
[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

26 March 2026 (Online & Print)  
18(3): 28455-28606  
ISSN 0974-7907 (Online)  
ISSN 0974-7893 (Print)



Open Access





ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher  
**Wildlife Information Liaison Development Society**  
www.wild.zooreach.org

Host  
**Zoo Outreach Organization**  
www.zooreach.org

Srivari Illam, No. 61, Karthik Nagar, 10th Street, Saravanampatti, Coimbatore, Tamil Nadu 641035, India  
Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India  
Ph: +91 9385339863 | [www.threatenedtaxa.org](http://www.threatenedtaxa.org)  
Email: [sanjay@threatenedtaxa.org](mailto:sanjay@threatenedtaxa.org)

#### EDITORS

##### Founder & Chief Editor

**Dr. Sanjay Molur**

Wildlife Information Liaison Development (WILD) Society & Zoo Outreach Organization (ZOO),  
Coimbatore, Tamil Nadu 641006, India

##### Assistant Editor

**Dr. Chaithra Shree J.**, WILD/ZOO, Coimbatore, Tamil Nadu 641006, India

##### Managing Editor

**Mr. B. Ravichandran**, WILD/ZOO, Coimbatore, Tamil Nadu 641006, India

##### Associate Editors

**Dr. Mandar Paingankar**, Government Science College Gadchiroli, Maharashtra 442605, India

**Dr. Ulrike Streicher**, Wildlife Veterinarian, Eugene, Oregon, USA

**Ms. Priyanka Iyer**, ZOO/WILD, Coimbatore, Tamil Nadu 641006, India

##### Board of Editors

**Dr. Russel Mittermeier**

Executive Vice Chair, Conservation International, Arlington, Virginia 22202, USA

##### Prof. Mewa Singh Ph.D., FASC, FNA, FNASC, FNAPsy

Ramanna Fellow and Life-Long Distinguished Professor, Biopsychology Laboratory, and  
Institute of Excellence, University of Mysore, Mysuru, Karnataka 570006, India; Honorary  
Professor, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore; and Adjunct  
Professor, National Institute of Advanced Studies, Bangalore

##### Stephen D. Nash

Scientific Illustrator, Conservation International, Dept. of Anatomical Sciences, Health Sciences  
Center, T-8, Room 045, Stony Brook University, Stony Brook, NY 11794-8081, USA

##### Dr. Fred Pluthero

Toronto, Canada

##### Dr. Priya Davidar

Sigur Nature Trust, Chadapatti, Mavinhalla PO, Nilgiris, Tamil Nadu 643223, India

##### Dr. John Fellowes

Honorary Assistant Professor, The Kadoorie Institute, 8/F, T.T. Tsui Building, The University of  
Hong Kong, Pokfulam Road, Hong Kong

##### Prof. Dr. Mirco Solé

Universidade Estadual de Santa Cruz, Departamento de Ciências Biológicas, Vice-coordenador  
do Programa de Pós-Graduação em Zoologia, Rodovia Ilhéus/Itabuna, Km 16 (45662-000)  
Salobrinho, Ilhéus - Bahia - Brasil

##### Dr. Rajeev Raghavan

Professor of Taxonomy, Kerala University of Fisheries & Ocean Studies, Kochi, Kerala, India

##### English Editors

**Mrs. Mira Bhojwani**, Pune, India

**Dr. Fred Pluthero**, Toronto, Canada

##### Copy Editors

**Ms. Usha Madgunaki**, Zooreach, Coimbatore, India

**Ms. Trisa Bhattacharjee**, Zooreach, Coimbatore, India

**Ms. Paloma Noronha**, Daman & Diu, India

##### Web Development

**Mrs. Latha G. Ravikumar**, ZOO/WILD, Coimbatore, India

##### Typesetting

**Mrs. Radhika**, Zooreach, Coimbatore, India

**Mrs. Geetha**, Zooreach, Coimbatore, India

#### Fundraising/Communications

**Mrs. Payal B. Molur**, Coimbatore, India

#### Subject Editors 2021–2023

##### Fungi

Dr. B. Shivaraju, Bengaluru, Karnataka, India

Dr. R.K. Verma, Tropical Forest Research Institute, Jabalpur, India

Dr. Vatsavaya S. Raju, Kakatiya University, Warangal, Andhra Pradesh, India

Dr. M. Krishnappa, Jnana Sahyadri, Kuvempu University, Shimoga, Karnataka, India

Dr. K.R. Sridhar, Mangalore University, Mangalagangothri, Mangalore, Karnataka, India

Dr. Gunjan Biswas, Vidyasagar University, Midnapore, West Bengal, India

Dr. Kiran Ramchandra Ranadive, Annasaheb Magar Mahavidyalaya, Maharashtra, India

##### Plants

Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India

Dr. N.P. Balakrishnan, Ret. Joint Director, BSI, Coimbatore, India

Dr. Shonil Bhagwat, Open University and University of Oxford, UK

Prof. D.J. Bhat, Retd. Professor, Goa University, Goa, India

Dr. Ferdinando Boero, Università del Salento, Lecce, Italy

Dr. Dale R. Calder, Royal Ontario Museum, Toronto, Ontario, Canada

Dr. Cleofas Cervancia, Univ. of Philippines Los Baños College Laguna, Philippines

Dr. F.B. Vincent Florens, University of Mauritius, Mauritius

Dr. Merlin Franco, Curtin University, Malaysia

Dr. V. Irudayaraj, St. Xavier's College, Palayamkottai, Tamil Nadu, India

Dr. B.S. Kholia, Botanical Survey of India, Gangtok, Sikkim, India

Dr. Pankaj Kumar, Department of Plant and Soil Science, Texas Tech University, Lubbock, Texas, USA

Dr. V. Sampath Kumar, Botanical Survey of India, Howrah, West Bengal, India

Dr. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Vijayasankar Raman, University of Mississippi, USA

Dr. B. Ravi Prasad Rao, Sri Krishnadevaraya University, Anantpur, India

Dr. K. Ravikumar, FRLHT, Bengaluru, Karnataka, India

Dr. Aparna Watve, Pune, Maharashtra, India

Dr. Qiang Liu, Xishuangbanna Tropical Botanical Garden, Yunnan, China

Dr. Noor Azhar Mohamed Shazili, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia

Dr. M.K. Vasudeva Rao, Shiv Ranjani Housing Society, Pune, Maharashtra, India

Prof. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Mandar Datar, Agharkar Research Institute, Pune, Maharashtra, India

Dr. M.K. Janarthanam, Goa University, Goa, India

Dr. K. Karthigeeyan, Botanical Survey of India, India

Dr. Errol Vela, University of Montpellier, Montpellier, France

Dr. P. Lakshminarasimhan, Botanical Survey of India, Howrah, India

Dr. Larry R. Noblick, Montgomery Botanical Center, Miami, USA

Dr. K. Haridasan, Pallavur, Palakkad District, Kerala, India

Dr. Analinda Manila-Fajard, University of the Philippines Los Baños, Laguna, Philippines

Dr. P.A. Sinu, Central University of Kerala, Kasaragod, Kerala, India

Dr. Afroz Alam, Banasthali Vidyapith (accredited A grade by NAAC), Rajasthan, India

Dr. K.P. Rajesh, Zamorin's Guruvayurappan College, GA College PO, Kozhikode, Kerala, India

Dr. David E. Boufford, Harvard University Herbaria, Cambridge, MA 02138-2020, USA

Dr. Ritesh Kumar Choudhary, Agharkar Research Institute, Pune, Maharashtra, India

Dr. A.G. Pandurangan, Thiruvananthapuram, Kerala, India

Dr. Navendu Page, Wildlife Institute of India, Chandrabani, Dehradun, Uttarakhand, India

Dr. Kannan C.S. Warriar, Institute of Forest Genetics and Tree Breeding, Tamil Nadu, India

#### Invertebrates

Dr. R.K. Avasthi, Rohtak University, Haryana, India

Dr. D.B. Bastawade, Maharashtra, India

Dr. Partha Pratim Bhattacharjee, Tripura University, Suryamaninagar, India

Dr. Kailash Chandra, Zoological Survey of India, Jabalpur, Madhya Pradesh, India

Dr. Ansie Dippenaar-Schoeman, University of Pretoria, Queenswood, South Africa

Dr. Rory Dow, National Museum of Natural History Naturalis, The Netherlands

Dr. Brian Fisher, California Academy of Sciences, USA

Dr. Richard Gallon, Llandudno, North Wales, LL30 1UP

Dr. Hemant V. Ghate, Modern College, Pune, India

Dr. M. Monwar Hossain, Jahangirnagar University, Dhaka, Bangladesh

For Focus, Scope, Aims, and Policies, visit [https://threatenedtaxa.org/index.php/JoTT/aims\\_scope](https://threatenedtaxa.org/index.php/JoTT/aims_scope)

For Article Submission Guidelines, visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions>

For Policies against Scientific Misconduct, visit [https://threatenedtaxa.org/index.php/JoTT/policies\\_various](https://threatenedtaxa.org/index.php/JoTT/policies_various)

continued on the back inside cover

Cover: Digital illustration of Smooth-coated Otter *Lutrogale perspicillata* by Dupati Poojitha. Reference from the picture taken by Rana & Sugandhi.



## Predicting the potential habitat of *Tragopan blythii* (Jerdon, 1870) (Aves: Galliformes: Phasianidae) in Mehao Wildlife Sanctuary of Arunachal Pradesh, India

Eba Tapo<sup>1</sup>  & Gibji Nimasow<sup>2</sup> 

<sup>1,2</sup> Department of Geography, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh 791112, India.

<sup>1</sup> eba.tapo@rgu.ac.in, <sup>2</sup> gibji.nimasow@rgu.ac.in (corresponding author)

**Abstract:** The Blyth's Tragopan *Tragopan blythii* is a medium-sized pheasant endemic to the eastern Himalaya and is classified as 'Vulnerable'. This species thrives in dense forest ecosystems at higher altitudes. Species distribution modelling (SDM) helps identify potential suitable habitats by relating species occurrence to key environmental variables, especially in areas with limited field data. The present study aims to predict the potential habitat of *T. blythii* in Mehao Wildlife Sanctuary, Arunachal Pradesh, using the maximum entropy (MaxEnt) method. The study offers valuable insights into the ecological and environmental conditions necessary for the survival of this vulnerable species. The results showed 3.93% (11.09 km<sup>2</sup>) of the total area as suitable, followed by 4.94% (13.91 km<sup>2</sup>) as moderately suitable, 18.55% (52.22 km<sup>2</sup>) as least suitable, and 72.58% (204.30 km<sup>2</sup>) as unsuitable. Model performance was good with a mean area under the curve (AUC) of 0.915 (SD = 0.040) and a true skill statistic (TSS) value of 0.798. The jackknife test revealed that the distribution of *T. blythii* is primarily determined by the mean diurnal range (BIO2), with additional influence from the temperature annual range (BIO7) and precipitation seasonality (BIO15). An analysis of the model output revealed a restricted distribution of *T. blythii* in the northern parts of the study area. These results support habitat prioritization and conservation planning for the long-term protection of the species. Thus, the model results can be used in further investigation to explore the natural habitat of this vulnerable species.

**Keywords:** Climate change, community awareness, conservation, eastern Himalaya, endemic, environmental variables, habitat, pheasant, species distribution modelling, vulnerable.

**Editor:** Aditya Srinivasulu, Zoo Outreach Organisation, Hyderabad, India.

**Date of publication:** 26 March 2026 (online & print)

**Citation:** Tapo, E. & G. Nimasow (2026). Predicting the potential habitat of *Tragopan blythii* (Jerdon, 1870) (Aves: Galliformes: Phasianidae) in Mehao Wildlife Sanctuary of Arunachal Pradesh, India. *Journal of Threatened Taxa* 18(3): 28455–28467. <https://doi.org/10.11609/jott.9958.18.3.28455-28467>

**Copyright:** © Tapo & Nimasow 2026. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.

**Funding:** The study does not receive any funding.

**Competing interests:** The authors declare no competing interests.

**Author details:** EBA TAPO is currently pursuing a PhD at the Department of Geography, Rajiv Gandhi University, Arunachal Pradesh, on the topic "Status of population, habitat occupancy and conservation of *Tragopan blythii* in Mehao Wildlife Sanctuary, Lower Dibang Valley District of Arunachal Pradesh". His research interest is in biogeography, specifically ornithogeography. GIBJI NIMASOW is currently a professor and head of the Department of Geography at Rajiv Gandhi University, Arunachal Pradesh. He has guided around ten Ph.D. theses and published about 60 research articles in reputed journals. His research interests include biogeography, mountain ecology, human geography, forest resources, traditional ecological knowledge, and remote sensing & GIS.

**Author contributions:** ET conceived, designed, and drafted the paper. GN interpreted, edited the language/ grammar, and revised the manuscript. Both authors read the revised manuscript and approved the submitted version.

**Acknowledgements:** The authors are grateful to Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh, for providing necessary infrastructural support to carry out doctoral-related work of the first author. The authors are also thankful to Dr. Dhoni Bushi and Dr. Ranjit Mahato for their invaluable assistance in making this study successful. Finally, we acknowledge the Soil and Limnology Laboratory, Department of Geography, for providing essential laboratory facilities to accomplish this study.



## INTRODUCTION

Species distribution modelling (SDM) has become a powerful tool for understanding the spatial patterns of bird species, informing conservation efforts, and predicting responses to environmental changes. This approach combines species occurrence data with environmental variables to predict where species are likely to be found. SDMs rely on high-quality data obtained from various sources like eBird and bird atlases, telemetry data from tracked migratory birds, museum historical records, and satellite imagery (Papeş 2007; Jiguet et al. 2011; Santos et al. 2023; Shirley et al. 2013). The commonly used predictors include bioclimatic variables such as temperature, precipitation, climate extremes, elevation, slope, terrain complexity, forest structure, wetland extent, agricultural areas, and the availability of prey species or competitors (Heikkinen et al. 2007; Shirley et al. 2013; Prosser et al. 2018; Pshegusov & Chadaeva 2023; Tamang et al. 2023). SDMs have been applied to a wide range of bird species, from migratory waterfowl to threatened vultures, and have proven essential in addressing conservation challenges (Papeş 2007; Prosser et al. 2018; Pshegusov & Chadaeva 2023). SDM is a cornerstone of conservation planning, helping to identify priority areas for habitat protection, assess the coverage of protected areas, identify gaps, and predict future habitat shifts due to climate change (Papeş 2007; Wu et al. 2014; Briscoe et al. 2021). By assessing habitat suitability, SDMs help design protected areas and corridors, support restoration efforts for degraded habitats, and aid in managing human-impact landscapes, viz., agricultural regions (Pshegusov & Chadaeva 2023; Tamang et al. 2023). SDMs can estimate population trends by modelling how environmental changes influence species distributions and predict areas susceptible to invasion by non-native bird species, allowing for pre-emptive control measures (Prosser et al. 2018; Briscoe et al. 2021).

Various SDM techniques are applied in birds, with maximum entropy (MaxEnt) being a prominent presence-only method known for its simplicity and effectiveness (Pshegusov & Chadaeva 2023; Tamang et al. 2023). MaxEnt enables researchers to conduct analyses with little programming expertise. It promotes reproducible research and offers features for model comparison and cross-validation (Mayer et al. 2024). It is also used to forecast invasive species and to predict future habitat expansions due to climate change scenarios (Schmid et al. 2024). Recent developments in MaxEnt modelling feature innovative optimisation algorithms

that effectively manage large-scale, non-smooth data, especially in wildfire science. These algorithms greatly enhance convergence rates and computational efficiency (Langlois et al. 2024).

*Tragopan blythii* (Image 1) is listed as 'Vulnerable' under criterion 'C2a(i)' by the IUCN Red List of Threatened Species in 2020 (BirdLife International 2020a). *Tragopan blythii* is distributed from Bhutan through Arunachal Pradesh, Nagaland, Mizoram, and Manipur in northeastern India, extending into northern Myanmar and southeastern Tibet, as well as northwestern Yunnan, China (Birdlife International 2001). The adult male *T. blythii* differs from other species within the tragopan group by having a restricted patch of red on its upper breast (Madge & McGowan 2002). It is vulnerable primarily due to its declining population size across small subpopulations (BirdLife International 2020b). In some regions, its population is estimated to comprise around 38 individuals only (Ghose et al. 2003). *Tragopan blythii* inhabits moist, evergreen, broadleaf forests featuring thick understorey, dense scrub, and montane bamboo on steep slopes, typically occurring either singly or in pairs or small groups of four to five individuals (Sathyakumar & Kaul 2007). The documented altitudinal range of the species is from 1,400 m (winter) to 3,300 m (summer), but the majority of records come from a narrower range of 1,800–2,400 m (BirdLife International 2020b). The vocalisations of *T. blythii* are significant for courtship and territorial displays, featuring distinct calls that assist in species identification. Acoustic analyses reveal that these calls are subject to sexual selection pressure, acting as a mechanism for species isolation (Islam & Crawford 2010). Recent research has concentrated on the phylogenetic analysis of *T. blythii* using mitochondrial DNA and multi-locus analyses (Randi et al. 2000; Zou et al. 2021), resulting in the discovery of a new phylogeographic population of *T. blythii* in Mount Kennedy, Myanmar (Zou et al. 2021). These findings underscore the need to comprehend the genetic diversity and population structure of *T. blythii* for effective conservation strategies. It is rare throughout much of India, with an estimated 50% of the population in the Nagaland area (Eastern Mirror Nagaland 2017). Studies on *T. blythii* emphasize the necessity of genetic analyses, population, and conservation measures to safeguard this vulnerable species and its unique populations (Randi et al. 2000; Zou et al. 2021). To ensure long-term survival, further research is essential to understand its phylogeography, behaviour, and ecology.

Arunachal Pradesh is the largest state in North East India and falls within the Himalayan global biodiversity

hotspots (Sen & Mukhopadhyay 1999; Meyers et al. 2000; Sinha et al. 2005). The state is also considered India's biodiversity frontier (Borges 2005; Mishra & Datta 2007; Borang et al. 2008). However, due to its remote location and mountainous topography, the rich terrestrial biodiversity, including wildlife, has been inadequately documented or relatively unexplored. The state is home to over 850 bird species, representing nearly two-thirds of India's avifauna. In particular, the Dihang Dibang Biosphere Reserve is noted for 492 species, including 37 that are globally threatened (Rangini et al. 2014). The population of *Tragopan blythii* is small, declining, and fragmented into minor subpopulations within the heavily disrupted habitat. Thus, the species is designated as a Schedule I bird under the Wildlife (Protection) Act 1972 (2022 amendment), India. The vulnerability is likely to intensify due to hunting practices and habitat degradation. As per reports, *Tragopan blythii* have been sighted in the Mishmi Hills of Arunachal Pradesh (King et al. 2008). Hence, this study attempts to understand the habitat and predict the distribution of *Tragopan blythii* in Mehao Wildlife Sanctuary, Arunachal Pradesh, which falls under the Mishmi Hills, using field methods and geospatial technology.

## MATERIALS AND METHODS

### Study area

The study area, Mehao Wildlife Sanctuary (MWS), is located between 28° 05' to 28° 15' N and 93° 30' to 95° 45' E in the Lower Dibang Valley District of Arunachal Pradesh (Figure 1). It spans approximately 282 km<sup>2</sup> and features a diverse topography with elevations of 500–3,000 m. The climate is predominantly temperate, with significant rainfall and various vegetation types, including subtropical forests, bamboo groves, and temperate forests. MWS is one of the oldest of the 13 sanctuaries in Arunachal Pradesh. Koronu, Injuno, Balek, Cheta, Ejengo, Rayang, and Tiwarigaon villages are located on the periphery of the sanctuary. The sanctuary hosts vital plant species such as *Terminalia myriocarpa*, *Duabanga grandiflora*, *Phoebe cooperiana*, *Bombax ceiba*, *Canarium strictum*, *Lagerstroemia speciosa*, *Michelia champaca*, *Gmelina arborea*, *Coptis teeta*, *Messua ferrea*, *Dillenia indica*, *Castanopsis indica*, and *Bischofia javanica*, along with various orchids. The wildlife includes Tigers, Black Bear, Leopards, Elephants, Wild Boar, Capped Langur, White-browed Gibbon, Musk Deer, and Mishmi Takin. Furthermore, numerous bird species inhabit the area, such as hornbills, babblers,

bulbuls, warblers, flycatchers, pigeons, and a range of reptiles, snakes, insects, and leeches (Murali et al. 2012).

### Occurrence data

The occurrence data were collected from both primary and secondary sources. Field surveys were conducted for two years (2022–2024) following the point count methods by strategically selecting the survey sites and using handheld Garmin global positioning system (GPS) devices (Volpato et al. 2009). The point counts were spaced at least 200 m apart, and each count captured species seen or heard within a radius of approximately 20 m. The survey covered various altitudinal zones and seasons during the morning hours when birds were most active. The surveys were conducted seasonally, in 18 locations during autumn (September), winter (December), spring (March), and summer (June) each year, totalling 144 counts over two years. Additionally, camera trapping techniques were employed to record *T. blythii* and assess its habitat conditions. The bird was identified in consultation with the ornithologists from the Department of Zoology, Rajiv Gandhi University. To limit spatial autocorrelation and sampling bias, occurrence records were filtered using the spThin package in R by applying a 10 km minimum distance between points. This reduced clustering caused by uneven sampling effort and improved the reliability of the species distribution model (Kramer-Schadt et al. 2013; Aiello-Lammens et al. 2015). After removing the coordinates falling outside boundary of MWS, only 36 occurrence records were used to run the final model.

### Environmental parameters

To predict the distribution of *T. blythii*, a set of environmental data, such as topographical (12.5 m) and climatic (30 arc-second) spatial resolution, has been acquired from various sources using ArcGIS 10.3. The elevation data was sourced from the Alaska Satellite Facility (n.d.), which provided key topographic parameters, including altitude, slope, and aspect. This high-resolution DEM provides a detailed dataset that offers insights into earth's surface, capturing the elevation data for producing topographic attributes. Additionally, 19 bioclimatic variables were downloaded from the WorldClim website (Fick & Hijmans 2017). These variables offer extensive global climate layers for various applications, such as mapping and spatial modelling. Multicollinearity among predictor variables was evaluated using the Variance Inflation Factor (VIF) in R, and variables with VIF values greater than seven were excluded to reduce redundancy and improve model

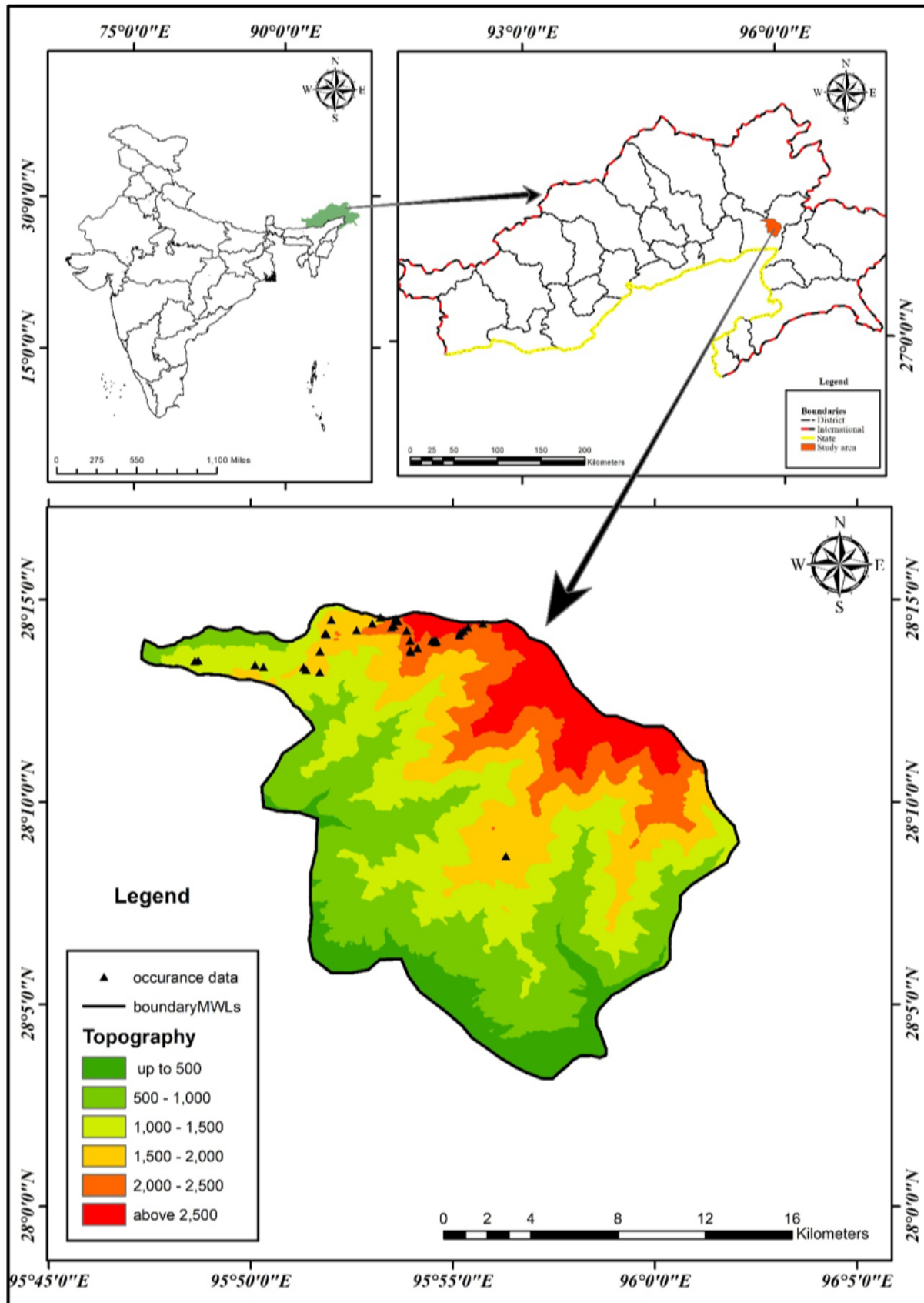


Figure 1. Location map of the study area showing occurrence records of *Tragopan blythii*. Source: The Gazette of India: Extraordinary Draft Notification declaring Eco Sensitive Zone around Mehao Wildlife Sanctuary [22.02.2018].

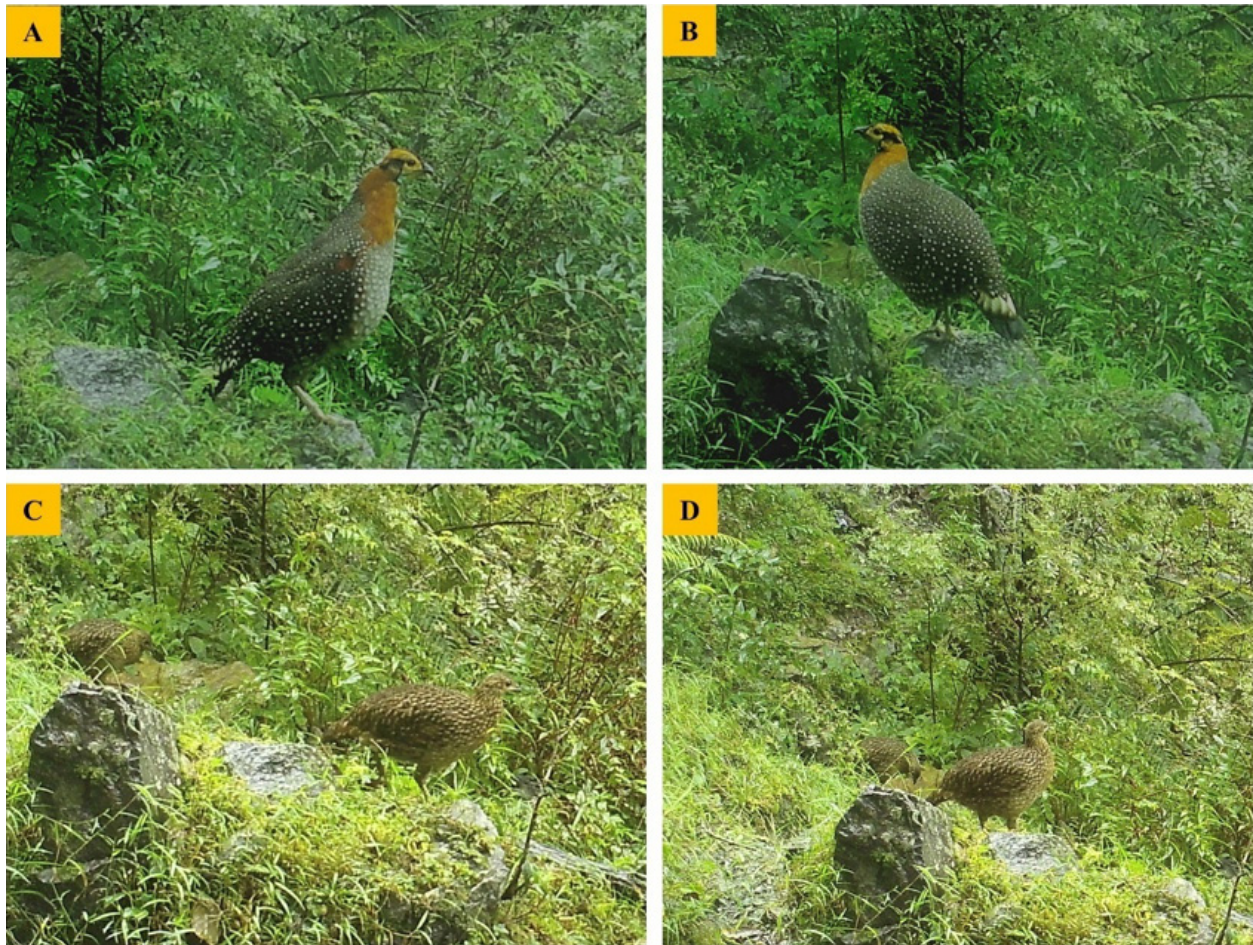


Image 1. A & B—Male *Tragopan blythii* | C & D—Female *Tragopan blythii*. © Eba Tapo.

performance (Zuur et al. 2010; Dormann et al. 2013; James et al. 2013; Manzoor et al. 2018). According to Parolo et al. (2008), Dormann et al. (2013), Merow et al. (2013), and Manzoor et al. (2018), highly correlated parameters affect model performance negatively and lead to inaccurate predictions. Hence, such parameters were removed by performing a multicollinearity (Pearson's R) test using the *usdm* package in *R* (Naimi & Araújo 2016). After the test, 12 predictor variables, namely Mean diurnal range (BIO2), isothermality (BIO3), temperature seasonality (BIO4), minimum temperature of the coldest month (BIO6), temperature annual range (BIO7), mean temperature of the coldest quarter (BIO11), precipitation seasonality (BIO15), precipitation of the driest quarter (BIO17), precipitation of the warmest quarter (BIO18), altitude, slope, and aspect were included in the final model (Figure 2).

#### Model settings and evaluation

The species distribution model of *T. blythii* was

generated using MaxEnt (version 3.4.1). MaxEnt (Phillips et al. 2006; Phillips & Dudík 2008) is regarded as one of the leading species distribution modelling techniques and has been widely used (Elith et al. 2011). It is deterministic and approaches the probability distribution linked to maximum entropy (Berger et al. 1996; Phillips et al. 2006; Baldwin 2009). All model parameters were kept at their default settings in MaxEnt. Variable importance was assessed using the jackknife test, which evaluates the relative contribution of each environmental predictor by sequentially excluding individual variables and by running models with each variable in isolation. This approach helps identify variables that contain unique information and those that most strongly influence model performance, based on changes in training gain. The jackknife test is particularly important for understanding predictor relevance and reducing redundancy among correlated variables in species distribution modelling (Phillips et al. 2006; Baldwin 2009; Elith et al. 2011). Five replicate

runs were used with cross-validation to ensure and evaluate the model's reliability (Pearson et al. 2004). Model performance was assessed using the threshold-independent area under the curve (AUC) of the receiver operating characteristic (ROC) curve, and true skill statistic (TSS). The values of AUC range from models with no predictive ability ( $AUC \leq 0.5$ ) to models having perfect predictions ( $AUC = 1.0$ ), where  $0.9-1 =$  excellent;  $0.8-0.9 =$  good;  $0.7-0.8 =$  satisfactory;  $0.6-0.7 =$  poor and  $< 0.6 =$  very poor or model failed (Araújo et al. 2005; Lissovsky & Dudov 2021). The TSS takes into account both omission and commission errors, and success due to random guessing, and ranges from -1 to +1, where +1 indicates perfect agreement and values of zero or less indicate a performance no better than random (Allouche et al. 2006). The methodology applied is shown in Figure 3.

## RESULTS

### Model performance

The model results showed that the distribution of *T. blythii* is mostly influenced by the mean diurnal range of temperature (33.7%), temperature annual range (17.8%), precipitation seasonality (15.1%), altitude (11.1%), and temperature seasonality (9.2%). Slope (4.7%), aspect (2.7%), precipitation of the driest quarter (2.5%), and precipitation of the warmest quarter (2.25%) also exerted some influence on the distribution of *T. blythii*. Model evaluation indicated excellent predictive performance, with a mean AUC of 0.915 (SD = 0.040) and a high TSS value of 0.798, reflecting robust model

reliability and classification accuracy (Figure 4). The jackknife test revealed that the distribution of *T. blythii* was primarily influenced by the mean diurnal range of temperature (BIO2), which accounted for 33.7% of the explained variable, followed by temperature annual range (BIO7) and precipitation seasonality (BIO15) with 17.8% and 15.1%, respectively. The contribution of other parameters was relatively lesser with altitude (11.1%), temperature seasonality (9.2%), slope (4.7%), aspect (2.7%), precipitation of the driest quarter (2.5%), and precipitation of the warmest quarter (2.2%). Isothermality (BIO3), minimum temperature of the coldest month (BIO6), and mean temperature of the coldest quarter (BIO11) showed meagre influence on the distribution of *T. blythii* (Table 1).

### Species distribution modelling of *T. blythii*

The model predicted the potential distribution of *T. blythii* in the MWS within a range of 0–0.9, which was categorised into five suitability categories, viz. highly suitable ( $>0.8$ ), suitable (0.6–0.8), moderately suitable (0.4–0.6), least suitable (0.2–0.4), and not suitable ( $< 0.2$ ). The results showed an area of 2.48 km<sup>2</sup> (0.88%) as highly suitable and 8.59 km<sup>2</sup> (3.05%) as suitable. Further, the model predicted an area of 13.91 km<sup>2</sup> (4.94%) as moderately suitable, 52.22 km<sup>2</sup> (18.55%) as least suitable, and the largest area of 204.30 km<sup>2</sup> (72.58%) as not suitable (Table 2). An examination of the final model revealed that the northern parts of the study area are suitable for *T. blythii*, owing to higher altitude, thick understorey, pronounced slopes, and cooler temperatures. On the other hand, the southern parts, mostly characterized by lower elevations, dense

**Table 1. Parameter contributions based on the MaxEnt model, codes, units, and source of the database.**

| Parameters                              | Contribution (%) | Code      | Units    | Source      |
|---|------------------|-----------|----------|-------------|
| Mean diurnal range                      | 33.7             | BIO2      | °C       | WorldClim   |
| Temperature annual range                | 17.8             | BIO7      | °C       | WorldClim   |
| Precipitation seasonality               | 15.1             | BIO15     | Unitless | WorldClim   |
| Altitude                                | 11.1             | Elevation | Meter    | ALOS PALSAR |
| Temperature seasonality                 | 9.2              | BIO4      | Unitless | WorldClim   |
| Slope                                   | 4.7              | Slope     | Degree   | ALOS PALSAR |
| Aspect                                  | 2.7              | Aspect    | Degree   | ALOS PALSAR |
| Precipitation of the driest quarter     | 2.5              | BIO17     | Mm       | WorldClim   |
| Precipitation of the warmest quarter    | 2.2              | BIO18     | Mm       | WorldClim   |
| Isothermality                           | 0.5              | BIO3      | Unitless | WorldClim   |
| Min. temperature of the coldest month   | 0.4              | BIO6      | °C       | WorldClim   |
| Mean temperature of the coldest quarter | 0.2              | BIO11     | °C       | WorldClim   |

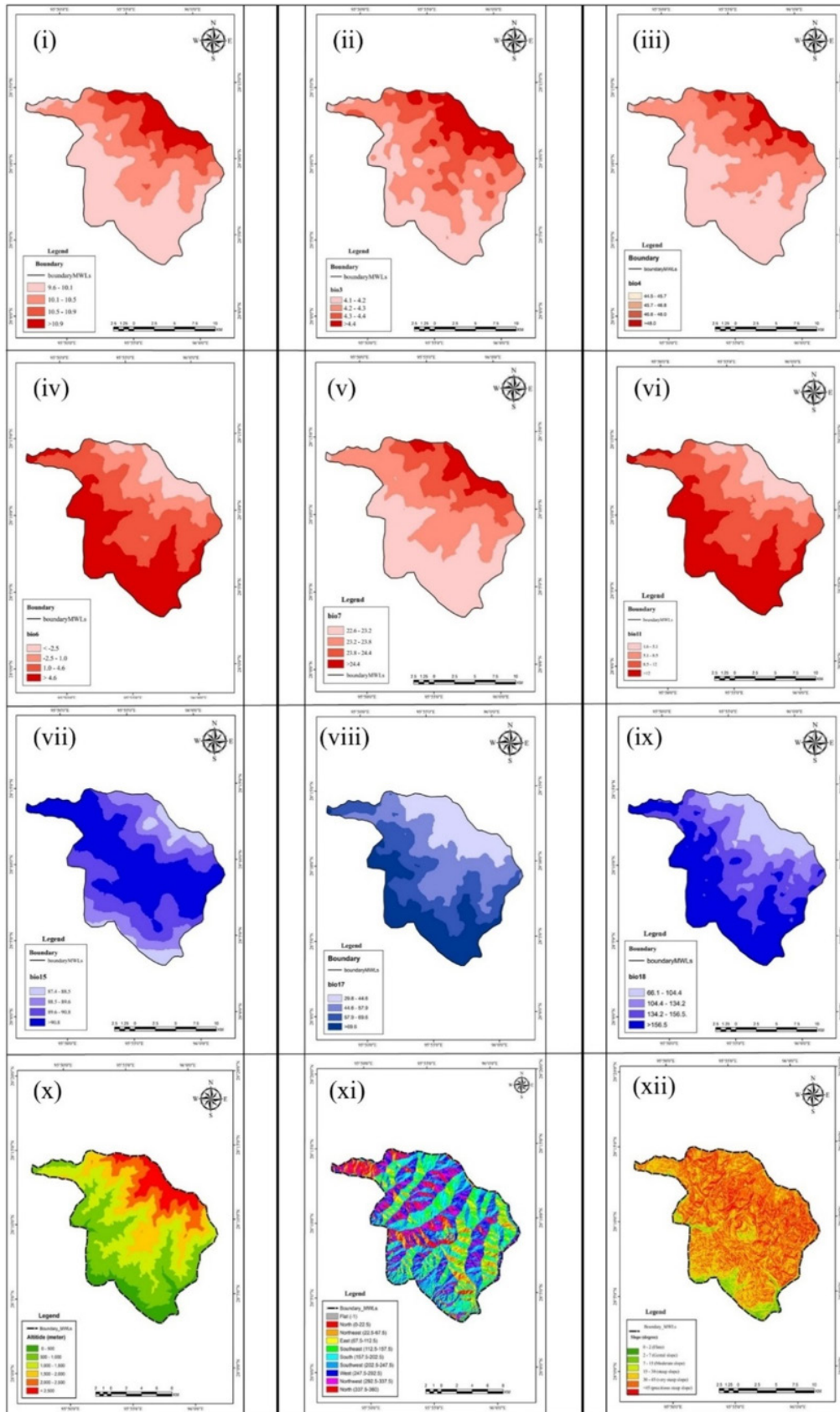


Figure 2. Environmental parameters used in the final model. [(i) = BIO2, (ii) = BIO3, (iii) = BIO4, (iv) = BIO6, (v) = BIO7, (vi) = BIO11, (vii) = BIO15, (viii) = BIO17, (ix) = BIO18, (x) = Altitude, (xi) = Aspect, (xii) = Slope]

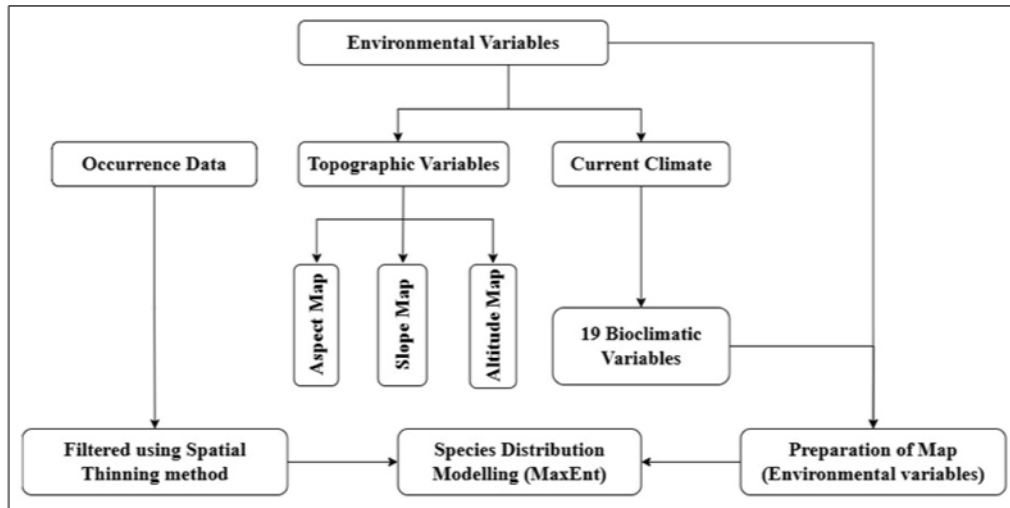


Figure 3. Flowchart of the methodology.

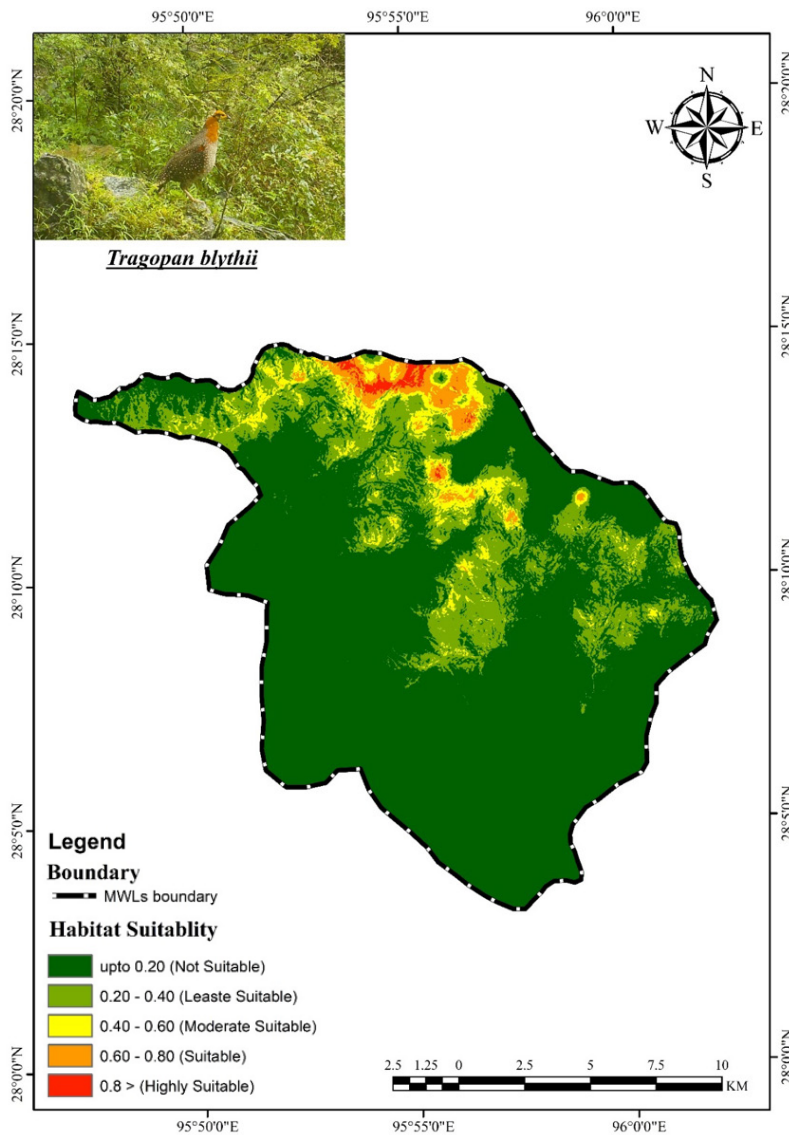


Image 2. Habitat suitability of *T. blythii* in the study area.

**Table 2: Suitable categories of *T. blythii* in the study area.**

| Suitable categories | Value       | Area (km <sup>2</sup> ) | Area (%)      |
|---------------------|-------------|-------------------------|---------------|
| Not Suitable        | 0 - 0.20    | 204.30                  | 72.58         |
| Least Suitable      | 0.20 - 0.40 | 52.22                   | 18.55         |
| Moderate Suitable   | 0.40 - 0.60 | 13.91                   | 4.94          |
| Suitable            | 0.60 - 0.80 | 8.59                    | 3.05          |
| Highly Suitable     | 0.60 - 0.80 | 2.48                    | 0.88          |
| <b>Total</b>        |             | <b>281.50</b>           | <b>100.00</b> |

canopy, and hot temperatures, have been predicted as unsuitable habitat for *T. blythii*. The suitable habitats are mostly found throughout the Mayodia Pass, which is characterized by higher elevation, cooler temperatures, and winter snowfall (Image 2).

## DISCUSSION

Model performance was high, with a mean AUC of 0.924 and a TSS value of 0.798, indicating excellent discriminatory power and reliable prediction of suitable habitats for *T. blythii* (Swets 1988; Elith et al. 2006; Phillips et al. 2006). Among the predictor variables, mean diurnal temperature range, annual temperature range, and precipitation seasonality emerged as the most influential climatic factors shaping the species' distribution. The results support earlier findings of climate as a primary determinant of species' geographic limits, especially for montane and habitat-specialist birds (Parmesan & Yohe 2003; Root et al. 2003; Reside et al. 2010; Hill & Preston 2015).

The diurnal temperature range, representing the difference between daytime and nighttime temperatures, is biologically important because it influences metabolic expenditure, thermoregulation, and activity patterns in birds (McKechnie & Wolf 2010; Wang et al. 2023). Large fluctuations in daily temperature can impose physiological stress and reduce habitat suitability for forest-dwelling pheasants adapted to stable microclimatic conditions. Similar patterns have been reported for the Western Tragopan *Tragopan melanocephalus* in the western Himalayas, where diurnal temperature range strongly influenced habitat suitability (Singh et al. 2020). Experimental and field studies further indicate that increased thermal variability can negatively affect growth, survival, and reproductive success across taxa (Vasseur et al. 2014; Stoks et al. 2017), suggesting that *T. blythii* may be particularly vulnerable to ongoing climatic instability.

Precipitation seasonality also played a major role in determining habitat suitability. Rainfall regimes regulate forest structure, understorey density, and availability of food resources such as seeds, shoots, and invertebrates (Choudhury 2001; Guisan & Thuiller 2005; Sathyakumar & Kaul 2007). High seasonal variability in precipitation may disrupt breeding cycles and reduce nesting success through habitat degradation and changes in vegetation phenology (Both et al. 2006; Soria-Auza et al. 2010). Comparable relationships between precipitation patterns and habitat suitability have been documented for pheasants and other montane birds across the Himalayas and southeastern Asia (Chhetri et al. 2018; Cohen et al. 2020; Li et al. 2022).

Topographic variables, particularly altitude and slope, were also significant predictors of *T. blythii* distribution. The species was predicted to occur primarily at 1,000–2,500 m, which closely matches earlier observations ranging 1,400–3,300 m (BirdLife International 2008; Ghosh 2003). Altitude integrates multiple environmental gradients such as temperature, humidity, vegetation type, and human disturbance, all of which influence species occupancy (Körner 2007; Elsen & Tingley 2015). Steeper slopes may provide refugia from anthropogenic pressures such as agriculture and logging, thereby enhancing habitat persistence for forest-dependent species (Jetz et al. 2007; Laurance et al. 2011). The strong association of *T. blythii* with primary evergreen broadleaf forests observed in this study corroborates previous findings emphasizing its dependence on intact forest ecosystems (Choudhury 1997; Ghose et al. 2003; Sathyakumar & Kaul 2007).

Model projections revealed that only a small fraction of the study area was classified as highly suitable (0.88%) or suitable (3.05%), whereas most regions were categorized as least suitable (18.55%) or unsuitable (72.58%). This limited availability of suitable habitat corresponds with the species' current vulnerability status and narrow ecological niche requirements (BirdLife International 2020b; IUCN 2023). Narrow climatic tolerances have been associated with heightened extinction risk under climate change, particularly for montane endemics (Thomas et al. 2004; Freeman et al. 2018). The results, therefore, suggest that even modest climatic shifts could lead to further habitat contraction and population decline in *T. blythii*.

Although this study employed MaxEnt due to its robustness with presence-only data and small sample sizes (Phillips et al. 2006; Elith et al. 2011), recent studies emphasize the advantages of ensemble ecological niche models that combine multiple algorithms such as

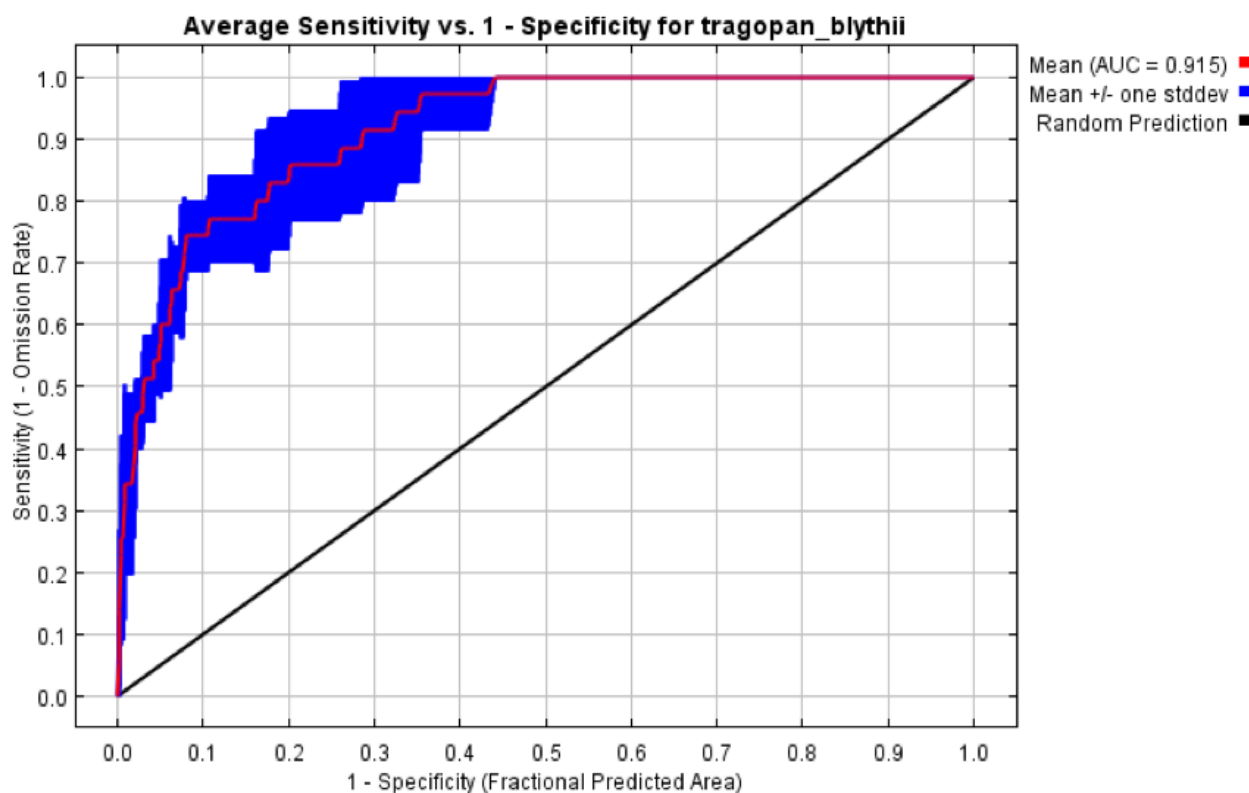


Figure 4. Area under the receiver operating characteristic Curve (AUC-ROC)

random forest, generalized linear models, and boosted regression trees (Araújo & New 2007; Marmion et al. 2009). Ensemble approaches reduce uncertainty and improve predictive performance, particularly for rare and elusive species with limited occurrence records (Thuiller et al. 2009; Feng et al. 2019). Such methods have already been applied successfully to forecast habitat shifts of Himalayan pheasants under climate change scenarios (Chhetri et al. 2018; Singh et al. 2020).

Following the reproducibility checklist proposed by Feng et al. (2019), this study recognizes several methodological limitations, including small sample size, potential sampling bias, and reliance on a single modelling algorithm. These factors may influence model transferability and prediction uncertainty (Warren & Seifert 2011; Merow et al. 2013). Future research should, therefore, incorporate ensemble modelling frameworks, bias-corrected occurrence data, and independent validation datasets to enhance robustness and reproducibility (Araújo et al. 2019; Feng et al. 2019; Zurell et al. 2020). Despite these limitations, the present findings provide an important baseline for understanding the climatic and topographic drivers of *T. blythii* distribution and offer valuable guidance for conservation planning and climate-adaptive management strategies.

## CONCLUSION

The study applied the MaxEnt method to predict the suitable habitats of *T. blythii* in the Mehao Wildlife Sanctuary, located in the Lower Dibang Valley of Arunachal Pradesh. The model used 36 occurrence records and 12 environmental variables for the targeted species. The model performance was good. The model predicted only 3.93% of the total area as suitable, which may be due to its restricted distribution range. Besides, the model also predicted about 5% of the area as moderately suitable, which remains to be explored to confirm species occurrence. The suitable areas of *T. blythii* were mostly located in the northern portion of the MWS at altitudes above 1,700 m. The occurrences of the species were most frequently observed at 1,000–2,500 m in the study area. The study area represents a key natural habitat of the vulnerable *T. blythii*. Thus, safeguarding areas recognised as suitable habitats can ensure conservation of *T. blythii* in the long run. Educating local communities on the significance of *T. blythii* can greatly aid such conservation efforts. These findings indicate the need to develop effective strategies for identifying potential habitats, supporting government policies to protect vulnerable species, and

reducing human activities like overexploitation, hunting, and deforestation in the preferred habitats of *T. blythii*. The study revealed the potential distribution range of *T. blythii* and laid the groundwork for future research. There is an essential need for initiatives to raise public awareness and build capacity by governmental agencies and NGOs, involving the local communities, to avert further decline in the population of Blyth's Tragopan.

## REFERENCES

- Aiello-Lammens, M.E., R.A. Boria, A. Radosavljevic, B. Vilela & R.P. Anderson (2015). spThin: an R package for spatial thinning of species occurrence records for use in ecological niche models. *Ecography* 38(5): 541–545. <https://doi.org/10.1111/ecog.01132>
- Alaska Satellite Facility (n.d.). ASF SAR data search. <https://search.asf.alaska.edu>
- Allouche, O., A. Tsoar & R. Kadmon (2006). Assessing the accuracy of species distribution models: prevalence, kappa and the true skill statistic (TSS). *Journal of Applied Ecology* 43: 1223–1232. <https://doi.org/10.1111/j.1365-2664.2006.01214.x>
- Araújo, M.B., R.G. Pearson, W. Thuiller & M. Erhard (2005). Validation of species-climate impact models under climate change. *Global Change Biology* 11(9): 1504–1513. <https://doi.org/10.1111/j.1365-2486.2005.01000.x>
- Araújo, M.B. & M. New (2007). Ensemble forecasting of species distributions. *Trends in Ecology & Evolution* 22(1): 42–47. <https://doi.org/10.1016/j.tree.2006.09.010>
- Araújo, M.B., R.P. Anderson, A.M. Barbosa, C.M. Beale, C.F. Dormann, R.E. Raquel, A. Garcia, A. Guisan, L. Maiorano, B. Naimi, R.B. O'Hara, N.E. Zimmermann & C. Rahbek (2019). Standards for distribution models in biodiversity assessments. *Science Advances* 5(1): eaat4858.
- Baldwin, R.A. (2009). Use of maximum entropy modeling in wildlife research. *Entropy* 11(4): 854–866. <https://doi.org/10.3390/e11040854>
- Berger, A., S.A.D. Pietra & V.J.D. Pietra (1996). A maximum entropy approach to natural language processing. *Computational Linguistics* 22(1): 39–71.
- BirdLife International (2001). *Threatened birds of Asia: The BirdLife International Red Data Book*. BirdLife International, Cambridge, UK, 3038 pp.
- BirdLife International (2008). *Tragopan blythii*. The IUCN Red List of Threatened Species 2008.
- BirdLife International (2020a). *Tragopan blythii*. The IUCN Red List of Threatened Species 2020: e.T22679163A177682428. <https://doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22679163A177682428.en>. Downloaded on 1.iv.2025.
- BirdLife International (2020b). Species factsheet: Blyth's Tragopan *Tragopan blythii*. Downloaded on 16.iv.2025.
- Borang, A. (2004). Checklist of birds of Dihang-Dibang Biosphere Reserve, Arunachal Pradesh. *Himalayan Biosphere Reserves* 6(1–2): 21–41.
- Borges, R.M. (2005). The frontiers of India's biological diversity. *Tropinet* 16(3): 1–3.
- Both, C., S. Bouwhuis, C.M. Lessells & M.E. Visser (2006). Climate change and population declines in a long-distance migratory bird. *Nature* 441: 81–83. <https://doi.org/10.1038/nature04539>
- Briscoe, N.J., D. Zurell, J. Elith, C. Koenig, G. Fandos, A.K. Malchow, M. Kéry, H. Schmid & G. Guillera-Arroita (2021). Can dynamic occupancy models improve predictions of species' range dynamics? A test using Swiss birds. *Global Change Biology* 27(18): 4269–4282. <https://doi.org/10.1111/GCB.15723>
- Chhetri, B., H.K. Badola & S. Barat (2018). Predicting climate-driven habitat shifting of the Near Threatened Satyr Tragopan *Tragopan satyra*; Galliformes in the Himalayas. *Avian Biology Research* 11(4): 221–230. <https://doi.org/10.3184/175815618X15316676114070>
- Choudhury, A. (2001). Some bird records from Nagaland, North-east India. *Forktail* 17: 91–104.
- Choudhury, A.U. (1997). New localities for Blyth's Tragopan from Nagaland. *WPA News* 52: 13–15.
- Cohen, J.M., D. Fink & B. Zuckerberg (2020). Avian responses to extreme weather across functional traits and temporal scales. *Global Change Biology* 26(8): 4240–4250. <https://doi.org/10.1111/gcb.15133>
- Dormann, C.F., J. Elith, S. Bacher, C. Buchmann, G. Carl, G. Carré, J.R.G. Marquéz, B. Gruber, B. Lafourcade, P.J. Leitão, T. Münkemüller, C. McClean, P.E. Osborne, B. Reineking, B. Schröder, A.K. Skidmore, D. Zurell & S. Lautenbach (2013). Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. *Ecography* 36(1): 27–46. <https://doi.org/10.1111/j.1600-0587.2012.07348.x>
- Eastern Mirror Nagaland (2017). Nagaland is home to 50% of world's Tragopan population. <https://easternmirrornagaland.com/nagaland-is-home-to-50-of-worlds-tragopan-population/>. Accessed 16.iv.2024.
- Elith, J., C.H. Graham, R.P. Anderson, M. Dudík, S. Ferrier, A. Guisan, R.J. Hijmans, F. Huettmann, J.R. Leathwick, A. Lehmann, J. Li, L.G. Lohmann, B.A. Loiselle, G. Manion, C. Moritz, M. Nakamura, Y. Nakazawa, J.M.M. Overton, A.T. Peterson, S.J. Phillips, K. Richardson, R. Scachetti-Pereira, R.E. Schapire, J. Soberón, S. Williams, M.S. Wisz & N.E. Zimmermann (2006). Novel methods improve prediction of species' distributions from occurrence data. *Ecography* 29(2): 129–151. <https://doi.org/10.1111/j.2006.0906-7590.04596>
- Elith, J., S.J. Phillips, T. Hastie, M. Dudík, Y.E. Chee, & C.J. Yates (2011). A statistical explanation of MaxEnt for ecologists. *Diversity and Distributions* 17(1): 43–57. <https://doi.org/10.1111/j.1472-4642.2010.00725.x>
- Elsen, P.R. & M.W. Tingley (2015). Global mountain topography and the fate of montane species under climate change. *Nature Climate Change* 5: 772–776. <https://doi.org/10.1038/nclimate2656>
- Fick, S.E. & R.J. Hijmans (2017). WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology* 37: 4302–4315. <https://doi.org/10.1002/joc.5086>
- Feng, X., D.S. Park, Y. Liang, R. Pandey & M. Papes (2019). Collinearity in ecological niche modeling: Confusions and challenges. *Ecological Modelling* 404: 1–12. <https://doi.org/10.1002/ece3.5555>
- Freeman, B.G., J.A. Lee-Yaw, J.M. Sunday & A.L. Hargreaves (2018). Expanding, shifting and shrinking: The impact of global warming on species' elevational distributions. *Global Ecology and Biogeography* 27(11): 1268–1276.
- Ghose, D., R. Kaul & G. Saha (2003). Status survey of the Blyth's tragopan in Blue Mountain National Park, Mizoram, India using the call-count technique. *Current Science* 84(1): 95–97.
- Ghosh, D. (2003). Distribution and habitat preference of *Tragopan satyra* Linnaeus 1758, *Tragopan blythii* Jerdon 1870 and *Tragopan temminckii* Gray 1831 in northeast India. PhD Thesis. Department of Zoology, University of Calcutta.
- Guisan, A. & W. Thuiller (2005). Predicting species distribution: Offering more than simple habitat models. *Ecology Letters* 8(9): 993–1009. <https://doi.org/10.1111/j.1461-0248.2005.00792.x>
- Heikkinen, R.K., M. Luoto, R. Virkkala, R.G. Pearson & J.-H. Körber (2007). Biotic interactions improve prediction of boreal bird distributions at macro-scales. *Global Ecology and Biogeography* 16(6): 754–763. <https://doi.org/10.1111/j.1466-8238.2007.00345.x>
- Hill, M.O. & C.D. Preston (2015). Disappearance of boreal plants in southern Britain: habitat loss or climate change? *Biological Journal of the Linnean Society* 115(3): 598–610. <https://doi.org/10.1111/bij.12500>
- Islam, K. & J.A. Crawford (2010). A Comparison of four vocalizations of the genus *Tragopan* (Aves, Phasianidae). *Ethology* 102(3): 481–494.

<https://doi.org/10.1111/j.1439-0310.1996.TB01141.X>

- IUCN (2023). The IUCN Red List of Threatened Species. Version 2023-2.
- James, G., D. Witten, T. Hastie & R. Tibshirani (2013). An introduction to statistical learning: With applications in R. Springer. <https://doi.org/10.1007/978-1-4614-7138-7>
- Jetz, W., D.S. Wilcove & A.P. Dobson (2007). Projected impacts of climate and land-use change on the global diversity of birds. *PLoS Biology* 5(6): e157. <https://doi.org/10.1371/journal.pbio.0050157>
- Jiguet, F., M. Barbet-Massin & D. Chevallier (2011). Predictive distribution models applied to satellite tracks: modelling the western African winter range of European Migrant Black Storks *Ciconia nigra*. *Journal of Ornithology* 152: 111–118. <https://doi.org/10.1007/s10336-010-0555-3>
- King, B., J. Geale & S. Chatterjee (2008). Recent observations of the east Himalayan subspecies of Blyth's Tragopan *Tragopan blythii molesworthi*. *Birding ASIA* 10: 96–97.
- Körner, C. (2007). The use of 'altitude' in ecological research. *Trends in Ecology & Evolution* 22(11): 569–574. <https://doi.org/10.1016/j.tree.2007.09.006>
- Kramer-Schadt, S., J. Niedballa, J.D. Pilgrim, B. Schröder, J. Lindenborn, V. Reinfelder, M. Stillfried, I. Heckmann, A.K. Scharf, D.M. Augeri, S.M. Cheyne, A.J. Hearn, J. Ross, D.W. Macdonald, J. Mathai, J. Eaton, A.J. Marshall, G. Semiadi, R. Rustam, H. Bernard, R. Alfred, H. Samejima, J.W. Duckworth, C. Breitenmoser-Wuersten, J.L. Belant, H. Hofer & A. Wilting (2013). The importance of correcting for sampling bias in MaxEnt species distribution models. *Diversity and Distributions* 19(11): 1366–1379. <https://doi.org/10.1111/ddi.12096>
- Langlois, G.P., J. Buch & J. Darbon (2024). Efficient first-order algorithms for large-scale, non-smooth maximum entropy models with application to wildfire science. *Entropy* 26(8): 691. <https://doi.org/10.3390/e26080691>
- Laurance, W.F., J.L.C. Camargo, R.C.C. Luizão, S.G. Laurance, S.L. Pimm, E.M. Bruna, P.C. Stouffer, G.B. Williamson, J. Benítez-Malvido, H.L. Vasconcelos, K.S. Van Houtan, C.E. Zarman, S.A. Boyle, R.K. Didham, A. Andrade & T.E. Lovejoy (2011). The fate of Amazonian forest fragments: a 32-year investigation. *Biological Conservation* 144(1): 56–67. <https://doi.org/10.1016/j.biocon.2010.09.021>
- Lissovsky, A.A. & S.V. Dudov (2021). Species-distribution modeling: advantages and limitations of its application. 2. MaxEnt. *Biology Bulletin Reviews* 11: 265–275. <https://doi.org/10.1134/S2079086421030087>
- Madge, S. & P. McGowan (2002). *Pheasants, Partridges and Grouse*. Christopher Helm, London, UK, 408 pp.
- Manzoor, S.A., G. Griffiths & M. Lukac (2018). Species distribution model transferability and model grain size—finer may not always be better. *Scientific Reports* 8(1): 7168. <https://doi.org/10.1038/s41598-018-25437-1>
- Marmion, M., M. Parviainen, M. Luoto, R.K. Heikkinen & W. Thuiller (2009). Evaluation of consensus methods in predictive species distribution modelling. *Diversity and Distributions* 15(1): 59–69. <https://doi.org/10.1111/j.1472-4642.2008.00491.x>
- Mayer, C., A. Tan & K. Zuraw (2024). Introducing maxent.ot: an R package for Maximum Entropy constraint grammars. *Phonological Data & Analysis* 6(4): 1–44. <https://doi.org/10.3765/pda.v6art4.88>
- McKechnie, A.E. & B.O. Wolf (2010). Climate change increases the likelihood of catastrophic avian mortality events. *Biology Letters* 6(2): 253–256. <https://doi.org/10.1098/rsbl.2009.0702>
- Merow, C., M.J. Smith & J.A. Silander Jr (2013). A practical guide to MaxEnt for modeling species' distributions: what it does, and why inputs and settings matter. *Ecography* 36(10): 1058–1069. <https://doi.org/10.1111/j.1600-0587.2013.07872.x>
- Meyers, N., R. Mittermeier, C. Mittermeier, G. Da Fonseca & J. Kent (2000). Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858. <https://doi.org/10.1038/35002501>
- Mishra, C. & A. Datta (2007). A new bird species from eastern Himalayan Arunachal Pradesh - India's biological frontier. *Current Science* 92(9): 1205–1206.
- Murali, K., C.K. Sarma, P.C. Ray & A. Kumar (2012). Birding around the Mehao wildlife sanctuary, an IBA, in Arunachal Pradesh. *Mistnet* 13(1): 6–8.
- Naimi, B. & M.B. Araújo (2016). SDM: a reproducible and extensible R platform for species distribution modelling. *Ecography* 39(4): 368–375. <https://doi.org/10.1111/ecog.01881>
- Papes, M. (2007). Ecological niche modeling approaches to conservation of endangered and threatened birds in central and eastern Europe. *Biodiversity Informatics* 4: 14–26. <https://doi.org/10.17161/bi.v4i0.37>
- Parmesan, C. & G. Yohe (2003). A globally coherent fingerprint of climate change impacts across natural systems. *Nature* 421: 37–42. <https://doi.org/10.1038/nature01286>
- Parolo, G., G. Rossi & A. Ferrarini (2008). Toward improved species niche modelling: *Arnica montana* in the Alps as a case study. *Journal of Applied Ecology* 45(5): 1410–1418. <https://doi.org/10.1111/j.1365-2664.2008.01516.x>
- Pearson, R.G., T.P. Dawson & C. Liu (2004). Modelling species distributions in Britain: a hierarchical integration of climate and land-cover data. *Ecography* 27(3): 285–298. <https://doi.org/10.1111/j.0906-7590.2004.03740.x>
- Phillips, S.J. & M. Dudík (2008). Modeling of species distributions with Maxent: new extensions and a comprehensive evaluation. *Ecography* 31(2): 161–175. <https://doi.org/10.1111/j.0906-7590.2008.5203.x>
- Phillips, S.J., R.P. Anderson & R.E. Schapire (2006). Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190(3–4): 231–259. <https://doi.org/10.1016/j.ecolmodel.2005.03.026>
- Prosser, D.J., C. Ding, R.M. Erwin, T. Mundkur, J.D. Sullivan & E.C. Ellis (2018). Species distribution modeling in regions of high need and limited data: waterfowl of China. *Avian Research* 9: 1–14. <https://doi.org/10.1186/s40657-018-0099-4>
- Provencher-Langlois, G., J. Buch & J. Darbon (2024). Efficient First-Order Algorithms for Large-Scale, Non-Smooth Maximum Entropy Models with Application to Wildfire Science. *Entropy* 26(8): 691. <https://doi.org/10.3390/e26080691>
- Pshegusov, R. & V. Chadaeva (2023). Modelling the nesting-habitat of threatened vulture species in the Caucasus: an ecosystem approach to formalising environmental factors in species distribution models. *Avian Research* 14: 100131. <https://doi.org/10.1016/j.avrs.2023.100131>
- Randi, E., V. Lucchini, T. Armijo-Prewitt, R.T. Kimball, E.L. Braun & J.D. Ligon (2000). Mitochondrial DNA phylogeny and speciation in the tragopans. *The Auk* 117(4): 1003–1015. <https://doi.org/10.1093/auk/117.4.1003>
- Rangini, N., M.S. Lodhi, L.M.S. Palni, S. Chaudhry & P.K. Samal (2014). A Review of Avifaunal Diversity of Dehang Debang Biosphere Reserve, Arunachal Pradesh. *Indian Forester* 140(10): 998–1004.
- Reside, A.E., J.J. Van Der Wal, A.S. Kutt & G.C. Perkins (2010). Weather, not climate, defines distributions of vagile bird species. *PLoS One* 5(10): e13569. <https://doi.org/10.1371/journal.pone.0013569>
- Root, T.L., J.T. Price, K.R. Hall, S.H. Schneider, C. Rosenzweig & J.A. Pounds (2003). Fingerprints of global warming on wild animals and plants. *Nature* 421: 57–60. <https://doi.org/10.1038/nature01333>
- Santos, E., H.C. Wiederhecker, L.E. Lopes & M.Á. Marini (2023). Equivalence of citizen science and scientific data for modelling species distribution of birds from a tropical savanna. *Austral Ecology* 48: 2171–2184. <https://doi.org/10.1111/aec.13454>
- Sathyakumar, S. & R. Kaul (2007). Pheasants. Galliformes of India. *ENVIS Bulletin: Wildlife and Protected Areas* 10(1): 41.
- Schmid, S.A., M.G. Gebhart & G. Turnage (2024). *Cyperus blepharoleptos* Maxent ecological niche models. *GRI Publications and Scholarship*. 6. <https://scholarsjunction.msstate.edu/gri-publications/6>
- Sen, A.K. & S.K. Mukhopadhyay (1999). Avian fauna of Mouling National Park, Arunachal Pradesh, India. *Current Science* 76: 1305–1308.
- Shirley, S.M., Z. Yang, R.A. Hutchinson, J.D. Alexander, K. McGarigal & M.G. Betts (2013). Species distribution modelling for the people:

- unclassified Landsat TM imagery predicts bird occurrence at fine resolutions. *Diversity and Distributions* 19(7): 855–866. <https://doi.org/10.1111/DDI.12093>
- Singh, H., N. Kumar, M. Kumar & R. Singh (2020). Modelling habitat suitability of western tragopan (*Tragopan melanocephalus*), a range-restricted vulnerable bird species of the Himalayan region, in response to climate change. *Climate Risk Management* 29: 100241. <https://doi.org/10.1016/j.crm.2020.100241>
- Sinha, A., A. Datta, M.D. Madhusudan & C. Mishra (2005). *Macaca munzala*: A New Species from Western Arunachal Pradesh, Northeastern India. *International Journal of Primatology* 26: 977–989. <https://doi.org/10.1007/s10764-005-5333-3>
- Soria-Azuza, R.W., M. Kessler, K. Bach, P.M. Barajas-Barbosa, M. Lehnert, S.K. Herzog & J. Böhner (2010). Impact of the quality of climate models for modelling species occurrences in countries with poor climatic documentation: a case study from Bolivia. *Ecological Modelling* 221(8): 1221–1229. <https://doi.org/10.1016/j.ecolmodel.2010.01.004>
- Stoks, R., J. Verheyen, M. Van Dievel & N. Tüzün (2017). Daily temperature variation and extreme high temperatures drive performance and biotic interactions in a warming world. *Current Opinion in Insect Science* 23: 35–42. <https://doi.org/10.1016/j.cois.2017.06.008>
- Swets, J.A. (1988). Measuring the accuracy of diagnostic systems. *Science* 240(4857): 1285–1293. <https://doi.org/10.1126/science.3287615>
- Tamang, R., V.J. Jins, S. Dewan, S. Chaudhry, S. Rawat & B.K. Acharya (2023). Ecological niche modelling of two water-dependent birds informs the conservation needs of riverine ecosystems outside the protected area network in the eastern Himalaya, India. *PLoS ONE* 19(5): e0303884. <https://doi.org/10.1371/journal.pone.0294056>
- Thomas, C.D., A. Cameron, R.E. Green, M. Bakkenes, L.J. Beaumont, Y.C. Collingham, B.F.N. Erasmus, M.F. de Siqueira, A. Grainger, L. Hannah, L. Hughes, B. Huntley, A.S. van Jaarsveld, G.F. Midgley, L. Miles, M.A. Ortega-Huerta, A.T. Peterson, O.L. Phillips & S.E. Williams (2004). Extinction risk from climate change. *Nature* 427: 145–148. <https://doi.org/10.1038/nature02121>
- Thuiller, W., B. Lafourcade, R. Engler & M.B. Araújo (2009). BIOMOD – a platform for ensemble forecasting of species distributions. *Ecography* 32(3): 369–373. <https://doi.org/10.1111/j.1600-0587.2008.05742.x>
- Vasseur, D.A., J.P. DeLong, B. Gilbert, H.S. Greig, C.D.G. Harley, K.S. McCann, V. Savage, T.D. Tunney & M.I. O'Connor (2014). Increased temperature variation poses a greater risk to species than climate warming. *Proceedings of the Royal Society B* 281(1779): 20132612. <https://doi.org/10.1098/rspb.2013.2612>
- Volpato, G.H., E.V. Lopes, L.B. Mendonça, R. Boçon, M.V. Bisheimer, P.P. Serafini & L.D. Anjos (2009). The use of the point count method for bird survey in the Atlantic-forest. *Zoologia (Curitiba)* 26: 74–78. <https://doi.org/10.1590/S1984-46702009000100012>
- Wang, Y-R., B.H. Samset, F. Stordal, A. Bryn & D.O. Hessen (2023). Past and future trends of diurnal temperature range and their correlation with vegetation assessed by MODIS and CMIP6. *Science of The Total Environment* 904: 166727. <https://doi.org/10.1016/j.scitotenv.2023.166727>
- Warren, D.L. & S.N. Seifert (2011). Ecological niche modeling in MaxEnt: The importance of model complexity. *Ecological Applications* 21(2): 335–342. <https://doi.org/10.1890/10-1171.1>
- Wu, T.Y., B.A. Walther, Y.H. Chen, R.S. Lin & P.F. Lee (2014). Reassessment of Taiwanese birds' conservation status and protected area coverage: How distribution modelling can help species conservation. *Bird Conservation International* 24(2): 223–238. <https://doi.org/10.1017/S0959270913000336>
- Zou, J., L. Dong, G. Davison, W. Hlaing, M.M. Aung, Y. Zhang, Z. Zhang, N. Wang & D. Chen (2021). Identifying A New Phylogeographic Population of the Blyth's Tragopan (*Tragopan blythii*) through Multi-locus Analyses. *Zoological Studies* 60: e40. <https://doi.org/10.6620/ZS.2021.60-40>
- Zurell, D., J. Franklin, C. König, P.J. Bouchet, C.F. Dormann, J. Elith, G. Fandos, X. Feng, G. Guillera-Aroita, A. Guisan, J.J. Lahoz-Monfort, P.J. Leitão, D.S. Park, A.T. Peterson, G. Rapacciuolo, D.R. Schmatz, B. Schröder, J.M. Serra-Diaz, W. Thuiller, K.L. Yates, N.E. Zimmermann & C. Merow (2020). A standard protocol for reporting species distribution models. *Ecography* 43(9): 1261–1277. <https://doi.org/10.1111/ecog.04960>
- Zuur, A.F., E.N. Ieno & C.S. Elphick (2010). A protocol for data exploration to avoid common statistical problems. *Methods in Ecology and Evolution* 1(1): 3–14. <https://doi.org/10.1111/j.2041-210X.2009.00001.x>



Mr. Jatishwor Singh Irungbam, Biology Centre CAS, Branišovská, Czech Republic.  
Dr. Ian J. Kitching, Natural History Museum, Cromwell Road, UK  
Dr. George Mathew, Kerala Forest Research Institute, Peechi, India  
Dr. John Noyes, Natural History Museum, London, UK  
Dr. Albert G. Orr, Griffith University, Nathan, Australia  
Dr. Sameer Padhye, Katholieke Universiteit Leuven, Belgium  
Dr. Nancy van der Poorten, Toronto, Canada  
Dr. Kareen Schnabel, NIWA, Wellington, New Zealand  
Dr. R.M. Sharma, (Retd.) Scientist, Zoological Survey of India, Pune, India  
Dr. Manju Siliwal, WILD, Coimbatore, Tamil Nadu, India  
Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India  
Dr. K.A. Subramanian, Zoological Survey of India, New Alipore, Kolkata, India  
Dr. P.M. Sureshan, Zoological Survey of India, Kozhikode, Kerala, India  
Dr. R. Varatharajan, Manipur University, Imphal, Manipur, India  
Dr. Eduard Vives, Museu de Ciències Naturals de Barcelona, Terrassa, Spain  
Dr. James Young, Hong Kong Lepidopterists' Society, Hong Kong  
Dr. R. Sundararaj, Institute of Wood Science & Technology, Bengaluru, India  
Dr. M. Nithyanandan, Environmental Department, La Ala Al Kuwait Real Estate. Co. K.S.C., Kuwait  
Dr. Himender Bharti, Punjabi University, Punjab, India  
Mr. Purnendu Roy, London, UK  
Mr. Saito Motoki, The Butterfly Society of Japan, Tokyo, Japan  
Dr. Sanjay Sondhi, TITLI TRUST, Kalpavriksh, Dehradun, India  
Dr. Nguyen Thi Phuong Lien, Vietnam Academy of Science and Technology, Hanoi, Vietnam  
Dr. Nitin Kulkarni, Tropical Research Institute, Jabalpur, India  
Dr. Robin Wen Jiang Ngiam, National Parks Board, Singapore  
Dr. Lionel Monod, Natural History Museum of Geneva, Genève, Switzerland.  
Dr. Asheesh Shivam, Nehru Gram Bharti University, Allahabad, India  
Dr. Rosana Moreira da Rocha, Universidade Federal do Paraná, Curitiba, Brasil  
Dr. Kurt R. Arnold, North Dakota State University, Saxony, Germany  
Dr. James M. Carpenter, American Museum of Natural History, New York, USA  
Dr. David M. Claborn, Missouri State University, Springfield, USA  
Dr. Kareen Schnabel, Marine Biologist, Wellington, New Zealand  
Dr. Amazonas Chagas Júnior, Universidade Federal de Mato Grosso, Cuiabá, Brasil  
Mr. Monsoon Jyoti Gogoi, Assam University, Silchar, Assam, India  
Dr. Heo Chong Chin, Universiti Teknologi MARA (UiTM), Selangor, Malaysia  
Dr. R.J. Shiel, University of Adelaide, SA 5005, Australia  
Dr. Siddharth Kulkarni, The George Washington University, Washington, USA  
Dr. Priyadarsanan Dharma Rajan, ATREE, Bengaluru, India  
Dr. Phil Alderslade, CSIRO Marine And Atmospheric Research, Hobart, Australia  
Dr. John E.N. Veron, Coral Reef Research, Townsville, Australia  
Dr. Daniel Whitmore, State Museum of Natural History Stuttgart, Rosenstein, Germany.  
Dr. Yu-Feng Hsu, National Taiwan Normal University, Taipei City, Taiwan  
Dr. Keith V. Wolfe, Antioch, California, USA  
Dr. Siddharth Kulkarni, The Hormiga Lab, The George Washington University, Washington, D.C., USA  
Dr. Tomas Ditrich, Faculty of Education, University of South Bohemia in Ceske Budejovice, Czech Republic  
Dr. Mihaly Foldvari, Natural History Museum, University of Oslo, Norway  
Dr. V.P. Uniyal, Wildlife Institute of India, Dehradun, Uttarakhand 248001, India  
Dr. John T.D. Caleb, Zoological Survey of India, Kolkata, West Bengal, India  
Dr. Priyadarsanan Dharma Rajan, Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Bangalore, Karnataka, India

#### Fishes

Dr. Topiltzin Contreras MacBeath, Universidad Autónoma del estado de Morelos, México  
Dr. Heok Hee Ng, National University of Singapore, Science Drive, Singapore  
Dr. Rajeesh Raghavan, St. Albert's College, Kochi, Kerala, India  
Dr. Robert D. Sluka, Chiltern Gateway Project, A Rocha UK, Southall, Middlesex, UK  
Dr. E. Vivekanandan, Central Marine Fisheries Research Institute, Chennai, India  
Dr. Davor Zanella, University of Zagreb, Zagreb, Croatia  
Dr. A. Biju Kumar, University of Kerala, Thiruvananthapuram, Kerala, India  
Dr. Akhilesh K.V., ICAR-Central Marine Fisheries Research Institute, Mumbai Research Centre, Mumbai, Maharashtra, India  
Dr. J.A. Johnson, Wildlife Institute of India, Dehradun, Uttarakhand, India  
Dr. R. Ravinesh, Gujarat Institute of Desert Ecology, Gujarat, India

#### Amphibians

Dr. Sushil K. Dutta, Indian Institute of Science, Bengaluru, Karnataka, India  
Dr. Annemarie Ohler, Muséum national d'Histoire naturelle, Paris, France

#### Reptiles

Dr. Gernot Vogel, Heidelberg, Germany  
Dr. Raju Vyasa, Vadodara, Gujarat, India  
Dr. Pritpal S. Soorae, Environment Agency, Abu Dhabi, UAE.  
Prof. Dr. Wayne J. Fuller, Near East University, Mersin, Turkey  
Prof. Chandrashekhar U. Rivonker, Goa University, Taleigao Plateau, Goa, India  
Dr. S.R. Ganesh, Kalinga Foundation, Agumbe, India.  
Dr. Himansu Sekhar Das, Terrestrial & Marine Biodiversity, Abu Dhabi, UAE

#### Birds

Dr. Hem Sagar Baral, Charles Sturt University, NSW Australia  
Mr. H. Byju, Coimbatore, Tamil Nadu, India  
Dr. Chris Bowden, Royal Society for the Protection of Birds, Sandy, UK  
Dr. Priya Davidar, Pondicherry University, Kalapet, Puducherry, India  
Dr. J.W. Duckworth, IUCN SSC, Bath, UK  
Dr. Rajah Jayapal, SACON, Coimbatore, Tamil Nadu, India  
Dr. Rajiv S. Kalsi, M.L.N. College, Yamuna Nagar, Haryana, India  
Dr. V. Santharam, Rishi Valley Education Centre, Chittoor Dt., Andhra Pradesh, India  
Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India  
Mr. J. Praveen, Bengaluru, India  
Dr. C. Srinivasulu, Osmania University, Hyderabad, India  
Dr. K.S. Gopi Sundar, International Crane Foundation, Baraboo, USA  
Dr. Gombobaatar Sundev, Professor of Ornithology, Ulaanbaatar, Mongolia  
Prof. Reuven Yosef, International Birding & Research Centre, Eilat, Israel  
Dr. Taej Mundkur, Wetlands International, Wageningen, The Netherlands  
Dr. Carol Inskipp, Bishop Auckland Co., Durham, UK  
Dr. Tim Inskipp, Bishop Auckland Co., Durham, UK  
Dr. V. Gokula, National College, Tiruchirappalli, Tamil Nadu, India  
Dr. Arkady Lelej, Russian Academy of Sciences, Vladivostok, Russia  
Dr. Simon Dowell, Science Director, Chester Zoo, UK  
Dr. Mário Gabriel Santiago dos Santos, Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, Vila Real, Portugal  
Dr. Grant Connette, Smithsonian Institution, Royal, VA, USA  
Dr. P.A. Azeez, Coimbatore, Tamil Nadu, India

#### Mammals

Dr. Giovanni Amori, CNR - Institute of Ecosystem Studies, Rome, Italy  
Dr. Anwaruddin Chowdhury, Guwahati, India  
Dr. David Mallon, Zoological Society of London, UK  
Dr. Shomita Mukherjee, SACON, Coimbatore, Tamil Nadu, India  
Dr. Angie Appel, Wild Cat Network, Germany  
Dr. P.O. Nameer, Kerala Agricultural University, Thrissur, Kerala, India  
Dr. Ian Redmond, UNEP Convention on Migratory Species, Lansdown, UK  
Dr. Heidi S. Riddle, Riddle's Elephant and Wildlife Sanctuary, Arkansas, USA  
Dr. Karin Schwartz, George Mason University, Fairfax, Virginia.  
Dr. Lala A.K. Singh, Bhubaneswar, Orissa, India  
Dr. Mewa Singh, Mysore University, Mysore, India  
Dr. Paul Racey, University of Exeter, Devon, UK  
Dr. Honnavalli N. Kumara, SACON, Anaikatty P.O., Coimbatore, Tamil Nadu, India  
Dr. Nishith Dharaiya, HNG University, Patan, Gujarat, India  
Dr. Spartaco Gippoliti, Socio Onorario Società Italiana per la Storia della Fauna "Giuseppe Altobello", Rome, Italy  
Dr. Justus Joshua, Green Future Foundation, Tiruchirappalli, Tamil Nadu, India  
Dr. H. Raghuram, Sri S. Ramasamy Naidu Memorial College, Virudhunagar, Tamil Nadu, India  
Dr. Paul Bates, Harison Institute, Kent, UK  
Dr. Jim Sanderson, Small Wild Cat Conservation Foundation, Hartford, USA  
Dr. Dan Challender, University of Kent, Canterbury, UK  
Dr. David Mallon, Manchester Metropolitan University, Derbyshire, UK  
Dr. Brian L. Cypher, California State University-Stanislaus, Bakersfield, CA  
Dr. S.S. Talmale, Zoological Survey of India, Pune, Maharashtra, India  
Prof. Karan Bahadur Shah, Budhanilakantha Municipality, Kathmandu, Nepal  
Dr. Susan Cheyne, Borneo Nature Foundation International, Palangkaraja, Indonesia  
Dr. Hemanta Kafley, Wildlife Sciences, Tarleton State University, Texas, USA

#### Other Disciplines

Dr. Aniruddha Belsare, Columbia MO 65203, USA (Veterinary)  
Dr. Mandar S. Paingankar, University of Pune, Pune, Maharashtra, India (Molecular)  
Dr. Jack Tordoff, Critical Ecosystem Partnership Fund, Arlington, USA (Communities)  
Dr. Ulrike Streicher, University of Oregon, Eugene, USA (Veterinary)  
Dr. Hari Balasubramanian, EcoAdvisors, Nova Scotia, Canada (Communities)  
Dr. Rayanna Hellem Santos Bezerra, Universidade Federal de Sergipe, São Cristóvão, Brazil  
Dr. Jamie R. Wood, Landcare Research, Canterbury, New Zealand  
Dr. Wendy Collinson-Jonker, Endangered Wildlife Trust, Gauteng, South Africa  
Dr. Rajeshkumar G. Jani, Anand Agricultural University, Anand, Gujarat, India  
Dr. O.N. Tiwari, Senior Scientist, ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India  
Dr. L.D. Singla, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India  
Dr. Rupika S. Rajakaruna, University of Peradeniya, Peradeniya, Sri Lanka  
Dr. Bahar Baviskar, Wild-CER, Nagpur, Maharashtra 440013, India

#### Reviewers 2021–2023

Due to paucity of space, the list of reviewers for 2021–2023 is available online.

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

**Journal of Threatened Taxa** is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64

Print copies of the Journal are available at cost. Write to:  
The Managing Editor, JoTT,  
c/o Wildlife Information Liaison Development Society,  
3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore,  
Tamil Nadu 641006, India  
ravi@threatenedtaxa.org & ravi@zooreach.org



[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

OPEN ACCESS



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at [www.threatenedtaxa.org](http://www.threatenedtaxa.org). All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

March 2026 | Vol. 18 | No. 3 | Pages: 28455–28606

Date of Publication: 26 March 2026 (Online & Print)

DOI: 10.11609/jott.2026.18.3.28455-28606

## Articles

**Predicting the potential habitat of *Tragopan blythii* (Jerdon, 1870) (Aves: Galliformes: Phasianidae) in Mehao Wildlife Sanctuary of Arunachal Pradesh, India**

– Eba Tapo & Gibji Nimasow, Pp. 28455–28467

**Composition and ecological guild structure of birds at Chaudhary Devi Lal University campus, Haryana, India**

– Harkrishan Kamboj, Vijay Singh, Vivek Goyal & Vinay Malik, Pp. 28468–28478

**New record of two natricine snakes, *Hebius gilhodesi* (Wall, 1925) and *Herpetoreas davidi* Nguyen et al., 2024 (Reptilia: Squamata: Colubridae), from India**

– Sourav Dutta, Bitupan Boruah & Abhijit Das, Pp. 28479–28494

**Diversity and distribution pattern of geometrid moths (Insecta: Lepidoptera: Geometridae) along the altitudinal gradient, Kumaun Himalaya, India**

– Narendra Singh Lotani & Chandra Singh Negi, Pp. 28495–28509

**New distribution records and taxonomic studies of ascomycetous fungi *Xylaria* and *Daldinia* (Ascomycota: Xylariales: Xylariaceae) in Karnataka, India**

– S. Bharath Kumar, A. Muthu Kumar & Praveen Kumar Nagadesi, Pp. 28510–28523

**Identification of wildlife crime hotspots in Punjab, India via kernel density estimation analysis**

– Navdeep Sood & Rohan Kumar, Pp. 28524–28533

## Communications

**Assessing nutritional status of Chital *Axis axis* (Erxleben, 1777) (Mammalia: Artiodactyla: Cervidae) through bone marrow condition of predated individuals in Kanha Tiger Reserve, India**

– Shravana Goswami, Ujjwal Kumar & Yadvendradev V. Jhala, Pp. 28534–28539

**Smooth-Coated Otter *Lutrogale perspicillata* (Mammalia: Carnivora: Mustelidae) observation near a community reservoir in Bannerghatta National Park**

– Amrita Nair & Avinash Krishnan, Pp. 28540–28545

**Range extension records of Tibetan Snowcock, Tibetan Sandgrouse, and Western Tragopan in Uttarakhand, India**

– Anuj Joshi, Ranjana Pal, Vineet K. Dubey & Sambandam Sathyakumar, Pp. 28546–28551

**Morphological and statistical perspectives on genital sexual dimorphism in Eupterotidae Swinhoe, 1892 (Insecta: Lepidoptera)**

– Sujata Saini & Shabnum Shafi, Pp. 28552–28563

**Distribution of rheophytes in Kopili River Basin, Assam and Meghalaya, India**

– Jayanta Das & Deepak K. Baruah, Pp. 28564–28572

## Short Communications

**First photographic record of Smooth-coated Otter *Lutrogale perspicillata* from the canals in Upper Ganga Ramsar Site, Uttar Pradesh, India**

– Aftab Alam Usmani, Pichaimuthu Gangaiamaran, Ruchi Badola & Syed Ainul Hussain, Pp. 28573–28577

**First camera-trap evidence of a ferret badger *Melogale sp.* (Mammalia: Carnivora: Mustelidae) from the community forests of Manipur, India**

– Chingrisoror Rumthao, Monesh Singh Tomar & Sushanto Gouda, Pp. 28578–28581

**Species composition of butterflies associated with nectar feeding on *Libidibia coriaria* (Jacq.) Schltld (Magnoliopsida: Fabales: Fabaceae)**

– V. Ajay Krishna, M.P. Gopika, S. Adithyan & K.S. Aneesh, Pp. 28582–28589

**New distribution records of five species of freshwater palaemonid prawns (Crustacea: Decapoda) in Nagaland, India**

– K. Valarmathi, Pp. 28590–28593

**Range extension of the lichenized ascomycete, *Cladonia fruticulosa* Kremp., 1882 (Lecanoromycetes: Lecanorales: Cladoniaceae), from Similipal Biosphere Reserve of Odisha**

– Shubham Pradhan, Satyabrata Dash, Bijayananda Sahoo & Biswajit Rath, Pp. 28594–28599

## Notes

**First photographic record of *Chitoria sordida sordida* (Moore, 1866) (Insecta: Lepidoptera: Nymphalidae: Apaturinae) from Arunachal Pradesh, India**

– Roshan Upadhaya, Rajesh Gopinath, R. Mahesh & Gaurav Joshi, Pp. 28600–28603

**Westward range extension of the Greater Bluewing *Rhyothemis plutonia* Selys, 1883 (Insecta: Odonata: Libellulidae) into Uttarakhand, India**

– Omkar Sanjay Damle, Pp. 28604–28606

Publisher & Host



Threatened Taxa