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Cover: A mesmerising Indian Luna moth *Actias selene* is dancing through the starry night (by Vincent van Gogh) moonlit sky, displaying its ballistic display of feather tail. Digital artwork by Vyshnavee Sneha Jaijar.

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COMMUNICATION

First camera-trap evidence of Dhole *Cuon alpinus* Pallas, 1811 (Carnivora: Canidae) from the Kaziranga-Karbi Anglong landscape, Assam, India

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Abstract: India is experiencing a decline in wildlife species due to habitat loss, deforestation, and climate change. Species once thought to be extirpated from certain areas are being rediscovered, offering hope for conservation efforts. The Dhole *Cuon alpinus* is listed as 'Endangered' on the IUCN Red List and under Schedule I of the Indian Wildlife (Protection) Act, 1972. The Kaziranga-Karbi Anglong landscape is located in the Indo-Burma biodiversity hotspot. Photographic evidence of a Dhole from the Kaziranga-Karbi-Anglong landscape, Assam, is reported, where the species was previously extirpated. Reconnaissance surveys were conducted in four identified corridors: Panbari, Haldhibari, Kanchanjuri, and Amguri. Based on these findings, camera traps were deployed. The identified corridor between Kaziranga and Karbi Anglong is crucial for wildlife movement, particularly during floods. Both large and small animals utilize these corridors to disperse to Karbi-Anglong when water levels rise. As floodwaters recede, some animals return to their original habitats, while others disperse to new areas. A total of six photographs of a single Dhole were captured in the Amguri Corridor, highlighting the critical role of wildlife corridors in supporting the movement and survival of elusive carnivores like Dholes in fragmented, non-protected landscapes.

Keywords: Asiatic Wild Dog, biodiversity hotspots, Brahmaputra floodplain, corridors, distribution, endangered species, fragmentation, northeastern India, trail camera, world heritage sites.

Assamese: ভাৰতবৰ্ষত বাসস্থানৰ হ্ৰাস, বনাঞ্চল ধ্বংস আৰু জলবায়ু পৰিৱৰ্তনৰ বাবে বন্যপ্ৰাণীৰ সংখ্যা ক্ৰমাগতভাবে কমি আহিছে। অৱশ্যে, সম্প্ৰতি কিছু প্ৰজাতি যিবোৰক নিৰ্দিষ্ট অঞ্চলৰ পৰা বিলুপ্ত বুলি বিবেচনা কৰা হৈছিল, সেইবোৰ পুনৰ অৱস্থিতিৰ প্ৰমাণ হৈছে। এই অৱস্থিতিয়ে বন্যপ্ৰাণী সংৰক্ষণৰ নতুন আশাৰ সৃষ্টি কৰিছে। এনে এটা উল্লেখযোগ্য প্ৰজাতি হৈছে ধ'ল বা ৰাং কুকুৰ (*Cuon alpinus*)। IUCN ৰেড লিষ্টত এই প্ৰজাতিটোক 'বিপন্ন' হিচাপে তালিকাভুক্ত কৰা হৈছে আৰু ই ভাৰতীয় বন্যপ্ৰাণী (সংৰক্ষণ) আইন, ১৯৭২ৰ অনুসূচী-১ ত অন্তৰ্ভুক্ত। অসমৰ কাজিৰঙা-কাৰ্বি আংলং অঞ্চল, যি ইণ্ডো-বাৰ্মা জৈৱবৈচিত্ৰ্য হটস্পটৰ অন্তৰ্গত, তাত ৰাং কুকুৰৰ ফটোগ্ৰাফিক প্ৰমাণ পোৱা গৈছে। উল্লেখযোগ্য যে এই অঞ্চলৰ পৰা ইয়াৰ আগতে এই প্ৰজাতিটো বিলুপ্ত হৈ পৰা বুলি ধাৰণা কৰা হৈছিল। প্ৰথমে এই অঞ্চলৰ চাৰিটা কৰিডৰ - পানবাৰী, হালধীবাৰী, কাঞ্চনজুৰি আৰু আমগুৰিত প্ৰাথমিক জৰীপ সম্পন্ন কৰা হৈছিল। পৰৱৰ্তী সময়ত এই কৰিডৰসমূহত কেমেৰা ট্ৰেপ স্থাপন কৰা হৈছিল। এই গৱেষণাত আমগুৰি কৰিডৰত এটা ৰাং কুকুৰৰ মুঠ ছয়টা আলোকচিত্ৰ ধৰা পৰিছিল। কাজিৰঙা আৰু কাৰ্বি আংলংৰ মাজৰ এই কৰিডৰসমূহে বন্যপ্ৰাণীৰ চলাচলৰ বাবে অতি গুৰুত্বপূৰ্ণ ভূমিকা পালন কৰে, বিশেষকৈ বানপানীৰ সময়ত। পানীৰ স্তৰ বাঢ়িলে বিভিন্ন আকাৰৰ প্ৰাণীয়ে কাৰ্বি আংলংলৈ যাবলৈ এই কৰিডৰসমূহ ব্যৱহাৰ কৰে। বানপানী অৱসান হ'লে কিছুমান প্ৰাণীয়ে নিজৰ মূল বাসস্থানলৈ উভতি যায়, আনহাতে কিছুমান নতুন অঞ্চললৈ স্থানান্তৰিত হয়। ৰাং কুকুৰৰ এই পুনৰ আবিষ্কাৰে প্ৰমাণ কৰিছে যে কৰিডৰসমূহে খণ্ডিত আৰু অসংৰক্ষিত অঞ্চলসমূহত ৰাং কুকুৰৰ দৰে দুৰ্লভ মাংসভোজী প্ৰাণীৰ চলাচল আৰু বাসস্থানৰ সুবিধা প্ৰদানত গুৰুত্বপূৰ্ণ ভূমিকা পালন কৰে।

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INTRODUCTION

The Dhole *Cuon alpinus* (Pallas, 1811), also known as the Asiatic Wild Dog, is a social canid (Pocock 1936; Johnsingh 1982; Habib et al. 2021) and a communal hunter, occasionally forming packs of up to 30 individuals (Fox 1984). Depending on prey availability, they may also hunt alone or in pairs (Cohen et al. 1978; Venkataraman et al. 1995). The Dhole is listed as 'Endangered' on the IUCN Red List (Kamler et al. 2015) and as a Schedule I species under the Indian Wildlife (Protection) Act, 1972. Historically, the Dhole's distribution ranged from the Tian Shan and Altai mountains (in the Russian Federation), Mongolia, and Kazakhstan (Thenius 1954) southwards through China, Tibet, Nepal, India, and Indochina (Selvan et al. 2013). Currently, the Dhole's distribution is confined to central & eastern Asia, India, Nepal, Bhutan, Bangladesh, China, Myanmar, Indonesia, Thailand, and Malaysia (Johnsingh 1985; Kamler et al. 2015; Srivathsa et al. 2019; Kao et al. 2020). Understanding the distribution of Dhole is therefore crucial for guiding effective conservation strategies and ensuring the species' long-term persistence across its range.

Although Dholes have been extensively studied in India, much of the research has primarily focused on their feeding ecology, genetics, and demography (Cohen 1978; Johnsingh 1982, 1985, 1992; Venkataraman 1995; Karanth & Sunquist 2000; Acharya 2007; Borah et al. 2009; Pal et al. 2018; Ghaskadbi et al. 2022; Modi et al. 2021 & 2022). But studies in northeastern India remain relatively limited (Babu & Venkataraman 2001; Gopi et al. 2010, 2012; Lyngdoh et al. 2014). The Dhole has been recorded in northeastern states such as Arunachal Pradesh, Assam, Meghalaya, Mizoram, Nagaland, & Sikkim and in the eastern state of West Bengal (Choudhury 1998, 2006; Durbin et al. 2008; Bashir et al. 2014; Singh et al. 2020). In Nagaland, a pack of Dholes was observed by birdwatchers on 21 May 2011, far from the Myanmar border, and this sighting was confirmed by the Nagaland Forest Department (Conservation India 2011).

The distribution range of the species has reduced to less than 25% of its former global range due to threats such as retaliatory killing, habitat loss, and prey depletion (Wolf & Ripple 2017; Ghimirey et al. 2024). Previous global assessments in 1990 reported that Dhole presence was confined only to the northern bank of the Brahmaputra River and have undergone extirpation in the south (Ginsberg & Macdonald 1990; Singh et al. 2020). Recent records of Dholes from Dampa Tiger Reserve in Mizoram and other areas of northeastern India, including non-protected regions, provide evidence of the species' persistence in the region (Singh et al. 2020). Here, the photographic record of the species in Kaziranga-Karbi Anglong landscape (KKAL), Assam, India is reported.

Study area

The KKAL of Assam spreads over 25,000 km^2, touching the neighbouring states of Meghalaya and Nagaland in northeastern India. The landscape is a complex mosaic of protected and non-protected areas. It comprises the Karbi plateau in Karbi Anglong, located on the southern side of the Brahmaputra River in Assam, with Kaziranga Tiger Reserve situated at the foothills of the Karbi Anglong District (Image 1). The landscape is severely fragmented with patches of protected areas that support globally threatened wildlife species. The landscape is connected with nearby protected areas such as Nameri Tiger Reserve (Assam) and Pakke Tiger Reserve (Arunachal Pradesh) to the northern side, Laokhowa Burhachapori Wildlife Sanctuary (Assam) to the western side, Nambor Wildlife Sanctuary (Assam), and Ntanki National Park (Nagaland) to the southern side through several corridors. Thus, understanding wildlife presence and corridor usage is important for better management of corridor functionality in the landscape. The four primary corridors connecting KKAL with the protected areas to the southern side are Panbari (92.20 km^2), Haldhibari (117.24 km^2), Kanchanjuri (109.83 km^2), and Amguri (49.83 km^2).

METHODS

A reconnaissance survey was conducted across these corridors, and based on the findings, camera traps were strategically deployed to monitor the mammalian species present. Camera traps were systematically placed along animal trails to maximize the chances of detecting wildlife species. A pair of camera traps was deployed within each 2 × 2 km^2 grid, ensuring at least one camera trap station in every grid. Infrared and White flash Cuddeback (H1453 IR and C1 model) camera traps were used during the study. A total of 83 camera traps were deployed across an area of 276 km^2 covering the four corridors of the KKAL. The study was conducted from February 2021 to December 2022, with continuous monitoring of animal movements, spanning a total of 15,278 camera-trap days. The primary aim of this study was to determine the structural and functional connectivity of wildlife corridors within the landscape.

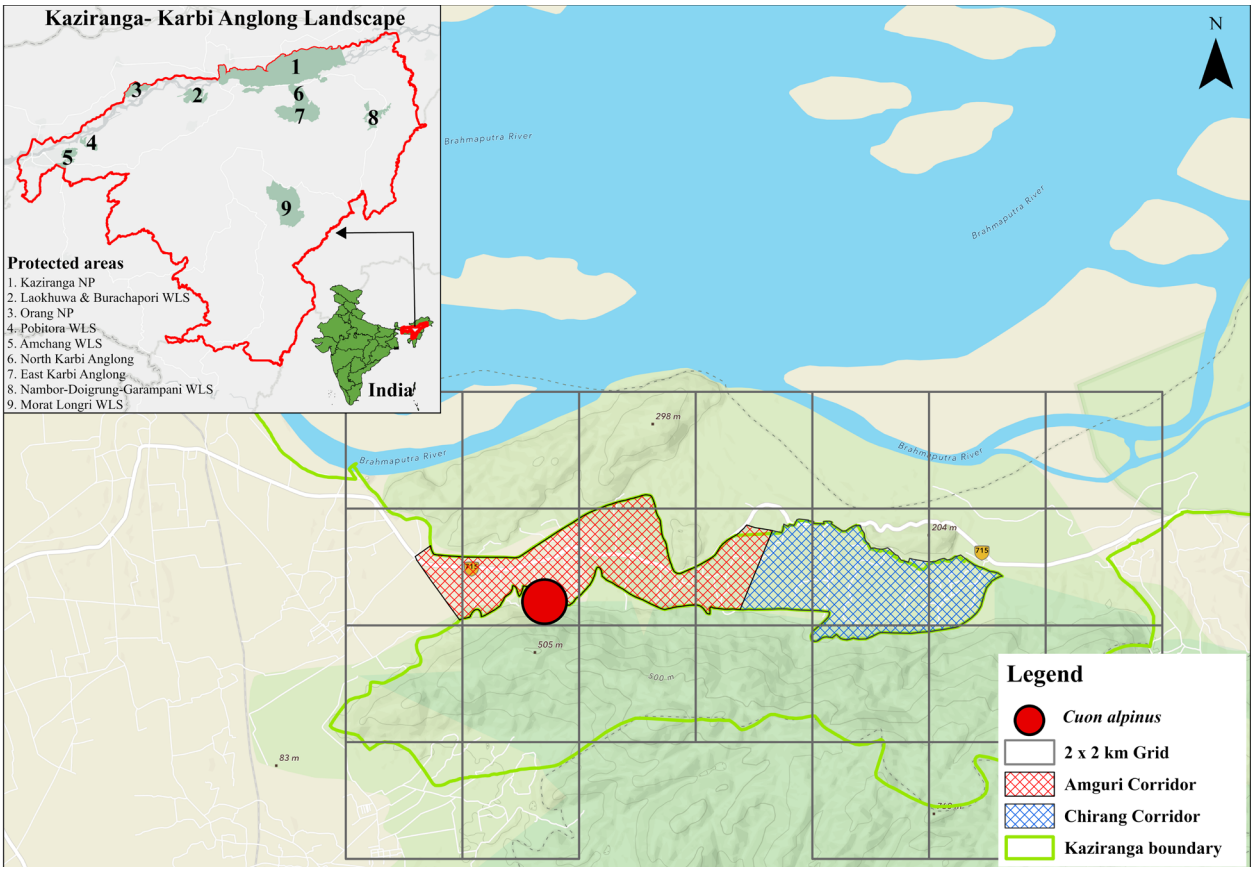

Image 1. Dhole *Cuon alpinus* occurrence in the Kaziranga-Karbi Anglong landscape, Assam, India.

Image 2. a—Heterogeneous and undulating terrain of the Karbi Anglong hills, characterized by mixed forest cover and anthropogenic clearings | b—Kalioni River flowing through a forested valley in Karbi Anglong, serving as a vital ecological corridor and freshwater source in the landscape. © Mujahid Ahamad

Image 3. Camera trap images of Dholes captured in the Amguri Corridor, Kaziranga-Karbi Anglong landscape, Assam, India.

While the study focused on broader connectivity patterns for multiple species, it also sought to assess habitat use, and movement of mammals.

RESULTS

A total of six photos were captured of a single individual, with the first capture time on 31 October 2022, at 11:55:05 AM. The individual returned through the same route at 11:56:37 AM, and the location (26.562^0 N, 93.04333^0 E) was within the Amguri Corridor (Image 3). This was the only instance where we captured a Dhole on camera in the landscape during the study period. The location of the photo-captured Dhole was approximately 375 m from the National Highway 37, with the nearest human settlement located at about 270 m. The habitat consists of moist mixed deciduous forest, dominated by teak *Tectona grandis* (Champion & Seth 1968).

DISCUSSION

This study provides the first photo evidence of Dholes by camera traps in KKAL, confirming the species' occurrence in this region. The southern region of the Brahmaputra River serves as a critical habitat for Dholes, a species that was extirpated in the 1990s (Ginsberg & Macdonald 1990). Recent sightings have been documented in Mizoram, Meghalaya, Nagaland, and Assam (Singh et al. 2020). In Assam, evidence on Dhole occurrence is limited. The most reliable record comes from Jeypore-Dihing Reserve Forest in Dibrugarh District, where Kashmira Kakati observed a Dhole in 2010, as described by Singh et al. (2020). Although secondary sources suggest occurrences in the Patharia Hills Reserve Forest, Karimganj district, these accounts lack reliability to confirm the species' presence (Talukdar & Choudhury 2017). The recent records of Dholes from Dampa Tiger Reserve in Mizoram and other areas of northeastern India, including non-protected regions, provide evidence of the species' persistence in the region (Singh et al. 2020). While the KKAL likely provides suitable habitat for Dholes due to its forested and hilly terrain, large portions of Kaziranga's open grasslands are likely less suitable for the species (Durbin et al. 2008; Bashir et al. 2014; Singh et al. 2020). This variability highlights the heterogeneous nature of the landscape in terms of its suitability as a Dhole habitat.

The persistence of the species in KKAL highlights the possibility of nearby source populations. One such source population is in Ntanki National Park in Nagaland (Srivathsa et al. 2020). Such dispersal is possible through the fragmented habitats of the Karbi Anglong District, which may act as a corridor facilitating movement between populations. Protected areas such as Morat Longri, northern Karbi Anglong, and eastern Karbi Anglong serve as ideal habitat patches that could support dispersal and provide stepping-stone habitats for wide-ranging species (Image 1). These protected areas and surrounding forests are likely to play a critical role in maintaining the metapopulation dynamics of Dholes in the region. The lack of recent sightings or reports from the area highlights the challenges posed by habitat

fragmentation and reduced connectivity. Therefore, it is crucial to identify and conserve potential source and sink populations within the larger landscape to ensure the persistence of Dholes.

The persistence of Dholes in this landscape is threatened by habitat fragmentation, reduced prey base, and retaliatory killings associated with Mithun depredation in Nagaland (personal communication with local communities during fieldwork December 2022). The fragmentation of corridors, particularly in the Karbi Anglong District, has likely disrupted the connectivity between source populations.This disruption may result in the isolation of small, vulnerable groups or even solitary dispersing individuals, thereby increasing their susceptibility to extirpation (Ginsberg & Macdonald 1990). While it is possible for a dispersing individual to establish a breeding pair and contribute to population growth, the lack of landscape connectivity poses a critical threat to long-term genetic viability. Furthermore, a decline in the prey base due to hunting of ungulates and competition with livestock has significantly reduced the availability of natural prey for Dholes (Wolf & Ripple 2017). These compounded threats highlight the urgent need for immediate policy intervention to address habitat fragmentation and ensure the persistence of both Dholes and their prey.

This study highlights the critical role of corridors in facilitating wildlife movement, ensuring habitat connectivity, and supporting species dispersal, especially during seasonal changes and extreme events like floods. In the absence of tigers and leopards, the Dhole assumes the role of apex predator in the ecosystem (Johnsingh 1992). Dholes are essential for regulating prey populations, and their persistence indicates the connectivity of the landscape. To ensure their conservation, future research should focus on understanding the movement ecology and connectivity of Dholes, as well as how corridor conservation benefits other species (Singh et al. 2020; Rodrigues et al. 2021).

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