Predicting Current and Future Distribution of Indian Vulture under Changing Climate Scenarios for Efficient Conservation Measures

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Abstract

Warming temperatures, shifting precipitation regimes, and more frequent extreme events are driving range shifts and population declines across many taxa. Birds are among the groups that are sensitive to climate change, with documented changes in migration timing, breeding phenology, and geographic distributions in response to recent warming. Gyps indicus (Family: Accipitridae), commonly known as Indian Vulture or Long-billed Vulture, is a critically endangered scavenger bird native to the Indian subcontinent. The present study aimed to identify key climatic variables defining its niche, map areas of suitable habitat under current conditions, and project range shifts under mid and late 21st century climate projections using MaxEnt. The AUC for the model was 0.96 depicting its excellent performance. The variable importance analysis revealed that the distribution of G. indicus is primarily determined by bio15 (Precipitation Seasonality), and bio9 (Mean Temperature of Driest Quarter). Under current climatic conditions, 2.97% area is predicted to be suitable for G. indicus and the suitable areas are distributed in Madhya Pradesh, Gujarat, Rajasthan, Uttar Pradesh, and some areas of Karnataka and Tamil Nadu. Under future climatic scenarios, the distribution of the species is predicted to change inevitably under each projected climatic scenario, more drastic under SSP585. The species is predicted to lose 13,683 km² and 18,766 km² area of its suitable areas under SSP585 by the years 2050 and 2070, respectively. This highlights the vulnerability of G. indicus to warming trends and shifting climatic regimes. There is an urgent need to strengthen conservation measures, such as expanding vulture-safe zones, mitigating poisoning risks, and protecting stable habitats identified in this study. Further, integrating habitat restoration with supplementary food provisioning and breeding site protection could enhance population recovery. The predicted suitable habitats identified in the present study provide a baseline for planning future conservation interventions.

Keywords

Aves, Critically Endangered, Habitat suitability, Range change, MaxEnt.