

Ecology and Conservation of Mountain Birds

High mountain habitats are globally important for biodiversity. At least 12 per cent of bird species worldwide breed at or above the treeline, many of which are endemic species or species of conservation concern. However, due to the challenges of studying mountain birds in difficult-to-access habitats, little is known about their status and trends. This book provides the first global review of the ecology, evolution, life history and conservation of high mountain birds, including comprehensive coverage of their key habitats across global mountain regions, assessments of diversity patterns along elevation gradients and adaptations for life in the alpine zone. The main threats to mountain bird populations are also identified, including climate change, human land use and recreational activities. Written for ecologists and naturalists, this book identifies key knowledge gaps and clearly establishes the research priorities needed to increase our understanding of the ecology of mountain birds and to aid in their conservation.

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The world's biological diversity faces unprecedented threats. The urgent challenge facing the concerned biologist is to understand ecological processes well enough to maintain their functioning in the face of the pressures resulting from human population growth. Those concerned with the conservation of biodiversity and with restoration also need to be acquainted with the political, social, historical, economic and legal frameworks within which ecological and conservation practice must be developed. The new Ecology, Biodiversity and Conservation series will present balanced, comprehensive, up-to-date and critical reviews of selected topics within the sciences of ecology and conservation biology, both botanical and zoological, and both 'pure' and 'applied'. It is aimed at advanced final-year undergraduates, graduate students, researchers and university teachers, as well as ecologists and conservationists in industry, government and the voluntary sectors. The series encompasses a wide range of approaches and scales (spatial, temporal and taxonomic), including quantitative, theoretical, population, community, ecosystem, landscape, historical, experimental, behavioural and evolutionary studies. The emphasis is on science related to the real world of plants and animals rather than on purely theoretical abstractions and mathematical models. Books in this series will, wherever possible, consider issues from a broad perspective. Some books will challenge existing paradigms and present new ecological concepts, empirical or theoretical models, and testable hypotheses. Other books will explore new approaches and present syntheses on topics of ecological importance.

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Preface

Humans have long held a fascination for mountains; these typically striking and beautiful landscapes are perceived as wild, challenging, and both inviting and hostile environments. For the naturalist, mountains are important as they host many iconic species that are rare or have restricted distributions. For the ecologist, mountains provide useful models to study the ecological and evolutionary mechanisms driving species diversity as environmental conditions and habitat types change dramatically across small increases in elevation, diversifying niche availability. Mountains are globally important for biodiversity as mountain regions cover one quarter of the earth's terrestrial surface, but support disproportionately high avian diversity and contain nearly one half of its biodiversity hot-spots.

Mountains host many charismatic and highly sought-after species such as giant hummingbird and glacier finch in the Andes, white-tailed ptarmigan in North America, white-winged snowfinch in the European Alps, grandala in Asia, scarlet-tufted sunbird in Africa or rosy finches in the Holarctic. Whether you are a birder or a professional ornithologist, the challenges of locating alpine birds adds to their allure given that they often have cryptic plumage and behaviour and occur in low densities in difficult to access habitats. We should stress that mountains are important for both specialist species and birds that live across elevation gradients. There is often extensive avian use all-year-round. Increasingly, mountains provide refugia for many open-country species that were formerly widespread, but are now declining in the lowlands due to increasingly intensive anthropogenic activities at low elevations. Given their sensitivity to climate change and habitat degradation, birds in high mountains can be very useful sentinels of environmental change.

Although often perceived as pristine and natural, many mountain areas have been shaped by a long history of human influence, given centuries-old management practices for hunting and agriculture, and the more recent use of mountains for recreation. Mountain biodiversity is

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increasingly threatened by growing pressure caused by human activities, especially climate change, that put at risk the many key ecosystem services provided by mountain habitats. Despite escalating threats, mountain biodiversity is poorly studied compared to many lowland habitats. Thus, there is a high priority to conduct further ecological and biodiversity conservation research for mountain ecosystems.

Cumulatively, we editors have spent over 75 years studying high mountain birds on four continents. We feel a strong urgency to assess the current state of mountain ornithology given the rapidly increasing pressures on high elevation ecosystems. Although there are some publications that focus on individual mountain bird species, this is the first book dedicated to research on mountain birds that addresses alpine habitats globally. In this volume, we aim to fill a large gap in the ornithology of mountain bird species and their associated ecological processes, threats and conservation.

The 10 chapters in our book focus on research at and above the treeline ecotone with an emphasis on the alpine zone, although we use examples that consider wider trends across elevation gradients from montane forest to the nival zone (the highest elevation habitats). The first chapter includes our working definition of ‘mountains’, global estimates of mountain habitats and an introduction to mountain bird communities and their habitats. The second chapter addresses the many adaptations that birds employ to live in high mountains. The following two chapters summarize knowledge on avian ecology in the open alpine and nival zones and the treeline ecotone. Chapter 5 assesses mountain bird population trends, mainly drawing on national-level monitoring schemes or long-term surveys in Europe and North America. Chapters 6 and 7 deal with potential threats to mountain bird populations, respectively climate change and human disturbance, assessing the evidence of likely impacts and conservation actions required to minimize those impacts and improve prospects for the future. Chapter 8 includes the current and potential future contributions of large-scale modelling approaches to mountain bird ecology and conservation. Chapter 9, as the first global treatment of alpine birds in tropical systems, reviews the impressive levels of avian species diversity and endemism, and contrasts ecological and systematic patterns with high latitude mountain avifauna.

The final chapter synthesizes the main points from each chapter and highlights the key knowledge gaps and research priorities needed to increase our knowledge of mountain birds to aid in their conservation. Our ‘roadmap’ to guide mountain bird research over the next decades

involves improving programmes for monitoring populations, increasing our basic ecological knowledge of mountain species, identifying the key drivers of their distributions and population trends, and providing an assessment of their resilience to environmental change, in particular climate change. All of this must be accompanied by an expansion of research and funding opportunities, especially in currently under-represented mountain systems which are often hot spots of avian diversity in the Global South. Achieving the goals set by our roadmap will greatly improve the future prospects for mountain birds, and mountain biodiversity more generally, especially in the face of global environmental change.

To conclude, high mountain systems support astounding levels of avian biodiversity and provide an impressive breadth of important services. Despite the warmer future faced by mountain birds, mountain areas are becoming increasingly important climate and habitat refugia for wildlife. As the cold upper limits on distributions for birds are relaxed, formerly unsuitable habitats may potentially support species that have been lost from more productive lower elevations. Thus, despite the threats posed by climate change, mountain ecosystems may, with appropriate management, become more important centres for bird conservation in a changing climate than they are at present.

Dan Chamberlain, Aleksi Lehikoinen, Kathy Martin

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