1 · *Introduction*

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1.1 Birds and Forests

Throughout the world, in most habitats, birds are highly noticeable animals manifesting diverse colorations, sounds, shapes and motions. With more than 10,000 species and more than 240 families, these conspicuous creatures have fascinated people for centuries and have a distinctive cultural position in many human societies (Collar *et al.* 2007; Cocker & Tipping 2013; del Hoyo & Collar 2014, 2016; Winkler *et al.* 2015). Scientifically, especially over the last 50 years, studies on birds have played an important part in improving our understanding of environmental processes, including some with implications for human safety, such as issues linked to the unimpeded use of certain pesticides (Newton 1995). But why write a book specifically about birds that inhabit forests?

The diversity of bird life found within forests is of incalculable value from cultural, aesthetic and scientific perspectives. Yet these environments, and the bird life they support, have frequently been shaped by human activities and are vulnerable to shifts in forest management, a changed climate and other pressures, such as introduced pathogens. Changes are to be expected in the future, with consequences for biodiversity and humans (Rudel *et al.* 2005). At the same time, there are many positive messages and opportunities for protecting and enhancing wildlife within forests. This book aims to explore these interactions between humans, forests and birds from diverse, but essentially scientific, standpoints.

Globally, forests cover about 30% of the terrestrial surface, but account for some 75% of the gross primary production of the biosphere and contain 80% of the plant biomass (Kindermann *et al.* 2008; Beer *et al.* 2010; Pan *et al.* 2013). Over large tracts of the planet, forests are the dominant ecosystem. They harbour the majority of terrestrial species on Earth. Forests deliver valuable ecosystem goods and services to humanity, including food, timber, fibre, medicine, clean water and aesthetic and

spiritual values, and play a crucial role in climate moderation (Millennium Ecosystem Assessment 2005; McKinley *et al.* 2011). Forests have also been crucial for the development of human societies in general (Perlin 2005).

The majority of all bird species (77%) use forest as their habitat, but not necessarily as their main habitat (BirdLife International 2017). Due to their structural and compositional diversity and complexity, forest ecosystems support particularly rich bird communities. Many forest birds are intimately linked to trees that may serve as nesting sites and foraging substrates and provide shelter. Due to forest loss, fragmentation and changes to internal forest ecosystem attributes, many specialised forest bird species have become threatened or have suffered population declines. The negative effects have been particularly severe for birds dependent on attributes such as dead wood, old trees and structurally complex forests (e.g., Imbeau *et al.* 2001; Mikusiński *et al.* 2001; Fuller *et al.* 2007; Roberge *et al.* 2008; Holt *et al.* 2011; Chollet & Martin 2013).

Research efforts to unravel relationships between human actions and forest birds have been impressive during recent decades, resulting in large numbers of research papers from around the world. These encompass global, regional, landscape and forest stand scales (e.g., Sallabanks *et al.* 2000; Schieck & Song 2006; Forsman *et al.* 2010; Hewson *et al.* 2011). The huge body of knowledge on forest birds has inspired and informed many different conservation actions. The book edited by Allen Keast (1990), *Biogeography and Ecology of Forest Bird Communities*, was a landmark ecological review with a global scope. A semi-popular book was produced a few years later, but with a much narrower western European outlook (Fuller 1995). Since 1996, more than 3,000 scientific papers containing the words 'bird' and 'forest' in their titles have been published (Web of Science, accessed 23 May 2017). Despite much fresh research and conservation effort since the mid-1990s, no book of continental or multicontinental scope devoted mainly to forest birds has been published recently. Therefore, the time seems right for a synthesis of knowledge in the fields of forest bird ecology and conservation.

It has become increasingly evident that knowledge of birds does not derive solely from professional ornithologists and ecologists. Much important information currently available, especially concerning bird distributions and population trends, has been contributed by large numbers of skilled birdwatchers (Hagemeijer & Blair 1997;

Greenwood 2007; Gregory *et al.* 2007; Sullivan *et al.* 2009; Jiguet *et al.* 2012). A citizen-based bird observation network linked to academic research is therefore a unique interface where science interacts with broader society, offering huge potential for reciprocal learning. Scientists in ornithology and avian ecology therefore have a responsibility to create feedback systems that inform conservation practitioners, land managers and the interested public about key research findings.

1.2 Contents and Structure of the Book

As a whole, this book is limited to birds and forests of the non-tropical parts of the Northern Hemisphere. Its main geographic focus is Europe: most chapters concentrate on this continent, while being informed by relevant research from North America and Asia. However, some chapters pertaining to general ecological and evolutionary issues build equally upon European and North American research.

The book consists of 13 thematic chapters organised in three parts.

The first part contains three chapters covering some fundamental evolutionary and ecological aspects. Chapter 2 sets the scene by providing a major overview of the evolutionary background of forest birds in the Northern Hemisphere. Chapters 3 and 4 deal with ecological adaptations of forest birds in Europe and North America, one of them exclusively devoted to hole-nesting birds, which form a distinctive component of forest bird assemblages.

Part II starts with Chapter 5, which documents the large-scale patterns in the richness and composition of forest birds across Europe. Chapters 6–9 are concerned with the characteristics of bird assemblages and their habitats in different European forest types, including the factors influencing finer-scale variation, together with the various pressures they face. The different biogeographical zones of Europe differ strikingly in terms of biophysical conditions that influence forests and bird communities. Hence, these topics are addressed in four chapters that take a broad 'ecoregional' approach. We recognise that any classification of forests will have its limitations; there are many gradients and 'grey areas', making it difficult to adopt an approach that will be universally acceptable. Variations in bird communities do not match comfortably with strict botanical classifications of forest types, partly because successional stage and vegetation structure are more important than exact plant composition in determining habitat quality

for many birds. Therefore, we feel it appropriate to review forest bird assemblages within a broader ecoregional framework. Chapter 10 is slightly different, in that it considers birds in man-made plantations predominantly composed of non-native trees; these form a distinctive but relatively novel set of habitats for forest birds, though in many cases their bird communities show considerable similarity with those in semi-natural forest stands.

While the chapters in Part II consider conservation topics that are relevant to specific regions or types of forest, Chapters 11–14 in Part III broaden the discussion of conservation and management. Knowledge of population trends is vital in order to understand temporal community dynamics and identify which species are in greatest need of research and conservation attention. Levels of exploitation and persecution of forest birds may be lower now than in historic times, but the topic remains highly relevant to the conservation of some forest bird species. Much recent research and conservation effort has gone into working out how to mitigate the effects of forestry on biodiversity and how to best manage habitat in different forest contexts; this is the subject of Chapter 13. Finally, we, the editors, conclude with some general observations about the future of forest bird populations of the Northern Hemisphere and critical issues that will deserve increased consideration in the coming years and decades.

We do not pretend to fully cover all subjects pertaining to forest birds within our focal geographic area. For the more fundamental aspects of the population, community and behavioural ecology of forest birds, the reader will have to consult other sources. The effects of climate change on birds have been recently extensively reviewed by Pearce-Higgins and Green (2014), and therefore we cover this topic collectively with other issues concerning the future of forest birds in the concluding chapter. The same applies to forest birds in relation to urban environments, which have been addressed comprehensively by Murgui and Hedblom (2017). Also, a recently published book concerning bird habitat provides deeper insights into some of the ecological issues relevant to forest birds (Fuller 2012).

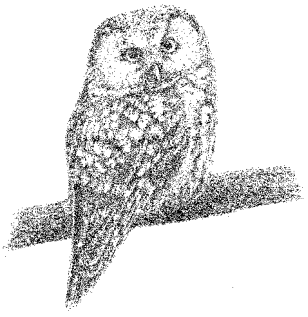
Forests and forest birds can be defined in several ways. In Part II of the book, we used the Food and Agricultural Organization of the United Nations (FAO) definition of forests (FAO 2010), which considers the minimum patch area (0.5 ha), tree height (5 m or existing potential to reach that height) and canopy cover (>10%). However, when needed, we extended our definition to include ‘other wooded land’. Moreover,

for simplicity, we considered 'forest' and 'woodland' as synonyms. Having this as a starting point, we defined a forest bird as a species that more than incidentally breeds or forages in (1) forest, according to the official FAO definition, or (2) other types of environments that fulfil the basic quantitative criteria of the FAO definition of forest but are predominantly under agricultural or urban use (e.g., some gardens, city parks and agroforestry systems). For more details about the adopted definitions of forests and forest birds, see Chapter 5. However, some authors of particular chapters occasionally had to deviate from these general definitions. This was the case, for example, when they presented results from previous studies where the focal bird assemblages included additional species not captured by our definition.

Many different forest bird species from Europe, North America and Asia are mentioned in the book. The naming of species has become slightly problematic with so many recent changes to both English and scientific names. In general, we have adopted the shortened (vernacular) English names in the text to assist with readability. But for formal lists of species in tables and appendices, full international English names are generally given. We have attempted to follow the International Ornithological Congress (IOC) list of bird names (BirdLife International 2017).

In total, 28 scientists participated in writing the chapters in this book. All 13 chapters following this introduction have been peer-reviewed by at least two referees. In editing this volume, we have sought to achieve a reasonably balanced treatment of the main applied aspects of forest ornithology within the geographical scope defined above. We hope that the book will provide a valuable reference not only for scientists and students, but also for conservation professionals, people working within the forest industry and a broader public interested in birds and nature. The book is largely a series of contributions that synthesise reviews and original data analyses, and, as such, we believe it has original value for ecological and ornithological science. On the other hand, an equally important goal has been to make the current breadth of knowledge concerning this important group of organisms available for broader audiences.

We deliver this book to your hands hoping that you will enjoy reading it and even learn some new, exciting things about forest birds. We also hope that the ideas and information it contains will be helpful in your professional or personal interests, and will help in some small way to ensure the continuing enjoyment of forest birds by future generations of people.



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