



Biodiversity Monitoring and Conservation

Bridging the Gap Between Global Commitment and Local Action

Edited by Ben Collen, Nathalie Pettorelli, Jonathan E. M. Baillie and Sarah M. Durant

 **WILEY-BLACKWELL**

ZSL
LIVING CONSERVATION

Table of Contents

[Conservation Science and Practice Series](#)

[Previously published](#)

[Title Page](#)

[Copyright](#)

[Contributors](#)

[Acknowledgements](#)

[Chapter 1: Biodiversity Monitoring and Conservation: Bridging the Gaps Between Global Commitment and Local Action](#)

[Why a book on biodiversity monitoring and conservation?](#)

[Biodiversity and human well-being](#)

[Species-based indicators of biodiversity change](#)

[Indicators of the pressures on biodiversity](#)

[The next generation of biodiversity indicators](#)

[Biodiversity monitoring in practice](#)

[Conclusions](#)

[References](#)

Part I: Species-Based Indicators of Biodiversity Change

Chapter 2: Tracking Change in National-Level Conservation Status: National Red Lists

Introduction

Methods

Interpreting the index in the context of biodiversity change?

Global Red List and RLI results

Implementation of the index: national case studies

Two decades of extinction risk assessment for the Venezuelan fauna

The Red Data Book for the mammals of South Africa

Critique of strengths and weaknesses

Acknowledgements

References

Chapter 3: The Wildlife Picture Index: A Biodiversity Indicator for Top Trophic Levels

Introduction

Component of biodiversity: medium to large terrestrial birds and mammals

The Wildlife Picture Index

[Measuring the WPI](#)
[Trend analysis using the WPI](#)
[Implementation of the WPI](#)
[Preliminary simulations](#)
[Cost of implementation](#)
[Weaknesses and strengths](#)
[The future](#)
[Acknowledgements](#)
[References](#)

[Chapter 4: Tracking Change in Abundance: The Living Planet Index](#)

[Introduction](#)
[Methods](#)
[What has the index told us about biodiversity
change? Interpreting the index](#)
[Global LPI results](#)
[Implementation of the index](#)
[Critique of strengths and weaknesses](#)
[Conclusions](#)
[Acknowledgements](#)
[References](#)

[Part II: Indicators of the Pressures on Biodiversity](#)

[Chapter 5: Satellite Data-Based Indices to Monitor Land Use and Habitat Changes](#)

[Introduction](#)

[Satellites and their possible role in helping monitoring biodiversity through habitat change](#)

[Satellites: a world of possibilities](#)

[The Normalized Difference Vegetation Index \(NDVI\) and its promising links with ecology](#)

[Limits to satellite data](#)

[Conclusions: biodiversity monitoring, satellites, and national reporting](#)

[Glossary](#)

[References](#)

[Chapter 6: Indicators of Climate Change Impacts on Biodiversity](#)

[Introduction](#)

[Attributing and measuring climate change impacts on species](#)

[Developing a theoretical framework for climate change indicators](#)

[Climate change indicators in practice](#)

[Validating climate change vulnerability assessments and indicators](#)

[Conclusions](#)

[Acknowledgements](#)

[References](#)

[Chapter 7: Monitoring Trends in Biological Invasion, its Impact and Policy Responses](#)

[Introduction](#)

[Review of indicators of invasions](#)
[Development of global indicators for biological invasion](#)
[Technical challenges to the development of invasion indicators](#)
[Discussion and conclusions](#)
[Acknowledgements](#)
[References](#)

[Chapter 8: Exploitation Indices: Developing Global and National Metrics of Wildlife Use and Trade](#)

[Introduction](#)
[Indicators currently available](#)
[Indicators of sustainable use](#)
[Future directions for indicators of exploitation and trade in wild species](#)
[Concluding remarks](#)
[Acknowledgements](#)
[References](#)

[Chapter 9: Personalized Measures of Consumption and Development in the Context of Biodiversity Conservation: Connecting the Ecological Footprint Calculation with the Human Footprint Map](#)

[Introduction](#)
[Ecological footprint calculation](#)
[The human footprint map](#)

[Connecting the ecological footprint and human footprint](#)

[Equivalency between the ecological footprint and the human footprint](#)

[Discussion](#)

[References](#)

[Part III: The Next Generation of Biodiversity Indicators](#)

[Chapter 10: Indicator Bats Program: A System for the Global Acoustic Monitoring of Bats](#)

[Introduction](#)

[Monitoring ultrasonic biodiversity](#)

[Developing an ultrasonic indicator](#)

[Comparisons with existing indicators](#)

[Indicator Bats Program](#)

[The future](#)

[Acknowledgements](#)

[References](#)

[Chapter 11: Occupancy Methods for Conservation Management](#)

[Introduction](#)

[First step: defining conservation management objectives](#)

[Proportion of area occupied \(PAO\)](#)

[Species richness](#)

[Conservation management of red slender loris in Sri Lanka](#)

[References](#)

[Chapter 12: Monitoring and Evaluating the Socioeconomic Impacts of Conservation Projects on Local Communities](#)

[Introduction](#)

[Why monitor the socioeconomic impacts of conservation projects?](#)

[What to monitor?](#)

[How to monitor? What are the pitfalls?](#)

[Conclusions](#)

[References](#)

[Chapter 13: Science to Policy Linkages for the Post-2010 Biodiversity Targets](#)

[Introduction](#)

[Twenty targets for 2020](#)

[Conclusions](#)

[Acknowledgements](#)

[References](#)

[Part IV: Biodiversity Monitoring in Practice](#)

Chapter 14: Building Sustainable National Monitoring Networks

International conventions for biodiversity conservation

Why national long-term sustainable monitoring?

Monitoring goals

Monitoring plan design

Data collection

Data storage

Data analysis

Standardization

Human and financial capacity

Institutional frameworks

Establishing trust and credibility

Communication and dissemination

Discussion

Conclusions

Acknowledgements

References

Chapter 15: Monitoring in the Real World

Introduction

The importance of power in monitoring

Real-world challenges

An ideal monitoring programme?

Conclusions

Acknowledgements

References

Chapter 16: Monitoring in UNDP-GEF Biodiversity Projects: Balancing Conservation Priorities, Financial Realities, and Scientific Rigour

Introduction

The GEF and biodiversity conservation

UNDP and biodiversity conservation

The role of biodiversity monitoring in the monitoring and evaluation of UNDP-GEF biodiversity projects

Mechanisms for increasing the contribution of GEF biodiversity projects to broader biodiversity monitoring efforts

Financing for increased technical support to GEF biodiversity projects and other considerations

Conclusions

Acknowledgements

References

Chapter 17: Scaling Up or Down? Linking Global and National Biodiversity Indicators and Reporting

Introduction

Global biodiversity indicators use

Global biodiversity indicators production

National biodiversity indicators use

National biodiversity indicators production

National biodiversity indicators data sources

National biodiversity indicator types

[Challenges in developing national biodiversity indicators](#)

[Regional indicators for biodiversity](#)

[National use of global indicators for biodiversity](#)

[National capacity needs for biodiversity indicators](#)

[Scaling up or scaling down? Addressing differing motivations](#)

[Acknowledgements](#)

[References](#)

[Chapter 18: Conserving Biodiversity in a Target-Driven World](#)

[Background](#)

[The CBD 2010 Target—positive aspects](#)

[The CBD 2010 Target—problematic aspects](#)

[The 2010 Target—why was it not met?](#)

[How do we raise the priority of biodiversity?](#)

[How will the Aichi 2020 Biodiversity Target help avoid pitfalls post-2010?](#)

[Linking targets to actions](#)

[Conclusion](#)

[Acknowledgements](#)

[References](#)

[Index](#)

Conservation Science and Practice Series

Published in association with the Zoological Society of London

Wiley-Blackwell and the Zoological Society of London are proud to present our *Conservation Science and Practice* series. Each book in the series reviews a key issue in conservation today from a multidisciplinary viewpoint.

Books in the series can be single or multi-authored and proposals should be sent to:

Ward Cooper, Senior Commissioning Editor. Email: ward.cooper@wiley.com

Each book proposal will be assessed by independent academic referees, as well as our Series Editorial Panel. Members of the Panel include:

Richard Cowling, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa

John Gittleman, Institute of Ecology, University of Georgia, USA

Andrew Knight, University of Stellenbosch, South Africa

Nigel Leader-Williams, University of Cambridge, UK

Georgina Mace, University College London, UK

Daniel Pauly, University of British Columbia, Canada

Stuart Pimm, Duke University, USA

Hugh Possingham, University of Queensland, Australia

Peter Raven, Missouri Botanical Gardens, USA

Helen Regan, University of California, Riverside, USA

Alex Rogers, University of Oxford, UK

Michael Samways, University of Stellenbosch, South Africa

Nigel Stork, Griffith University, Australia.

Previously published

Biodiversity Conservation and Poverty Alleviation: Exploring the Evidence for a Link

Edited by Dilys Roe, Joanna Elliott, Chris Sandbrook and Matt Walpole

ISBN: 978-0-470-67478-9 Paperback;

ISBN: 978-0-470-67479-6 Hardback; December 2012

Applied Population and Community Ecology: The Case of Feral Pigs in Australia

Edited by Jim Hone

ISBN: 978-0-470-65864-2 Hardcover; July 2012

Tropical Forest Conservation and Industry Partnership: An Experience from the Congo Basin

Edited by Connie J. Clark and John R. Poulsen

ISBN: 978-0-4706-7373-7 Hardcover; March 2012

Reintroduction Biology: Integrating Science and Management

Edited by John G. Ewen, Doug. P. Armstrong, Kevin A. Parker and Philip J. Seddon

ISBN: 978-1-4051-8674-2 Paperback;

ISBN: 978-1-4443-6156-8 Hardcover; January 2012

Trade-offs in Conservation: Deciding What to Save

Edited by Nigel Leader-Williams, William M. Adams and Robert J. Smith

ISBN: 978-1-4051-9383-2 Paperback; ISBN: 978-1-4051-9384-9 Hardcover; September 2010

Urban Biodiversity and Design

Edited by Norbert Müller, Peter Werner and John G. Kelcey

ISBN: 978-1-4443-3267-4 Paperback;

ISBN: 978-1-4443-3266-7 Hardcover; April 2010

Wild Rangelands: Conserving Wildlife While Maintaining Livestock in Semi-Arid Ecosystems

Edited by Johan T. du Toit, Richard Kock and James C. Deutsch

ISBN: 978-1-4051-7785-6 Paperback; ISBN: 978-1-4051-9488-4 Hardcover; January 2010

Reintroduction of Top-Order Predators

Edited by Matt W. Hayward and Michael J. Somers

ISBN: 978-1-4051-7680-4 Paperback; ISBN: 978-1-4051-9273-6 Hardcover; April 2009

Recreational Hunting, Conservation and Rural Livelihoods: Science and Practice

Edited by Barney Dickson, Jonathan Hutton and Bill Adams

ISBN: 978-1-4051-6785-7 Paperback; ISBN: 978-1-4051-9142-5 Hardcover; March 2009

Participatory Research in Conservation and Rural Livelihoods: Doing Science Together

Edited by Louise Fortmann

ISBN: 978-1-4051-7679-8 Paperback; October 2008

Bushmeat and Livelihoods: Wildlife Management and Poverty Reduction

Edited by Glyn Davies and David Brown

ISBN: 978-1-4051-6779-6 Paperback; December 2007

Managing and Designing Landscapes for Conservation: Moving from Perspectives to Principles

Edited by David Lindenmayer and Richard Hobbs

ISBN: 978-1-4051-5914-2 Paperback; December 2007

Conservation Science and Practice Series

Biodiversity Monitoring and Conservation: Bridging the Gap between Global Commitment and Local Action

Edited by

Ben Collen

Institute of Zoology, Zoological Society of London, London, UK

Nathalie Pettorelli

Institute of Zoology, Zoological Society of London, London, UK

Jonathan E.M. Baillie

Conservation Programmes, Zoological Society of London, London, UK

Sarah M. Durant

Institute of Zoology, Zoological Society of London, London, UK



WILEY-BLACKWELL

A John Wiley & Sons, Inc., Publication

This edition first published 2013 © 2013 by John Wiley & Sons, Ltd

Blackwell Publishing was acquired by John Wiley & Sons in February 2007. Blackwell's publishing program has been merged with Wiley's global Scientific, Technical and Medical business to form Wiley-Blackwell.

Registered office: John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial offices: 9600 Garsington Road, Oxford, OX4 2DQ, UK

The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

111 River Street, Hoboken, NJ 07030-5774, USA

For details of our global editorial offices, for customer services and for information about how to apply for permission to reuse the copyright material in this book please see our website at www.wiley.com/wiley-blackwell.

The right of the author to be identified as the author of this work has been asserted in accordance with the UK Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by the UK Copyright, Designs and Patents Act 1988, without the prior permission of the publisher.

Designations used by companies to distinguish their products are often claimed as trademarks. All brand names and product names used in this book are trade names, service marks, trademarks or registered trademarks of their respective owners. The publisher is not associated with any product or vendor mentioned in this book.

Limit of Liability/Disclaimer of Warranty: While the publisher and author(s) have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. It is sold on the understanding that the publisher is not engaged in rendering professional services and neither the publisher nor the author shall be liable for damages arising herefrom. If professional advice or other expert assistance is required, the services of a competent professional should be sought.

Library of Congress Cataloging-in-Publication Data

Biodiversity monitoring and conservation : bridging the gap between global commitment and local action / Ben Collen, Nathalie Pettorelli, Jonathan Baillie, Sarah Durant.

pages cm

Includes bibliographical references and index.

ISBN 978-1-4443-3291-9 (cloth)—ISBN 978-1-4443-3292-6 (pbk.) 1. Biodiversity—Monitoring. 2. Biodiversity conservation. I. Collen, Ben.

QH541.15.B56B5786 2013

333.95'16—dc23

Cover Image:

Front Cover: Red slender loris, **Loris tardigradus tardigradus**, Sri Lanka © James T. Reardon / ZSL

Back Cover: Cheetah, **Acinonyx jubatus**, Tanzania © Sarah Durant / ZSL

Cover design by Design Deluxe

Contributors

Rosamunde Almond United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), 219 Huntingdon Road, Cambridge, CB3 0DL, UK.

Jonathan E.M. Baillie Conservation Programmes, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Sultana Bashir Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK.

Andriy-Taras Bashta Animals Research and Protection Association "Fauna", Trylovsky st. 7/54, Lviv 79049, Ukraine; Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine, Kozelnytska st. 4, Lviv 79026, Ukraine.

Zoltán Bilhari The Nature Foundation, Toldi út 63, Nyíregyháza 4400, Hungary.

Philip Bubb United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), 219 Huntingdon Road, Cambridge, CB3 0DL, UK.

Stuart Butchart BirdLife International, Wellbrook Court, Cambridge, CB3 0NA, UK.

Colin Catto The Bat Conservation Trust, 15 Cloisters Business Park, Battersea, London, UK.

Alanna Collen Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Ben Collen Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Wolfgang Cramer Mediterranean Institute of Biodiversity and Ecology (IMBE), Aix-en-Provence, France.

István Császár Romanian Bat Protection Association, 440014 str. I. Budai Deleanu nr. 2, Satu Mare, Romania.

Steven de Bie Wageningen University, Droevendaalsesteeg 4, Wageningen, The Netherlands.

Stefanie Deinet Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Adriana De Palma Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Sandra Díaz Instituto Multidisciplinario de Biología Vegetal, (CONICET-UNC) and FCEFN, Universidad Nacional de Córdoba, 5000 Córdoba, Argentina.

Sarah M. Durant Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Wendy B. Foden IUCN, 219c Huntingdon Road, Cambridge, CB3 0DL, UK; Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg, 2050, South Africa.

Yolan Friedmann Endangered Wildlife Trust, Private Bag X11, Parkview 2122, South Africa.

Piero Genovesi IUCN SSC Invasive Species Specialist Group; ISPRA, Via Curtatone 3, I-00185 Rome, Italy.

Alexander Gorbachev PERESVET, Olega Koshevogo St., 80, kv. 12, 241029, Bryansk, Russia; University of Bryansk, Bezhitskaya St., 14, 241036, Bryansk, Russia.

Janine Griffiths Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK; Conservation Programmes, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Péter Györfi The Nature Foundation, Toldi út 63, Nyíregyháza 4400, Hungary.

Katherine Homewood University College London, Gower Street, London, WC1E 6BT, UK.

Alice Hughes School of Biological Sciences, Woodland Road, University of Bristol, Bristol BS8 1UG, UK.

Igor Ivashkiv Animals Research and Protection Association “Fauna”, Trylovsky st. 7/54, Lviv 79049, Ukraine; Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine, Kozelnytska st. 4, Lviv 79026, Ukraine.

Julia Jones School of the Environment, Natural Resources and Geography, Bangor University, Bangor, UK.

Kate Jones Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK; University College London, Gower Street, London, WC1E 6BT, UK.

Margaret Kinnaird Mpala Research Centre, PO Box 555, Nanyuki, Kenya 10400.

Natalia Koryagina PERESVET, Olega Koshevogo St., 80, kv. 12, 241029, Bryansk, Russia.

Anikó Kurali The Nature Foundation, Toldi út 63, Nyíregyháza 4400, Hungary.

Steve Langton The Bat Conservation Trust, 15 Cloisters Business Park, Battersea, London, UK.

Anne Larigauderie DIVERSITAS, Muséum National d'Histoire Naturelle (MNHN), 57, rue Cuvier, CP 41, 75231 Paris Cedex 05, France.

Philippe Le Prestre Institut Hydro-Québec en environnement, développement et société, Université Laval, Pavillon Des-Services 3800, Québec (Qc) G1V 0A6, Canada.

Jonathan Loh WWF International, Avenue du Mont-Blanc CH-1196, Gland, Switzerland.

Georgina Mace Imperial College London, Centre for Population Biology, Silwood Park, Ascot, SL5 7PY, UK; University College London, Gower Street, London, WC1E 6BT, UK.

Darryl MacKenzie Proteus Wildlife Research Consultants, PO Box 5193, Dunedin 9058, New Zealand.

Robyn Manley Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Georgiana Margiean Romanian Bat Protection Association, 440014 str. I. Budai Deleanu nr. 2, Satu Mare, Romania.

Melodie McGeoch Centre for Invasion Biology and Cape Research Centre, South African National Parks, P.O. Box 216, Steenberg 7947, South Africa.

Louise McRae Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Harold Mooney Department of Biology, Stanford University, Stanford, California, 94306, USA.

Timothy O'Brien Wildlife Conservation Society, Global Conservation Programs, 2300 Southern Blvd., Bronx, New York 10460, USA.

Thomasina Oldfield TRAFFIC International, 219a Huntingdon Rd, Cambridge, CB3 0DL, UK.

Ivan Pandourski Institute of Zoology, Bulgaria Academy of Sciences, 1 Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria.

Stuart Parsons School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand.

Charles Perrings ecoSERVICES Group, School of Life Sciences, PO Box 874501, Arizona State University, Tempe, AZ 85287, USA.

Nathalie Pettorelli Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Igor Prokofev PERESVET, Olega Koshevogo St., 80, kv. 12, 241029, Bryansk, Russia; University of Bryansk, Bezhitskaya St., 14, 241036, Bryansk, Russia.

James Reardon Conservations Programmes, Zoological Society of London, Regent's Park, London, NW1 4RY, England, UK; Southland Conservancy, Department of

Conservation, PO Box 743, Invercargill 9840, New Zealand.

Jon Paul Rodriguez Centro de Ecología, Instituto Venezolano de Investigaciones Científicas, Apdo. 20632, Caracas 1020-A, Venezuela.

Franklin Rojas-Suárez Provita, Apdo. 47552, Caracas 1041-A, Venezuela.

David Roy Centre for Ecology and Hydrology, Maclean Building, Benson Lane, Crowmarsh Gifford, Wallingford, Oxfordshire, OX10 8BB, UK.

Jon Russ The Bat Conservation Trust, 15 Cloisters Business Park, Battersea, London, UK.

Eric Sanderson Global Conservation Programs, Wildlife Conservation Society, 2300 Southern Blvd., Bronx, New York 10460, USA.

Robert Scholes CSIR Natural Resources and Environment, PO Box 395, Pretoria 0001, South Africa.

Simon Stuart IUCN Species Survival Commission, Rue Mauverney 28, 1196 Gland, Switzerland; UNEP World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge, CB3 0DL, UK; Conservation International, 2011 Crystal Drive, Arlington, VA 22202, USA; Department of Biology and Biochemistry, University of Bath, Bath BA2 7AY, UK; Al Ain Zoo, P.O. Box 45553, Abu Dhabi, United Arab Emirates.

Abigel Szodoray-Paradi Romanian Bat Protection Association, 440014 str. I. Budai Deleanu nr. 2, Satu Mare, Romania.

Farkas Szodoray-Paradi Romanian Bat Protection Association, 440014 str. I. Budai Deleanu nr. 2, Satu Mare, Romania.

Elena Tilova The Green Balkans – Stara Zagora, 9 Stara Planina Str., Stara Zagora 6000, Bulgaria.

Charlotte L. Walters The Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK; The Bat Conservation Trust, 15 Cloisters Business Park, Battersea, London, UK.

Aidan Weatherill The Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK.

Oleg Zavarzin PERESVET, Olega Koshevogo St., 80, kv. 12, 241029, Bryansk, Russia.

Acknowledgements

This book is the result of a symposium held at the Zoological Society of London, and Ben Collen, Nathalie Pettorelli, Jonathan Baillie, and Sarah Durant are extremely grateful to the many individuals and institutions that contributed to this symposium. The editors are also grateful to Joy Hayward and Linda DaVolls from the Zoological Society of London for their help in organizing the symposium. Matthew Hatchwell and Linda Krueger from the Wildlife Conservation Society helped shape our original ideas on the symposium and chair the meeting. The international participation at the symposium would not have been possible without funding received from the Zoological Society of London and the Wildlife Conservation Society. B.C. is supported by the Rufford Foundation and is an Honorary Fellow of the United Nations Environment Programme—World Conservation Monitoring Centre. Three anonymous reviewers gave us insightful comments on our first proposal, which helped shape this book. Each chapter of this book was evaluated by multiple referees, and we thank them for their time, input, and advice. The editors appreciate the guidance throughout the writing of this publication of Wiley-Blackwell, particularly Kelvin Matthews, Ward Cooper, and Delia Sandford.

Chapter 1

Biodiversity Monitoring and Conservation: Bridging the Gaps Between Global Commitment and Local Action

Ben Collen¹, Nathalie Pettorelli¹, Jonathan E.M. Baillie² and Sarah M. Durant²

¹Institute of Zoology, Zoological Society of London, London, UK

²Conservation Programmes, Zoological Society of London, London, UK

Why a book on biodiversity monitoring and conservation?

As the impacts of anthropogenic activities increase in both magnitude and extent, biodiversity is under increasing pressure. Habitats available to wildlife have undergone dramatic modifications, and significant biodiversity has already been lost over modern times, while we are yet to experience the full impacts of anthropogenic climate change (Mace *et al.*, 2005; Dawson *et al.*, 2011; Pereira *et al.*, 2010b). Over the past few hundred years, humans have increased species extinction rates by as much as 1000 times compared with background rates that were typical over Earth's history (Regan *et al.*, 2001; Millennium Ecosystem Assessment, 2005), and accelerating increases in anthropogenic pressures on biodiversity may further increase species extinction rates (Balmford and Bond, 2005). In developing means to address these challenges, scientists are hampered by a lack of information on biological systems, particularly information relating to long-term trends, which is crucial to developing an understanding of how these systems may respond to global environmental change. Such serious knowledge gaps make it very difficult to develop effective policies and legislation to reduce and reverse biodiversity loss.

A further impetus for conservation action has been gained through an increasing realization that declines in biodiversity have detrimental impacts on ecosystem structures and functions as well as human well-being, particularly for the world's most marginalized and impoverished communities (Millennium Ecosystem

Assessment, 2005). Biodiversity provides many products—often plants, animals, and fungi—that directly contribute to incomes and human livelihoods. Biodiversity also provides genetic resources for the pharmaceutical industry, which can be key in maintaining human health, while the growth of nature tourism has meant that biodiversity conservation has become a major contributor to many national economies, including those of some of the world's poorest countries. As well as delivering these ecosystem services, biodiversity underpins the functioning of ecosystems, and hence the delivery of services such as access to fresh water or climate regulation. Biodiversity is therefore key to security, resilience, social relations, and human health and hence affects people not only by way of material livelihoods and macroeconomics.

In order to counter global biodiversity loss and consequent impacts on human well-being, there have been several recent high-profile international political commitments to improve biodiversity conservation. These have mainly consisted of goal setting, in the form of conservation targets to which governments, decision-makers, and the international community are committed; the most notable example of which are the targets set by the Convention on Biological Diversity (CBD; Convention on Biological Diversity, 2011; UNEP, 2002). However, because of the complexity of biological systems, and a lack of long-term biodiversity data, nations are hampered not only in assessing progress towards such targets, but also in developing appropriate policy and legislative responses to reverse biodiversity declines.

Global commitments to stemming biodiversity loss have contributed to the development of methods to track changes in many metrics of biodiversity, and addressing biodiversity information requirements has become one of the fastest growing areas of research in the field of

conservation biology. This information is critical for increasing our understanding of the manner in which biodiversity is changing, and how changes can be influenced and reversed. It is also required for setting priorities for biodiversity conservation, such as protected area placement (e.g., Araújo 1999; Possingham *et al.*, 1993; Rodrigues *et al.*, 2004), species and ecosystem priority setting among the many deserving causes of conservation attention (e.g., Isaac *et al.*, 2007; Myers *et al.*, 2000), and for the biodiversity assessments required to provide the data for such activities (Baillie *et al.*, 2008; Collen *et al.*, 2012; Mace *et al.*, 2008; Pereira *et al.*, 2010a).

The process of reversing decline in biodiversity, at the outset, might appear straightforward. We should simply measure what is happening to the components of biodiversity that we wish to conserve; put in place conservation actions to counteract declines in the taxa and places that are changing most rapidly, or which we are least willing to lose; monitor and evaluate the impacts of these actions; and continue to manage adaptively. Yet our first collective attempt to measure and slow biodiversity change (the Convention on Biological Diversity 2010 Target) met with almost universal agreement that we had failed (Butchart *et al.*, 2010; Convention on Biological Diversity, 2010). That there were only eight years between the agreement of that target ('to achieve, by 2010, a slowing in the rate of biodiversity loss') by parties to the CBD, and the deadline by which a change should have taken place, must at least partly explain why we failed to meet this target. Even with the strongest political will, a substantial slowing in biodiversity declines would not have been possible in the timeframe, unless the many and complex underlying drivers of decline were effectively tackled.

It has become clear though, in the myriad of post-2010 papers, reports, and evaluations, that there are some

problems in the overall approach. First of all, the target set was not action orientated, nor tied to appropriate activities from which the impact of changing pressures on biodiversity could be measured. This has to some degree been addressed in the newly agreed Aichi Target and Strategic Plan for 2020. Secondly, there appeared to be a disconnection between these laudable global commitments to improving the status of biodiversity, and the local-scale action required to ultimately ensure their achievement. From a research perspective, there has been a focus on identifying the most effective means to generate the metrics of biodiversity required to measure significant change (Dobson, 2005; Mace and Baillie, 2007), and how best to fill the many gaps in biodiversity data (Collen *et al.*, 2008; Pereira and Cooper, 2006). However, from a policy perspective it remains unclear how global targets should be harmonized with the many national responsibilities to biodiversity conservation and vice versa (Jones *et al.*, 2011; Nicholson *et al.*, 2012). Moreover, from a practical perspective there is a need to better coordinate biodiversity monitoring and conservation, at all scales, for increased efficiency and greater impact.

As the Aichi Target becomes agreed and implemented, it is extremely timely to reflect not only on lessons learned from the 2010 targets, but also on how we might better integrate national and global biodiversity monitoring and indicators over the coming decade. Such complex policy objectives present many challenges to conservation scientists and policy-makers alike. A key issue is how best to monitor progress towards such global-scale targets. There is also growing recognition of a need for biodiversity monitoring at a national, as well as a global scale, and better coordination between different monitoring approaches so as to make optimal use of all forms of biodiversity data. Although several indicators have been developed for use at the global

scale, the data on which these indicators are based frequently come from monitoring schemes carried out with quite different objectives than monitoring global biodiversity change. While a dedicated global monitoring system may be ideal, would it be prohibitively expensive? Might a more cost-effective solution be to implement monitoring at a national scale, according to national priorities, and aggregate national measures to a global indicator? The scale at which monitoring takes place may need to be taken into account when assessing progress towards both global and national targets. At the local level, the theory of optimal monitoring is advancing fast; focusing on how best to allocate limited resources in the face of the inevitable trade-offs between monitoring and intervention, and explicitly considering uncertainty. This approach could potentially be applicable to promote more cost-effective monitoring across larger regional or national scales.

In this book, which results from a symposium held at the Zoological Society of London in summer 2009, we have addressed two key themes in biodiversity conservation and monitoring, bringing together insights from science and policy spheres: evaluating a variety of approaches to biodiversity monitoring that could help to provide indicators at national to global scales, and the steps needed to reduce the barriers for successful implementation of such approaches. Specifically we have focused on addressing challenges faced by countries in meeting their obligations under the biodiversity conventions, particularly CBD, and to help bridge the gap between international commitments and local action. We have structured this book around four areas: first, we examine the use of species-based indicators, and what they can tell us about the status and trends of several important metrics directly related to the overall health of biodiversity (Balmford *et al.*, 2005; Green *et al.*, 2005). These chapters describe how each measure of